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1 Acknowledgments

WorldFish and Myanmar collaborative partners including the fisher communities of the Ayeyarwady Delta and Central Dry Zone would like to thank the Australian Government for the funding provided through the Department of Foreign Affairs and Trade (DFAT) and the Australian Centre for International Agricultural Research (ACIAR) and the many people who have contributed to this work.

We acknowledge and thank the fisher communities, Department of Fisheries, local government authorities, FRDN partners (including the Myanmar Fisheries Federation), university research staff, and the Myanmar Fisheries Partnership members for their dedication during extremely difficult working conditions from early 2020 throughout 2021.

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2 Executive summary

Myanmar ranks fourth in the world for inland fisheries production, is a major contributor to economies and local livelihoods and contributes the largest source of animal protein in Myanmar diets. Despite the importance of the fisheries sector to income generation and food systems, fishery management is weak across the sector and social disparities in access and availability to nutrient-rich aquatic foods often effects the poorest and most marginal groups. The project '*Improving fishery management in support of better governance of Myanmar's inland and delta fisheries*' was established to contribute to addressing this context. It is delivered through three linked objectives, summarised as follows:

1. Characterise existing fishery management practices and assess their performance on fish production and benefit distribution.
2. Test and adapt improved fisheries management approaches for different access arrangements
3. Strengthen R&D capacities for improving fisheries management and providing guidance for governance and policy development

Achieving these gains in Myanmar required a reconfiguration of the legislative and institutional tenure arrangements – changes that emerged as a result of processes and research backed dialogues facilitated by the Myanmar Fisheries Partnership established and convened by the project. Ayeyarwady Delta lawmakers promulgated a new Freshwater Fisheries Law - officially acknowledging for the first time the right for fishing communities to officially register and participate as a group to the auction of commercial fishing rights (Ayeyarwady Regional Parliament 2018). Unfortunately for the people of Myanmar these gains are under threat due to the political instability in the country and potentially a return to extractive command and control type management approaches.

During this project's implementation period a combination of the Fisheries Research Development Network (FRDN) coupled with the Fisheries Information Center (FIC) and capacity building from WorldFish and Myanmar Fisheries Partnership (MFP) members has allowed local research staff to develop their scientific skills both social and natural. All stakeholders participating in this project have benefited from the capacity building work at fisher, research worker and fisheries administration levels both local and national. The participatory monitoring and data collection work carried out by fisherfolk is the result of their interest and the capacity building opportunities provided by a mix of university and Department of Fisheries staff who were in turn trained by WorldFish experts from Myanmar and nearby Cambodia. The fisher communities and those involved in fish value chains have participated actively in all aspects of this project. In terms of sustainability, this is of particular importance regarding the interactions with and between local university and DoF scientists. A particular achievement in this regard is regarding the access and sustainability of the Fisheries Information Centre (FIC). This digital library is now accessible online 24h/7 and 1,550 different users (updated by March 2021) visited the website www.dof-myanmar-fic.org a total of 1,249 times. In 2021, the Department of Fisheries committed to maintain the functioning of FIC long-term.

MYFish2 has played an important role in cooperating with other international agencies and projects e.g., ACIAR Rice Fish Project, reviewing the Rice Shrimp project in Viet Nam, through collaborative research e.g., with IWMI, IRRI and Charles Sturt University on food, land and water governance and research on integrating fish in irrigation infrastructure. In addition, hosting seminars, sharing the convening of the MFP with the FAO, communicating research in journal articles, conducting a joint risk assessment of the fisheries sector are quite significant achievements.

Despite the successful implementation of the Project, highlighted above, it must be recorded that the output in adaptations for improved fisheries management has been less than anticipated. It is limited to three pilot studies and an assessment of similar management

practices elsewhere. The reason for this shortcoming relates to a number of factors; the capacity of DoF, university and community stakeholders, safety concerns due to COVID-19, the current political situation (hence reduced ability to conduct fieldwork) and the limited number of fishery management sites that are covered by both the bio-monitoring and the socio-economic monitoring surveys.

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3 Background

Estimates of national fisheries production in Myanmar range from 3 to 5.5 million metric tons per year. Official Myanmar statistics cite 5.5 million metric tons, but in 2015, the Food and Agriculture Organization of the United Nations (FAO) stated that the official statistics in Myanmar were "based on target levels rather than on real data collection" (FAO 2016), and as a consequence, the FAO considers 3 million metric tons to be a more realistic figure and of this total, estimated inland fisheries production of 863,450 metric tons for 2015 (Funge-Smith 2018). However, even if this lowest figure is used, Myanmar would still rank fourth in the world for inland fisheries production and nationally it contributes 27% of the total amount of fish consumed and provide livelihoods for an estimated 1.5 million people (FAO, 2013).

Inland fisheries encompass a diverse range of aquatic habitats (rivers, rice fields, reservoirs, village ponds, irrigation canals, wetlands and coastal estuarine areas) and are divided into four access types: (1) licenced fisheries; (2) leasehold; (3) tender lot; and (4) unlicensed open access (subsistence) fisheries. Leasehold and tender-lots represent fishing rights allocated for a specific fishing ground and gear type rented to private individuals and these are reported by DOF to account for about 25% of all freshwater fish production. Licenced fisheries account for about 75% of fish production and make provision for fishing gear licensing in open access areas (Baran 2015) where unlicensed (subsistence) fishing is permissible.

Despite the importance of the fisheries sector to national food and nutritional security, income generation and export earnings, fishery management (FM), defined as an "integrated process of information gathering, analysis, planning, consultation, and decision-making" (Soe, 2020) was identified through dialogue under the Myanmar Fisheries Partnership (MFP) as weak across the sector. The MFP was established in 2016 under MYFish to bring together key actors across government, the private sector, and donor-supported organizations operating fisheries and aquaculture development projects in Myanmar. The emergence of such a coordination platform was made possible by the increasing political openness of Myanmar's governing institutions at the time, in a context of unprecedented political transition (Tezzo et al. 2018). Previous governments failed to recognize the importance of fisheries to the rural economy with policies, laws and institutions focused primarily on revenue capture and meeting centrally planned production targets.

In the case of freshwater fisheries, the MFP served as a catalyst to the political and legal reforms that unfolded in the Ayeyarwady Delta, the most productive inland fisheries region in the country (Soe et al. 2020). Marked by decades of extractive economic policies, the country's freshwater fisheries have been increasingly managed on a commercial basis through the auction of individual-based fishing rights (Tezzo et al. 2017), the latter prompting growing concerns about the sustainable access of smallholders to the resources (Reeves et al. 1999, Soe 2018, Campbell 2019). Despite the growing social movement contesting these resource developments and the increasing engagement of civil society with these issues, resource user concerns enjoyed little credibility and legitimacy with policy-makers.

The initial focus of research engagement under the MFP was oriented towards policy agenda setting. MFP members acknowledged a severe lack of basic data on the fisheries sector, a need to build a shared understanding of fishery issues and priorities to which policy might respond, and a need to improve coordination among a growing number of actors and initiatives, many of whom were externally funded. The first joint outputs included a series of policy briefs, aimed at identifying for the new government the status and priorities of the sector, and drawing upon the collective knowledge of Myanmar fisheries experts (Myanmar Fisheries Partnership 2016). The publication of these briefs was timed so they coincided with the election of a new government committed to reforming natural resource governance.

This research identified five key issues impacting on inland freshwater FM including: (1) biases and insufficient catch statistics; (2) conflicts between fishers and farmers in seasonally flooded environments; (3) fisheries laws that focus on revenue generation with limited provisions for resource management; (4) poorly regulated open-access fisheries; and (5) unreported and unregulated fishing in reservoirs and canals. These issues alongside dispersed landing sites for SSF, few fisher organizations in open access fisheries, and limited government staff and facilities for managing fisheries, undermine the efficacy of fishery governance, defined as “the sum of legal, social, economic and political arrangements used to manage fisheries” (Funge-Smith, S. and Bennett, A., 2019).

Having achieved a level of recognition, the MFP was then able to engage in both invited and newly created spaces to support policy design and adoption. In 2018, under the umbrella of the Partnership, the Network Activities Group (NAG) – a local civil society organization – co-organized dialogues between the DoF, fishing communities, and regional authorities, bringing to the fore issues of equity associated with fishing access rights in the Ayeyarwady Delta (Nyein et al. 2018).

Echoing global efforts and building on experiences of community-based fisheries management as a more sustainable and inclusive alternative to commercial management in the region, this laid the foundations for subsequent MYfish2 research. Working in partnership with DoF, NGOs, Universities, and civil society organisation (CSOs) through the Fishery Research and Development Network (FRDN) set up under MYFish, the project would characterise and assess the performance of leasable fisheries under differing tenure arrangements and monitor and evaluate the impacts of different FM practices on the ecological and social well-being of fishing dependent communities. Data on these impacts e.g., on fish production, biodiversity, food security, human nutrition and gender equity was collected and analysed and the findings made available to support dialogue and discussions between government and fisheries organisations in an effort to stimulate improved and more insightful governance.

4 Objectives

The project development goal is '*maximum sustainable fish production in small-scale fisheries with equitable benefits to the stakeholders in fish-dependent communities in AD and CDZ*'. The specific aim is to assess different management practices and evaluate their performance in terms of securing benefits for small-scale fishers. These benefits are: increased fish production and incomes, improved food security and nutrition, and better gender equity.

Objective 1: Characterise existing fishery management practices and assess their performance on fish production and benefit distribution in key fish-production areas

1.1: Prepare and field validate a framework for analysing fisheries management across different agro-ecologies based on co-management and social ecological systems;

1.2: Train DoF staff to survey existing FM and associated NR management practices and map these with key fish-production areas in the AD and CDZ;

1.3: Design and implement detailed ecological and socio-economic surveys to assess and evaluate the current status of fishery and associated NR management and benefits from selected water bodies in key fish production areas in the AD and CDZ.;

1.4: Facilitate analysis with DoF and FRDN to better understand the drivers and scenarios influencing FM;

1.5: Summarise findings from the FM studies into a series of technical publications and data sets that are readily available through the Fisheries Information Center (FIC).

Objective 2: Field test and adapt improved fisheries management approaches for different access arrangements in key fish-production areas of Ayeyarwady Region

2.1: Identify pilot research sites across agro-ecologies (delta and freshwater) that include a variety of management approaches (implement licence fisheries; leasehold; tender lot; and unlicensed fisheries) and fishery access arrangements, (open, individual leasehold, and co management leasehold) to test and adapt improved FM practices;

2.2: Agree and develop pilot FM interventions with DoF, fishery operators and communities that adhere to the Ayeyarwady Freshwater Fisheries Law (AFFL) and build capacity to implement improved FM;

2.3: Prepare and implement a M&E system for DoF to monitor the impacts of different FM practices and evaluate the performance (compliance to norms, rules and regulations) of improved management practices, under the different access arrangements;

2.4: Analyse and summarize the results of the FM pilots with DoF and FRDN, store data in the FIC and publish results in a regular FRDN newsletter.

Objective 3: Strengthen R&D capacities of government, partners and fisheries organisations for improving the management fisheries and associated natural resources, and providing guidance for governance and policy development

3.1: Institutionalise the FRDN within DoF's Fisheries Information Center (FIC) and digital library and store reports, FM and NR management data to be readily available to DoF and partners;

3.2: Establish links and collaborations between international researchers and Myanmar fisheries scientists to broaden international appreciation of Myanmar's inland fisheries and build capacity of DoF and FRDN in fisheries management;

3.3: Hold partners meetings, seminars and annual symposia on fisheries management and build capacity for better fisheries and natural resource governance and policy development.

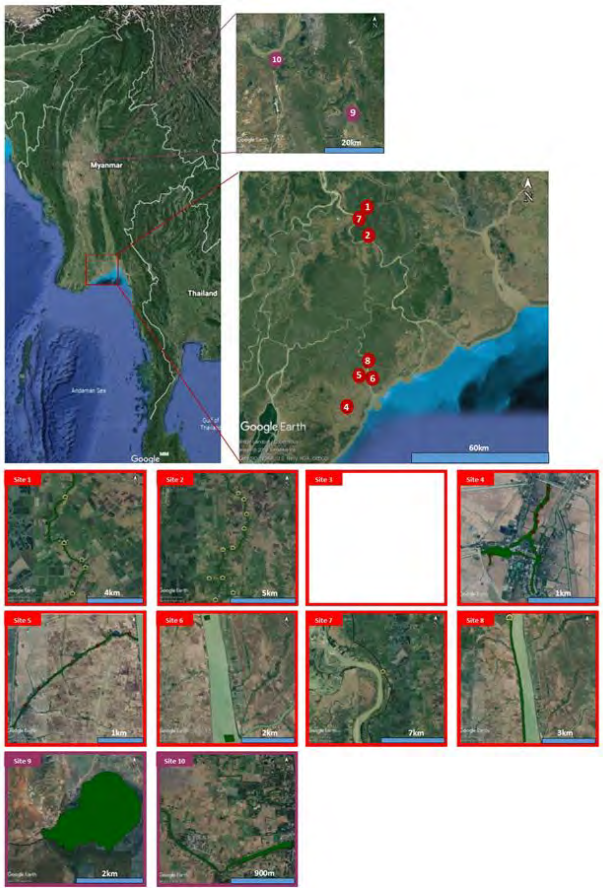
5 Methodology

Objective 1: Characterise existing fishery management practices and assess their performance on fish production and benefit distribution in key fish-production areas

The main research question that was addressed by this objective was:

1. Under the current fisheries management arrangements which practices best: a) contribute to fish production, b) protect natural resources, and c) provide equitable benefits to small scale fishers?

To address this question, activities included a meta-analysis of existing data, development of an analytical framework and survey designs to describe existing fisheries and associated natural resources management practices.



The study took a case study approach and selected 10 study sites distributed across two administrative regions: eight in the Ayeyarwady Delta Region, across Maubin and Pyapon Townships, and two in the Central Dry Zone Region, across Kyaukse and Tada-U Townships (Figure 1). Given the study objectives, the site selection also intentionally covered a mix of individually-managed and community-managed (leasable and tender) fisheries in each geographical sample. Open fisheries were occasionally covered in these same sites whenever relevant. Selection was based on criteria including concentration of fishers, biological importance (fish migration and spawning), previous research knowledge and data, presence of ACIAR MYFARM projects and key fishery management issues such as conflicts over water or stock enhancement.

Figure 1. Mapping of study sites

The data collected aimed to provide an overall diagnosis and support a critical comparison of challenges and opportunities brought by the different management regimes. The main units of analysis were a selection of delimited water bodies where capture fisheries occurred under different management systems. The selection of floodplain, permanent lakes, segment of rivers and creeks offered a broad perspective on the three different management systems in Myanmar, namely tender lot fisheries, leasable fisheries (both administratively managed at township level), and open access fisheries (typically accessed through gear licenses, or in some cases no license).

Activity 1.1: Prepare and field validate a framework for analysing FM across different agro-ecologies based on co-management and social ecological systems

Theoretical underpinnings of FM were presented and discussed through a series of seminars with DoF and selected FRDN members. A social ecological systems (SES) framework was used to develop a field methodology for assessing the necessary conditions for, and successful outcomes of, adaptive co-management of small-scale fisheries. For example, characteristics of an existing leasable fishery area, such as resource system; resource users; property rights and social entities; level of user participation in the management etc. were described through fisher surveys, focus group discussions and key informant interviews with key stakeholders and project beneficiaries.

A meta-analysis of existing data was conducted. For several of the case study sites in AD/CDZ, descriptive information on the ecological characteristics and management regimes had already been collected (e.g. FAO assessment, MYFish 1 leasable fishery survey, etc.). This study aimed to make the best of this secondary information while avoiding duplication of efforts. The compilation of existing datasets was coordinated by WorldFish/DoF through their networks (NGOs, local authorities and partners).

Our approach to the characterization process was to adapt some of the tools designed for Rapid Appraisal of Agricultural Innovation Systems (RAAIS). RAAIS is a diagnostic tool originally developed for the agricultural sector and allowing the analysis of agricultural issues from broad entry themes to more specific entry points for productivity, natural resource management, social development, and institutional innovation. RAAIS is a participatory diagnostic tool to combine multiple methods of data collection, building on existing experiences with rapid appraisal approaches and (participatory) innovation systems analysis.

The methods for the RAAIS generate both qualitative and quantitative data; facilitate ‘insider’ and ‘outsider’ analysis; targets different stakeholder groups across different levels with individual, group and multi-stakeholder perceptions on problems and solutions; and provide sufficient detail on the main problem under review, the innovation capacity in the fishery system and the functioning of the fishery innovation system. We adapted the RAIIS to assess management systems in the fishery sector. To do so we combined RAAIS with another theoretical framework tailored to the identification of fisheries management issues: the Participatory Diagnosis Adaptive Management (PDAM). We combined these two frameworks by adopting the four radar issues of PDAM as the four analytical dimensions to be investigated by RAIIS. These dimensions were elaborated, as follows:

Assessment Dimensions	**Indicators**
People & livelihoods	Living conditions; diversification/income dependence; assets and income poverty
Natural system	Biodiversity; stock status and trends; fishing practices; aquatic ecosystem condition
Institutions & governance	Fishing and development policies; organizational and institutional capabilities; access to markets and financial services; collective action abilities; governance performance and rights; legal frameworks
External drivers	Infrastructure development; conflicts with other sectors or users

Methodological steps

Based on RAAIS tool, the following main stages were conducted to assess the management systems based on the context of each site; (i) identifying constraints and challenges; (ii) categorizing constraints and challenges; and (iii) exploring specific and generic entry points for innovation/appropriate management system for equitable and sustainable fisheries. Objectives, session and activities of each stage are presented in detail in Appendix 1.

The following steps were conducted in each site to gather a broad range of information from relevant stakeholders and articulate a participatory assessment of existing fishery management systems. These methodological steps were as follows:

Multi-stakeholder workshops focus mainly on insider analyses of innovation capacity in the fishery management system and conditions of the system. Different groups of stakeholders (maximum of 25 participants) identified, categorized and analyzed constraints and challenges for innovation in each of the fishery management system.

Key Informant Interviews involved a one-on-one conversation between the WF/DoF team members and a key informant. Around 4- 5 key informants were identified as knowledgeable stakeholders in each site. This method is also appropriate for areas exhibiting low, medium, and high levels of conflict. KII were used as a validation platform of the information gathered during the multi-stakeholder workshop.

Focus Group Discussion, 3 FGDs were conducted with representatives of fishery associations or fisher communities to provide insights into the "entry theme(s)" under review and the functioning of collaboration between stakeholder groups, effectiveness of policies and other institutions, and what constrains or enables innovation capacity in the fishery management system. The FGD respondents followed a stratified approach with representative stakeholders from varied groups and different administrative levels. The FGD were smaller groupings (approximately 10 participants). The FGD were focused on validation and description of the constraints and challenges identified during the multi-stakeholder workshop to understand the underlying reasons of those constraints and challenges.

Activity 1.2: Train DoF staff to survey existing FM and associated NR management practices and map these with key fish-production areas in the AD and CDZ.

During the characterization of fisheries and fisheries management practices, surveys were conducted at the selected township in AD and CDZ, to map fisheries management zones or units in key fish production areas. Defining ecological, socio-economic and administrative boundaries was essential to identify discrete management units at various sizes and scales. The townships selected in AD and CDZ were surveyed as study sites to test the research tools and are illustrative of sufficient variety in existing management practices, strategies, and issues commonly confronted by resource managers and stakeholders. The surveys provide an inventory of fish, and fish breeding and spawning sites, explore potential for the establishment of protected areas as new management units, and also initiate a process of more comprehensive zoning of fisheries domains. The characterisation of individual fisheries also included collecting data on associated farming systems, such as recession rice cultivation, and types/extent of forest cover, including mangrove in the Delta areas. The characterisation also included assessing governance status such as the extent of decentralisation, development of state/region fisheries laws, conflict resolution and the level of community participation in decision-making processes.

Activity 1.3: Design and implement detailed ecological and socio-economic surveys to assess and evaluate the current status of fishery and associated NR management and benefits from selected water bodies in key fish production areas in the AD and CDZ.

The fisheries studied were defined into broad ecological and socio-economic groups and systems, encapsulating the rivers, rice-fish fields, reservoirs, village ponds, irrigation canals, wetlands and coastal estuarine areas that produce fish and support the livelihoods and

welfare needs of the men, women and children dependent on the fish resources. A multi-method approach was employed to triangulate natural, social and economic data across households, communities, and different access right systems.

Ecological surveys were developed to elicit data on species diversity, fish production, water quality and habitat status. Socio-economic surveys were carried out at household and community levels to identify the characteristics of different fisher families in different wealth, age, gender and ethnic group categories and included leasehold and tender-lot owner's families, (where they reside in the area), as well as small-scale fisher families.

Socio-economic indictors of household incomes, food security, nutrition and gender equity were collated alongside community level assessments from different focus groups discussions (gender, fisher types). The methodology for this assessment was derived from a similar project funded by ACIAR in Cambodia (FIS/2010/058). The selection and prioritization of socio-economic and ecological indicators was guided by national and state/region government strategies on poverty alleviation, food security, and natural resource management. The ecological and socio-economic surveys were undertaken by DoF with WorldFish scientists providing backstopping and also by five FRDN university partners.

Activity 1.4: Facilitate analyses with DoF and FRDN to better understand the drivers and scenarios influencing FM

Results from the surveys were presented and discussed with DoF and University partners to identify the key drivers (economic, social, environmental) influencing fisheries management and were used to grade surveyed management practices sites into different fish production, income, biodiversity, food security, nutrition and gender equity categories. Categorisation was aimed at simplifying data analysis and to encourage the use of research knowledge to adapt management practices and inform decision-making.

Activity 1.5: Summarise findings from the FM studies into a series of technical publications, and data sets that are readily available through Fisheries Information Center (FIC)

Comprehensive reports were produced on the 'Characteristics of fisheries management in the Ayeyarwady River Basin' and 'Fisheries production and benefit distribution in the Ayeyarwady River Basin'. The cases documented from different agro-ecologies were intended to support DoF and sector partners in shaping future interventions in FM and provide DoF with a better understanding of the essential information (environmental, social and economic) needed for adaptive fisheries management and informing policy and governance decision making.

Objective 2: Field test and adapt improved fisheries management approaches for different access arrangements in key fish-production areas of Ayeyarwady Region

The main research questions that were addressed by objective 2 are:

1. What adaptions to fishery management practices strengthen the sustainability and equitable benefit sharing from priority fish-production systems?
2. What is the impact of improved fishery management practices on fish production, incomes, biodiversity, food security, human nutrition and gender equity for small-scale fisher households and communities particularly women and children?

To address these questions, activities included identifying and developing 3 pilot research sites in the AD and monitoring the performance of adapted management practices, applying indicators for fish production, incomes, biodiversity, food security, human nutrition and gender equity across the different agro-ecologies of the AD.

The activities under this objective included analysing and summarizing results of the FM pilots and making data available through the FIC and FRDN network. Our activities benefitted from drawing upon regional expertise on fishery management from Cambodia and Bangladesh. Gender and nutrition research expertise was also used to monitor and develop nutrition and gender sensitive interventions. Development of a WEFI (women empowerment index in fishery) was intended to be used to measure gender impacts. Nutrition interventions were aimed at increasing total fish production, fish species diversity and access to more fish diversity and availability of micronutrient-rich small indigenous fish (e/g. mola, climbing perch and gourami). This included stock enhancement and/or fisheries management interventions to increase the consumption of fish especially for women and young children and was expected to support behaviour change communication (BCC) to promote the benefits of nutrition.

Activity 2.1: Identify and agree on pilot research sites across agro-ecologies (delta and freshwater) that include a variety of management approaches (implement licence fisheries; leasehold; tender lot; and unlicensed fisheries) and fishery access arrangements, (open, individual leasehold, and co management leasehold) to test and adapt improved FM practices

The project carried out participatory diagnostic surveys at selected sites and drew upon the methodologies applied in Participatory Diagnosis and Adaptive Management (PDAM) for the management of small-scale fisheries in developing country context, discussed above. Particular attention was given to in-depth understanding and analysis of key management issues using the PDAM “issue radar”, which categorizes issues associated into four system dimensions: “People and livelihoods”; “Natural systems”; “Institutions and governance”; and “External drivers”, and helps to guide identification of key threats and opportunities for the interventions.

Based on the results of this diagnostics, a number of interventions were identified and discussion held with DoF and fisheries organisations to agree on FM adaptations at selected sites including: piloting co-management of leasable fisheries areas for broader local community and licenced fisher’s participation e.g., the establishment of fish conservation zones/ fish refuges, stock enhancement and closed seasons among other aspects.

Discussions and agreement between DoF and sector stakeholders and beneficiaries were carried out before any fisheries management adaptations were introduced. The agreement took the form of a 1year fisheries activity development plan for each pilot site. The survey data collected on key indicators through Activity 1.3 was intended to be used to validate qualitative information collected through this process.

2.2. Develop pilot FM interventions with DoF, fishery operators and communities that adhere to the Ayeyarwady Freshwater Fisheries Law (AFFL) and build capacity to implement improved FM.

It was anticipated that at least nine pilots would be developed (three in each agro-ecology of the AD). The pilot studies were expected to fall into two categories: 1) pilots that were led by NGOs / Universities / private sector through the FRDN small-grants program; and 2) pilots led by DoF through the ARDF activity working group (AWGs) supported by the R&D Division of DoF. The FRDN small-grants program was set up to support pilot research projects that are co-financed through other partner programs and can draw upon the technical experience and backstopping from WorldFish scientists and partner governance expertise to facilitate joint research and documentation.

Under MYFish2, a concerted effort was made to ensure that all fishers operating in the pilot site areas were aware of the Ayeyarwady Freshwater Fishery Law and are knowledgeable about its contents. Awareness raising/training sessions on the AFFL were arranged before each of the pilot studies commenced. This was also an opportunity to learn from fishers,

which parts of the law are most difficult/unacceptable for them to follow. This information was channelled to the DoF and the parliamentary Law Drafting Committee, as they drafted their amendment of the AFFL. Fisher friendly media materials, were used during the awareness/training sessions.

Agreement over proposed fishery management interventions required broad agreement from the fishers themselves. To try and achieve this, fishers were consulted at the earliest opportunity, and their ideas on possible interventions considered and integrated into the fishery activity plans for each pilot site. Obviously, in the case of individual tenders or leasehold fisheries, agreement with the 'owner' would be simpler. However, for community co-managed fisheries[1], the concerns and interests of different types of fishers and resource users were taken into account before efforts to develop a fisheries activity plan were made.

Having agreed on the composition of the fisheries activity plans, the capacity for implementation was built in each community or with each individual operator. To achieve this, training courses on basic fisheries science and natural resources management were conducted at each of the pilot sites, before the interventions took place. Examples of similar fisheries management scenarios in neighbouring countries, (esp. Cambodia, Thailand and Bangladesh) were used to highlight key elements currently lacking in Myanmar's current approach to fisheries management.

Activity 2.3 Prepare and implement a M&E system for DoF to monitor the impacts of different FM practices and evaluate the performance (compliance to norms, rules and regulations) of improved management practices, under the different access arrangements;

The survey data collected through Activity 1.3 was intended to be used as a baseline for monitoring and evaluating the impact of changes in fisheries management practices introduced through Activity 2.1. Because the ecological and socio-economic impacts of the pilot activities were unlikely to be detectable over a short space of time, the project also designed an M&E system to help DOF and other Myanmar partners to monitor changes and progress towards positive development outcomes resulting from the new management practices.

Activity 2.4 Analyse and summarize the results of the FM pilots with DoF and FRDN and store data in the FIC and publish results in a regular FRDN newsletter

The research process included analysing and summarising results by DoF and FRDN and were intended to build upon the R&D capacity building processes. Technical backstopping to the DoF and FRDN teams was provided by WorldFish. Myanmar researchers were exposed to and learned different approaches to research design, data collection, analysis and the dissemination of findings. Similarly, we worked with DoF and FRDN partners to collect, analyse and present data on the impact of fisheries management at the pilot sites.

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[1] *The project team assisted with the production of new Fisheries Co-Management Guidelines which can be seen at annex xx*

Objective 3: Strengthen R&D capacities of government, partners and fisheries organisations for improving the management fisheries and associated natural resources in Ayeyarwady Region, and providing guidance for governance and policy development

The main research questions that were addressed by objective 3 are:

1. How can R&D capacities be strengthened in government, NGOs, private sector and community fisheries organisations through engagement in the testing and modifying fishery management practices in small-scale fisheries?
2. How can the project findings be best used to build sector capacity in improving fishery management and for better governance and policy development?

To address these questions, activities focused on institutionalising the FRDN within the R&D division of DoF and by creating research relationships and partnerships between national and international researchers and institutions. The activities were designed to continue to build R&D capacity within the national DoF and extend this to region/state DoF through specific AWGs. Both the FRDN and AWGs made data available through regular partner meetings, seminars and annual symposia that were used to exchange learning and experiences on fishery management.

The project data on FM impacts were made available to help facilitate discussions and dialogue between DoF other sector partners through the FRDN and by supporting sector partners in the MFP. Collectively the activities aimed to institute the FRDN as the principal R&D mechanism of the DoF. By doing this, data was to be provided to sector partners and stakeholders on the performance of different management practices, in order to be used to strengthen future governance and policy development. The impact expected was the overall improvement in; (i) R&D capacity of national and state/regional fisheries professionals, (ii) collaboration and information sharing for improved FM and (iii) the DoF promoting participation of small-scale fisheries organisations in the co-management of fisheries.

Activity 3.1: Institutionalise the FRDN within DoF's Fisheries Information Center (FIC) and digital library and store reports, FM and NR data to be readily available to DoF and partners

To ensure the long-term sustainability of FRDN, the network was expected to be institutionalised through the DoF's Fisheries Information Center (FIC). The FIC is a digital library program of DoF and WorldFish that gathers and disseminates research knowledge on the fishery sector in Myanmar. It is located in the DoF Yangon Regional Office and operates in close collaboration with the Myanmar University Central Library (www.uclmyanmar.org). The FIC offers a large variety of resources in a digital format and is intended to empower DoF in addressing existing knowledge gaps and supporting research efforts from universities, civil society and the private sector.

The proposed institutionalisation of the FRDN through the FIC was developed to complement the existing functions of the FIC and to upgrade its current repository role to a research networking body. WorldFish provided backstopping to the FRDN research-grants program and assistance with building collaborations and leveraging support from international research institutions and donor organisations.

Activity 3.2 Establish links and collaborations between international researchers and Myanmar fisheries scientists to broaden international appreciation of Myanmar's inland fisheries and build capacity of DoF and FRDN in fisheries management

The project supported the development of researcher-to-researcher networks, strengthening collaborations with international research partners and fostering new partnerships to co-research and co-document fisheries management R&D in Myanmar. The FRDN research grant program was promoted and relationships between international researchers and Myanmar scientist nurtured through the course of the program. These

relationships were initially be targeted towards building capacity in fisheries management expertise and collaborations were encouraged to support national scientists in the collection, analysis and presentation of data from the pilot sites in order to assess and provide feedback on the impacts of fishery management practices on social and economic benefits.

Activity 3.3: Hold partners meetings, seminars and annual symposia on FM and build capacity for better fisheries and NR governance and policy development

The project used symposia and seminars through the FRDN to disseminate data on the fisheries management for different fishery sites in the AD. Regular meetings and seminars between DoF, partners and stakeholders were designed to help to institutionalise the M&E and data feedback processes and develop and adapt different management practices to maximise socio-economic and ecological benefits.

Data from the pilots was made available to regional/state government and shared through presentations to the MFP in order that the research findings might support governance and policy dialogue at national and regional/state levels. However, the global Covid 19 pandemic alongside the recent political instability in Myanmar has to an extent limited our progress in terms of being able to conduct fieldwork and in our engagement with the government. Whilst the safety of FRDN University research teams, WorldFish staff and community members was paramount a number of methodological adaptations were made to try and address this e.g., under Covid-19 conditions new methods and tools were developed for remote data collection e.g., telephone interviews and adapted telephone surveys, virtual focus group discussions and technical back stopping done remotely. Despite these efforts the unstable political context complicated our ability to sustainably influence governance and policy processes.

6 Achievements against activities and outputs/milestones

Objective 1: To …

no.	activity	outputs/ milestones	comments
1.1	Prepare and field validate a framework for analysing FM across different agro-ecologies based on co-management and social ecological systems	Technical field guide for the AD and CDZ documenting the testing, adaption and adoption of an analytical framework for assessing FM	Analytical tool available for resource managers to gain broader understanding of fisheries governance. Field guide completed and field tested, annex 3 annual report 2019
1.2	Train DoF staff to survey existing FM and associated NR management practices and map these with key fish-production areas in the AD and CDZ.	Easy to use research protocol that provides a step-by-step guide to the methodologies and field data collection requirements to assess FM	Government has up-to-date maps of key fish producing areas and governance systems used to incorporate consideration of sustainable fisheries into strategies and programming. Data collection protocol finalised and field tested, appendix 4 report 2019
1.3	Design and implement detailed ecological and socio-economic surveys to assess and evaluate the current status of fishery and associated NR management and benefits from selected water bodies in key fish production areas in the AD and CDZ.	Comprehensive electronic inventory and mapping data of key fish production areas with descriptions of their management features and practices	DoF analysis and documentation of fisheries governance mapping data used by national and international organizations to design investments and interventions. Ecological and socio-economic surveys have been designed to assess and evaluate the current status of fishery management and benefits, available in the 2019 annual report, Appendix 5. These surveys have been implemented for base, mid and end line, with results available and a clean data set has been compiled and analysed. Ecological and socio-economic data collection surveys now complete with base line, mid line and end line surveys, reported against in the FRDN site reports, a standalone biomonitoring report and socio-economic results presented in PowerPoint are available, Appendix 3.
1.4	Facilitate analyses with DoF and FRDN to better understand the drivers and scenarios influencing FM.	Workshop report listing key drivers, uncertainties and scenarios influencing FM in key fish production areas with production and	Analysis derived from GIS Maps, reports and presentations used to help target investments directed towards improving fisheries governance and through the

no.	activity	outputs/ milestones	comments
		benefit distribution categories	FRDN 'umbrella' training sessions have been held for participating members: the DoF, Myanmar Fisheries Federation (MFF) and five state/region universities.
1.5	Summarise findings from the FM studies into a series of technical publications, and data sets that are readily available through Fisheries Information Center (FIC)	Comprehensive reports on the 'Characteristics of fisheries management in the Ayeyarwady River Basin' and 'Fisheries production and benefit distribution in the Ayeyarwady River Basin	DoF and stakeholders using the findings to adapt co-management processes, Appendix 2 Large database available for both the Socio economic and biomonitoring monitoring programmes. Comprehensive reports on the characteristics of fisheries management -10 stand alone case study reports and an overall synthesis report have been completed and are available in Appendices 4 & 5 Publications on food systems perspectives on fisheries development to better comprehend the importance of inland fisheries and aquaculture for food and nutrition security Appendix 6

PC = partner country, A = Australia

Objective 2: To …

no.	activity	outputs/ milestones	comments
2.1	Identify and agree on pilot research sites across agro-ecologies (delta and freshwater) that include a variety of management approaches (implement licence fisheries; leasehold; tender lot; and unlicensed fisheries) and fishery access arrangements, (open, individual leasehold, and co management leasehold) to test and adapt improved FM practices	Technical report produced that provides a case-by-case justification and rationale for the fisheries co-management pilot studies and the FM modification agreed	Pilot research sites have been selected and technical reports provided. The project presented the fisheries co-management work to date at a Myanmar National Fisheries Co-Management workshop in June 2019. Appendix 7.

no.	activity	outputs/ milestones	comments
2.2	Develop pilot FM interventions with DoF, fishery operators and communities that adhere to the Ayeyarwady Freshwater Fisheries Law (AFFL) and build capacity to implement improved FM.	A compilation of case study reports from each pilot site providing examples of best practices and documenting the training in FM and assessment of the impact of FM rules and regulations tested	Existing FM systems have been documented along the degree to which they can be classified as 'community based' management intervention, Appendix 2. Fisheries management interventions piloted in 3/5 CFG groups in research sites across agro-ecologies A series of fisheries management trainings were conducted in 3 pilot sites across agro-ecologies.
2.3	Prepare and implement a M&E system for DoF to monitor the impacts of different FM practices and evaluate the performance (compliance to norms, rules and regulations) of improved management practices, under the different access arrangements;	M&E planning document approved by DoF and generating ecological, socio-economic data on FM impacts and benefits applied to delta and inland fishery pilot sites	A monitoring and evaluation system has been designed and stakeholders trained in its use. Reports can be seen at Appendix 8. A WEFI (Womens' empowerment in Fisheries index has been developed and is available in Appendix 9
2.4	Analyse and summarize the results of the FM pilots with DoF and FRDN and store data in the FIC and publish results in a regular FRDN newsletter	Quarterly FRDN newsletter promoting the findings of the project; over 500 document downloads from the FIC website; at least 10 DoF/ FRDN publications on fisheries management	Ten FRDN site reports produced and available in the FIC with results of fisheries management assessments - see hyperlink.

PC = partner country, A = Australia

Objective 3: To ...

No.	Activity	Outputs/ Milestones	Comments
3.1	Institutionalise the FRDN within DoF's Fisheries Information Center (FIC) and digital library and store reports, FM and NR data to be readily available to DoF and partners	FRDN committee minutes illustrating the FRDN is managed by a cross-sector committee providing small grants and bringing together national and international researchers and practitioners	The FRDN steering committee has been established and is operational. Four SC meetings have been conducted to date, Appendix 10. Small grants function with MYFISH2 support has been operational for CFG management interventions but not utilised by external stakeholders.

No.	Activity	Outputs/ Milestones	Comments
3.2	Establish links and collaborations between international researchers and Myanmar fisheries scientists to broaden international appreciation of Myanmar's inland fisheries and build capacity of DoF and FRDN in fisheries management	At least half the FRDN projects receive co-financing and/or technical resources from international researchers and / or institutions that build R&D capacities in fishery management	Links have been established with Charles Sturt University Australia and with further projects both ACIAR (Fish passages) and others (Darwin Initiative–hilsa project). There is also a link with the Rice-Fish project where a common RF and Fishery Management study site within a polder in the southern delta has been identified, Appendix 11. Relations with the International Water Management Institute (IWMI) have been further developed through collaborations under the Water Land and Ecosystems CRP on GIS-based water management and mapping alongside the adaptation of the Mean Diet Diversity Tool in Kyon kadun pilot site, Appendix 11.
3.3	Hold partners meetings, seminars and annual symposia on FM and build capacity for better fisheries and NR governance and policy development	Quarterly FRDN meetings and seminars and annual symposia reports documenting the dialogue on FM and governance involving DoF, policy-makers, researchers, scientists, businesses, NGOs and CSO	Annual symposia have been held, the first being Q4 2017. The project participated actively at the 3rd World Small-Scale Fisheries Congress in October 2018 in Chiang Mai, Thailand. The project has also supported the use of the FAO Small-Scale Fisheries guidelines by means of an intervention entitled Multi-Stakeholder Information and Communication (MuSIC) Workshop for Small-scale fisheries, food security and wholesome nutrition: 'Understanding, appreciating and interrogating the linkages' Fisheries management trainings conducted in 3 pilot sites across agro-ecologies involving WorldFish, DoF and community fishery group members, Appendix 12. MFP meetings were conducted in 2018/2019 to raise awareness to fisheries issues and communicate results of better management practices from pilot sites. *A final MYFish2 closure symposium is now planned for Q4*

No.	Activity	Outputs/ Milestones	Comments
			2021/Q1 2022 to coincide with the Rice Fish project closure meeting.

PC = partner country, A = Australia

7 Key results and discussion

Myanmar Fisheries Partnership

Research findings were made available to regional and state government authorities through a variety of channels and shared directly with the MFP through presentation and discussion at national and regional/state levels. The MFP provided the space and place for MYFish2 research (presented in the sections below) to add to the knowledge base and stimulate dialogue on different management arrangements and their implications for people and the environment, emphasising the importance of SSF' rights to establish community management organisations in order to sustainably increase fish production and ensure that benefits are shared more equitably with fishing-dependent communities.

In part as a result and additionally as a consequence of the long-term efforts of a variety of MFP members, Ayeyarwady Delta lawmakers promulgated a new Freshwater Fisheries Law - officially acknowledging for the first time the right for fishing communities to officially register and participate as a group to the auction of commercial fishing rights (Ayeyarwady Regional Parliament 2018). Following this legal recognition and as a pledge of goodwill towards SSF research and advocacy efforts led by the Partnership, the Department of Fisheries decided to bypass the auction process for 500 fishing sites in 2019-20, making it compulsory for officers to extend these fishing licenses to communities at their auction floor price.

This legislative and political reform laid the foundations for subsequent research to monitor and evaluate the performances of experimental community-based fisheries management. The research supported the policy experiment with nearly real-time data on biological, social and economic outcomes, building upon a participatory network (the FRDN) for data collection and engaging university research partners across the region. Findings from this and other research efforts were shared with the MFP in twice-yearly meetings, as well as through an online network explicitly designed to promote exchange of information in the fisheries sector.

Yet, this progress appears ultimately to have been overwhelmed by the military coup of February 2021. Military appointed Administration Councils swiftly replaced numerous civil servants across multiple government bodies, including the national-level ministries such as agriculture and fisheries as well as agencies in the country's 14 states and regions. The civil disobedience movement protesting the military takeover, in addition to mass street demonstrations, entailed tens of thousands of state employees refusing to work (Global Witness 2021) and a boycott of military-owned and military-linked businesses. Perhaps partly in response to the loss of revenue resulting from such boycotts as well as international sanctions, a recent report from the Myanmar national daily newspaper 'Myanmar Alin' on the 9 September 2021 (but as yet unconfirmed by the DoF or by other reputable outlets in Myanmar, stated that the regime has amended section 8 of the Ayeyarwady Region Freshwater Fisheries Law. The amended section revokes provisions upholding the rights of communities to participate as a group in the auction of commercial fishing licenses and economic incentives to sustain their engagement, as well as for the creation of community fishery associations registered with township authorities. "It's not clear why the junta decided to abolish this section, but it means that now only the minister can issue 'notification[s], orders and instructions' for community fishery groups" (Frontier Myanmar. 2021 – now no longer available online).

Characterisation and assessment of fisheries management systems in the Ayeyarwady Delta

The goal behind the different case studies was to assess the performance of individual and community managed systems along the four different PDAM dimensions as follows:

- Natural System - indicators used for assessment include (i)stock status and trends, (ii) aquatic ecosystem condition, (iii) fishing practices, and (iv) biodiversity.
- Institutions & governance - indicators used for assessment include (i) fishing and development policies, (ii) organizational and institutional capabilities, (iii) access to markets and financial services, (iv) collective action capabilities, (v) governance performance and rights, and (vi) legal frameworks.
- People & livelihood - indicators used for assessment include (i) Living conditions, (ii) diversification/income dependence, and (iii) assets and income poverty
- External drivers - indicators used for assessment include (i) Infrastructure development and (ii) conflicts with other sectors or users.

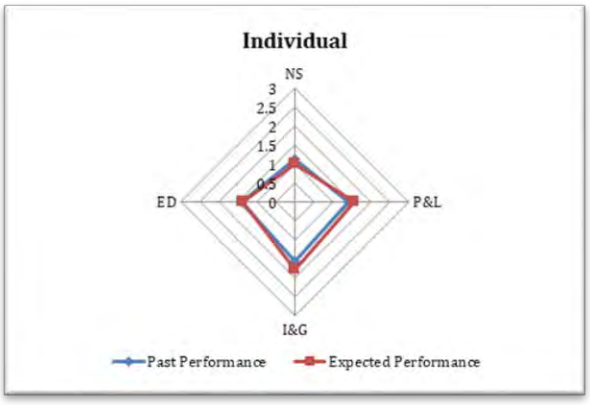
The first finding of note is that a straight dichotomy between individual and community managed systems was found to be overly simplistic and a more accurate assessment needed to consider the management systems as operating along a spectrum from individual tenure to community tenure with a number of 'intermediary' systems between these extremes. A revised typology and general characteristics of our ten pilot sites are presented in table 1 below.

#	Fishery name	Township	License system	Type	Revised typology (spectrum)	Years of Mngt.	Aquatic habitat	CSO/NGO
1	Ah Lae Met Kun	Maubin	Lease	Community	Quasi-community	2	River	Yes
2	Auk Met Kun	Maubin	Lease	Individual	Individual	6	Channel	No
3	Hlaing Tar Mezali	Maubin	Lease	Community	Quasi-community	2	Channel	No
4	Kyonekadon Yeyoe Gyi	Pyapon	Lease	Community	Quasi-individual	1	River	No
5	Ha Hpaung	Pyapon	Lease	Individual	Quasi-individual	5	Channel	No
6	Ah Char Ka Dar	Pyapon	Tender	Community	Mixed	3	Channel	Yes
7	Sar Ma Lauk	Maubin	Tender	Individual	Mixed	2	Channel	No
8	Pa Zun chuk Sat Yone	Pyapon	Tender	Individual	Quasi-individual	3	Coastal	No
9	Sunye Inn	Kyaukse	N/A	Community	Community	3	Oxbow lake	No
10	Myint Thar Ngapat	Tada U	Lease	Individual	Individual	3	Oxbow lake	No

Table 1. Background information on the study sites

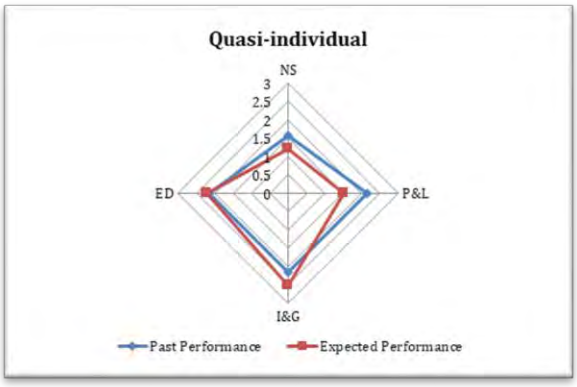
Moving from individual to community-based tenure, this section starts with a brief summary of the performance of each system along the four analytical dimensions of the PDAM. Building on the spectrum of governance typology, we then go on to explore constraints and challenges for each tenure type, identifying patterns across study sites.

The **individual tenure system** had a *very poor performance* for all dimensions of the system, especially for the Natural System dimension (Figure 2).



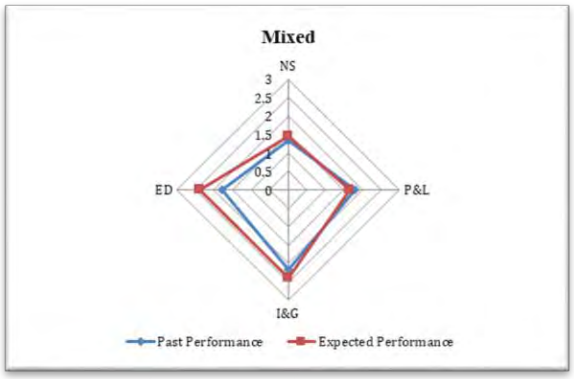
The individual ownership of the lease is believed to have contributed to a deterioration of the integrity of the ecosystem in terms of water quality and water level, biodiversity, habitats, and fish stocks. The decline of the ecosystem was further aggravated by illegal fishing, poaching, agriculture, aquaculture, and water pollution. This affected the food security and community cohesion since only the lease/sublease owners and their kin benefitted. It closed the door to wider community participation and to limited implementation of what was agreed with the DoF.

The **quasi-individual tenure system** was rated *Satisfactory* for Institution & Governance, External Drivers, and People & Livelihood**,** (Figure 3).



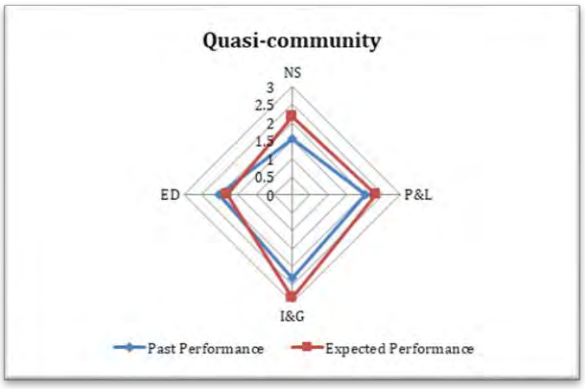
Fishers were granted access rights to the lease, after payment of the obligatory fees and in case they used approved fishing gears. Enforcement of laws and regulations was adequate in smaller leases but faced issues in bigger leases. The constraints were a lack of control over construction of irrigation infrastructure, encroachment, and clearing of habitats for agriculture and aquaculture. The limited institutional support of the DoF made resolving issues difficult. The impact on the Natural System was scored *Low* and was evidenced by a deterioration of fish stocks and of the biodiversity in the lease.

The **mixed tenure system,** (figure 4) was -



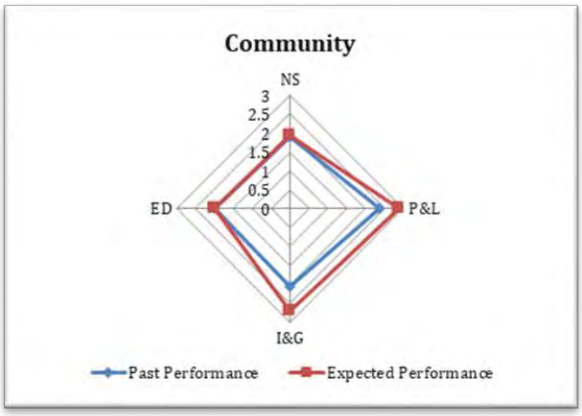
rated *High* on the Institutions and Governance dimension as it provided fair access to fishers in the lease. However, it was limited regarding gear regulation and seasonality of fishing activities due to weak CFA enforcement of policy and plan management and the low investment potential by poor fishers. This system scored *Average* for People and Livelihood due to the stakeholders' access to the lease. External Drivers scored *Average* due to new CFA management system of the lease. The Natural system dimension was rated *low* due to the declining biodiversity and productivity of the system. The future performance of the system was seen to be positive if the CFA improved their management system and got more DoF support.

The **quasi-community tenure system** rated *Above average* for Institutions & Governance, External Drivers, and People & Livelihood, (Figure 5).



This meant it granted better access and more equitable sharing of resources, increased participation by more fishers including the poor, and better agreements regarding fish prices. The External Driver dimension scored *above average* because illegal fishing was reduced in each segment of the lease since broader access translated to more active regulation. Similarly, the People and Livelihood dimension was rated *above average* because food security and fisher incomes improved as a result of lower access fees in their segments. Participating in the lease created a sense of ownership among CFA members. Lastly, fishers were able to sell to a collector/trader of their choice allowing them to receive higher prices for their fish. However, the Natural System dimension still scored *below average* due to the decrease in biodiversity, fish stocks, and habitats due to illegal practices and lower productivity as a result of pollution by agricultural and human activities. The stakeholder perception was that the rating could be improved with better CFA governance, government support for protection and conservation, and regulations on agriculture, industries, and construction.

The **community-tenure** (Figure 6) was - rated *Above average* on People and Livelihood since food security and livelihood of the community were managed satisfactorily by the CFA committee. Collaboration between the CFA and the government and other relevant institutions need to be strengthened due to limited enforcement of laws and regulations regarding illegal fishing. The performance for the Natural System dimension was rated *Average* because the Department of Science & Technology (DoST) had established areas to conserve biodiversity, fish stock, and habitats. Illegal activities in the lease were stable because of the open access nature of the lease, but agricultural and anthropogenic pollution deteriorated the quality of the environment. Nonetheless, the stakeholders were optimistic that People & Livelihood and Institution & Governance dimensions would increase in the coming year.



In summary, (Table 2), we concluded that among **all tenure systems**, the Natural System was *not performing well* in sustaining biodiversity, fish stocks, and habitats. Anthropogenic activities should be addressed, including illegal fishing, encroachment by farming and aquaculture developments, improper waste disposal, sedimentation, algal blooms, proliferation of lotus plants, and climate change aggravated the decline in productivity.

The tenure systems for **individual and mixed tenure** systems were the *worst performing* systems because the benefits were limited to the lease/tender owners. This meant the lease was managed in a way to ensure maximum profits—no considerations of sharing wider benefits to fishers, to policies and regulations that enhances productivity, equity and sustainability of the resources. It also disregarded collaboration with the DoF and other governance entities to promote natural ecology of the system.

The more democratic tenure systems were the **quasi-individual and quasi-community**, as these ranked *Average* to *Above Average* in terms of ensuring people's livelihood, mainly by broadening access to the fishery resources. However, the CFA management needed to be strengthened to improve equity in resource use, to develop more sustainable fishing methods, and to make the system more participatory in order to safeguard resources against detrimental fishing practices. The CFA needed to strengthen cooperation with the DoF regarding enforcement of policies and regulations. At the same time, there was a need to enable collaboration with other government agencies to mitigate or minimise the effects of agriculture and aquaculture developments, and anthropogenic impacts on fish resources, and the Natural System more broadly.

	Individual	Quasi-individual	Mixed	Quasi-community	Community
Natural System					
People & Livelihood					
Institution & Governance					
External Drivers					

Colour Code: Green = Positive State; **Orange** = Warning State; **Red** = Negative State

Table 2: Colour coding summary of the different management system performance in each dimension

The assessment of the constraints and challenges of the management system - found that the **individual Tenure systems** were profit-oriented, with no concept of conservation or sustainability of the ecosystem, and with little benefits for fishers. Only the few fishers related to the lease owner by kinship or patronage had access to the lease. The lease holders dictated fish prices and exploited fishers through loans for their gears, fuel, and other expenses. Fishers were forced to sell their catch to the leaseholder, usually below market price. The leaseholder provided low salaries to additional workers hired during the peak season, favouring relatives and friends. This created many constraints under Institution & Governance, since poor fishers resorted to illegal fishing and poaching in the lease. The profit-oriented nature of this contract disregarded anything relating to auctions, open and closed season, reseeding, no-take zones, as well as not enforcing other DoF policy and regulations. There was little cooperation between the DoF and the leaseholders after the lease had been awarded.

The **mixed tenure management system** was beset with issues related to People and Livelihood. The main issue here was there was little trust and cooperation between village representatives and the CFA regarding the management of the lease/tender, therefore the benefits weren't shared with a large number of fishers. Weak governance was due to low capacity and trust of CFA members, particularly leaders in other segments of the lease, and weak cooperation by members to improve their management capacity, awareness and knowledge of the purpose of the CFA and sustainability of the resource. Weak management led to low enforcement against illegal fishing activities as well as habitat degradation due to uncontrolled agricultural, aquaculture, and settler activities. The main cause was that benefits of the lease were not distributed to fishers, especially the poor. Without good collaboration between stakeholders regarding the development and sustainability of the lease, food security and income of the people is at risk.

The **quasi-individual, quasi-community and community tenure** was rated *Very High* for people and livelihood. However, the CFA operations only started recently. There was an apparent lack of capacity on how to manage their lease areas. Attendance of CFA members in meetings, workshops and trainings needed to be enhanced so they could learn and

increase their management capacity. Dividing the lease area into segments has resulted in easier management by sub-groups than in case of centralised management. However, this method lacked guidelines to inform other fishers, including the poor, resulting in limited access for other fishers in the lease area. There were issues related to the limited investment by CFA members. Therefore, improving financial capacity of the CFA, through member contributions or through financial and technical support from government and external institutions would be crucial. The CFAs were committed to conservation initiatives, including a closed season, reseeding, and no-take zones. However, internal regulations and actions against illegal fishing had to be strategized and implemented well. Some uninformed fishers violated the regulations and fished illegally. Monitoring, control and surveillance of these activities was not supported by policy and there was no plan to be implemented. This weak collaboration between the CFA committee and other stakeholders impacted the External Driver dimension in the lease (e.g., water utilisation without coordinating with the fisheries sector, pollution, encroachment by rice farms and aquaculture ponds resulting in erosion and sedimentation of the channel, poor water quality, and fish migration). Collaboration by CFA and DoF with other sectors would reduce these risks and help to protect and conserve the lease.

Based on the result of the characterisation study the following points were highlighted as priority actions in each dimension to achieve more sustainable inland fisheries in Myanmar.

People & Livelihood -

- Develop policy or bylaws that allow villagers to be CFA members in order to ensure their access to the lease
- CFA cooperative and/or private partnerships to support diversification of fisher livelihood portfolios aimed at reducing pressure of overfishing in the lease
- Strengthen the capacity of and collaboration between the CFA and local authorities to manage and conserve the lease/tender

Natural System -

- Mainstream ecosystem approaches to fisheries management.
- Identify best management practices for the wise use of natural resources
- Conduct environmental performance monitoring
- Assess species abundance and biodiversity
- Map and manage critical habitats through appropriate conservation measures

Institution and Governance dimension -

- Legal and policy reforms to ensure the long-term provision for community managed leasable fisheries options
- Small grant fund for the CFA to implement management measures
- Develop monitoring and evaluation protocols to assess lease performance
- Institutional strengthening and capacity development of CFA committee and local authorities

External Drivers

- Promote integrated IWRM type planning approaches incorporating trade-offs analysis for sector priorities e.g., what are the costs and benefits of infrastructure development viz a viz for capture fisheries
- Increase awareness of the fishers on illegal fishing gears, poisoning, and corresponding penalties

Monitoring surveys

These surveys aim to identify the different practices and to evaluate how they contribute to securing benefits for small-scale fishers (i.e. evaluate their outcomes in terms of productivity, equity and sustainability). For that purpose, the project put in place a data gathering program component whose objective is to "monitor the development of community fishing groups (CFGs), their functioning and their performance, from a social, economic and environmental perspective.

This program includes two main data gathering protocols: i) a biomonitoring component focused on dominant fishing gears, fishing operations and catch, and ii) a socioeconomic monitoring including governance dimensions.

Bio-monitoring survey **(Refer to Appendix 3)**

The study sites are characterized by a large environmental diversity and features that need to be taken into account when analysing their fishery data. The geographic location and main characteristics of each site selected for biomonitoring are summarized in Figure 7.

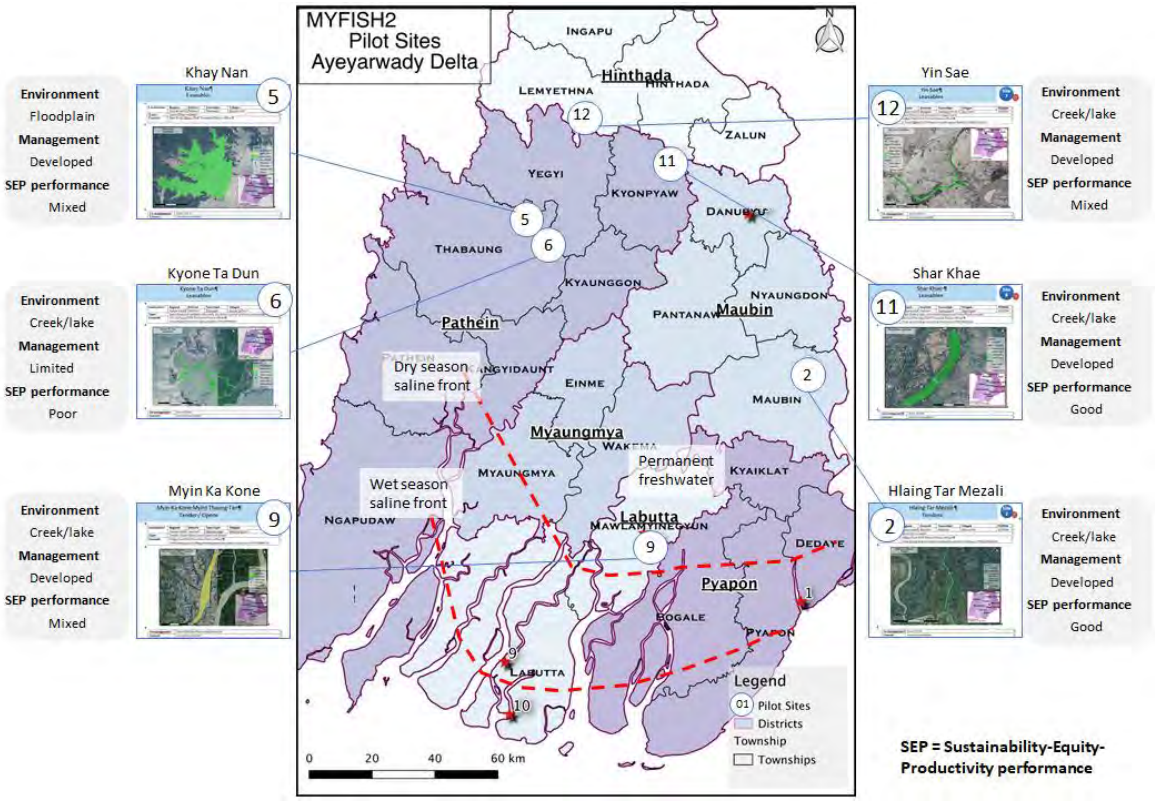


Figure 7: Overview of the 6 sites subject to biomonitoring

These six sites were selected from a preliminary list of 15 sites (later reduced to 10) that had been studied during the characterisation phase of the MYFISH 2 project. There were Community Fishery Groups (CFGs) present in five out of six sites.

Each site was analysed initially along three dimensions: **Productivity, Equity, and Sustainability**. This analysis was based mainly on expert judgment and the comparison between sites is relative rather than absolute. **Productivity** focuses on three indicators: natural fish productivity, fish productivity from stocking, and period of exploitability. **Equity** is based on three indicators: the number of people with decision-making power, level of social organisation in fisheries management, and the duration of open access period. **Sustainability** of the resource is based on level of environmental management, fishing effort management, and lastly external environmental challenges.

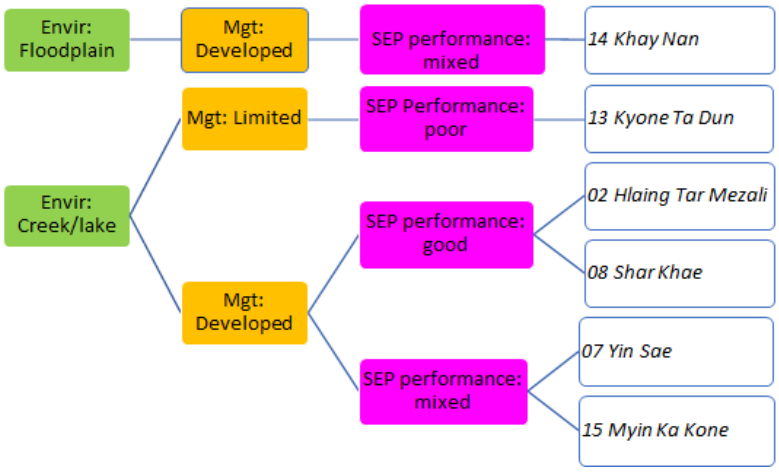


Figure 8: SEP performance overview of the 6 sites

Kyone Ta Dun is the only site that ranks poorly for all three dimensions. Most sites either have mixed performance or good performance across the three dimensions.

Due to the large variety in the surveyed sites in terms of environment, management system, scale, it is necessary to conceptualise data analysis to allow comparison between units. The **analysis** is structured around three axes: **description of sites** (Fishing effort, fish diversity, catch, CPUE), **temporal patterns** (monthly patterns and inter-annual patterns), and **comparison between sites** (comparisons based on a single characteristic). It was assumed that the most important factor of comparison between sites is the nature of the environment (creek/lake or floodplain). The second factor is the degree of resource management (developed or limited) and then lastly the S-E-P performance is considered.

The indicators to be assessed during the bio-monitoring period include i) number of individuals and weight per species, ii) unit effort (time). Using these indicators subsequently the following things are analysed: CPUE, species diversity, dominant species, and the trend over time for these three indicators. Guidelines for data collection and data entry were developed and shared with the survey teams. Data was collected by different surveyors (or self-surveyors in case fishers themselves recorded the data) and they were managed by a senior surveyor who collected the data once a month. The collected data was then sent to university researchers for compilation and analysis. Bio-monitoring data was collected for a two-year period (Dec. 2018- Dec. 2020).

The **main fishing gears** used in the study sites were set gill nets (ranging from around 40% to 80% of all fishing operations). The use of gillnets is an indication fishing rights being given to individual fishers, even in places where fish are stocked, irrespective of the level of management in any given site. The second-most commonly used gear were surrounding nets, being used to fence off fish in a floodplain (Kyone Ta Dun) or harvesting stocked fish (Shar Khae). Fish traps were commonly seen in two sites, and common use of cast nets was seen in two sites.

Species diversity was lower than would be expected for the Ayeyarwady Delta region. Results show that the number of taxa varies from 25 in Shar Khae to 39 in Hlaing Tar Mezali, with most sites featuring around 30 different species. This is a low local biodiversity compared to the fish biodiversity of the Lower Ayeyarwady Basin, i.e. 159 species (Zockler and Kottelat 2017[1]). The difference could be explained by i) the higher taxonomic diversity when species are identified by taxonomists rather than by fishers; ii) the focus by fishers on mid- to large-size commercially valuable species, and iii) the reduced biodiversity in stocked water bodies.

Shar Khae was the site with the highest **production figures**. The lease exists of two parts, one which is stocked with fish by the lease owner, and the other which is an open access area for local fishers. Most sites were considered to have low levels of production. The main

proportion of fish catches was done by collective gears. Individual gears only represented around one third of total production. WorldFish organised several awareness raising trainings and provided expenses for the establishment of conservation zones in the study sites.

CPUE was calculated for gillnets in each of the sites. Khay Nan was the site with the highest productivity. Comparison both production (total catch) and productivity (CPUE) led to the following conclusions (Figure 9). Two sites (Khay Nan and Kyone Ta Dun) had limited fishing operations, limited production, but relatively high productivity. Two sites had intensive fishing, high production, and medium productivity (Yin Sae, Hlaing Tar Mezali). One site had active fishing, very high production, but medium productivity (Shar Khae) and one site had active fishing, but low production and low productivity (Myin Ka Kone).

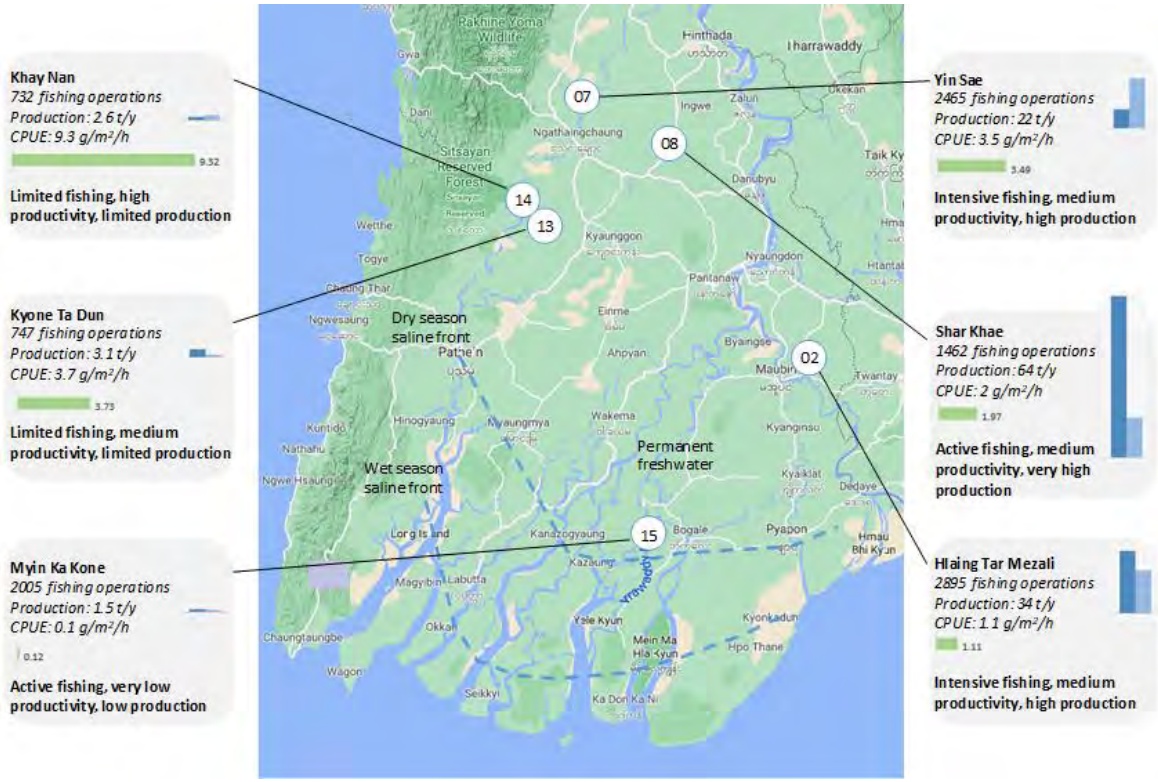


Figure 9: Overview of fishing activity, productivity and production in each study site

Most fishing operations are based on the lunar calendar. The period with the highest production for individual gears is seen in December-January when water levels have dropped post monsoon and fish are consequentially more concentrated, (Figure 10). For collective gears, the period with the highest production is January-April. Fishing using collective gears is stopped during the rainy season (approximately from May-October) highlighting the importance of fishing operations using individual gears for subsistence and fisher livelihoods. There was little difference in the production pattern across years.

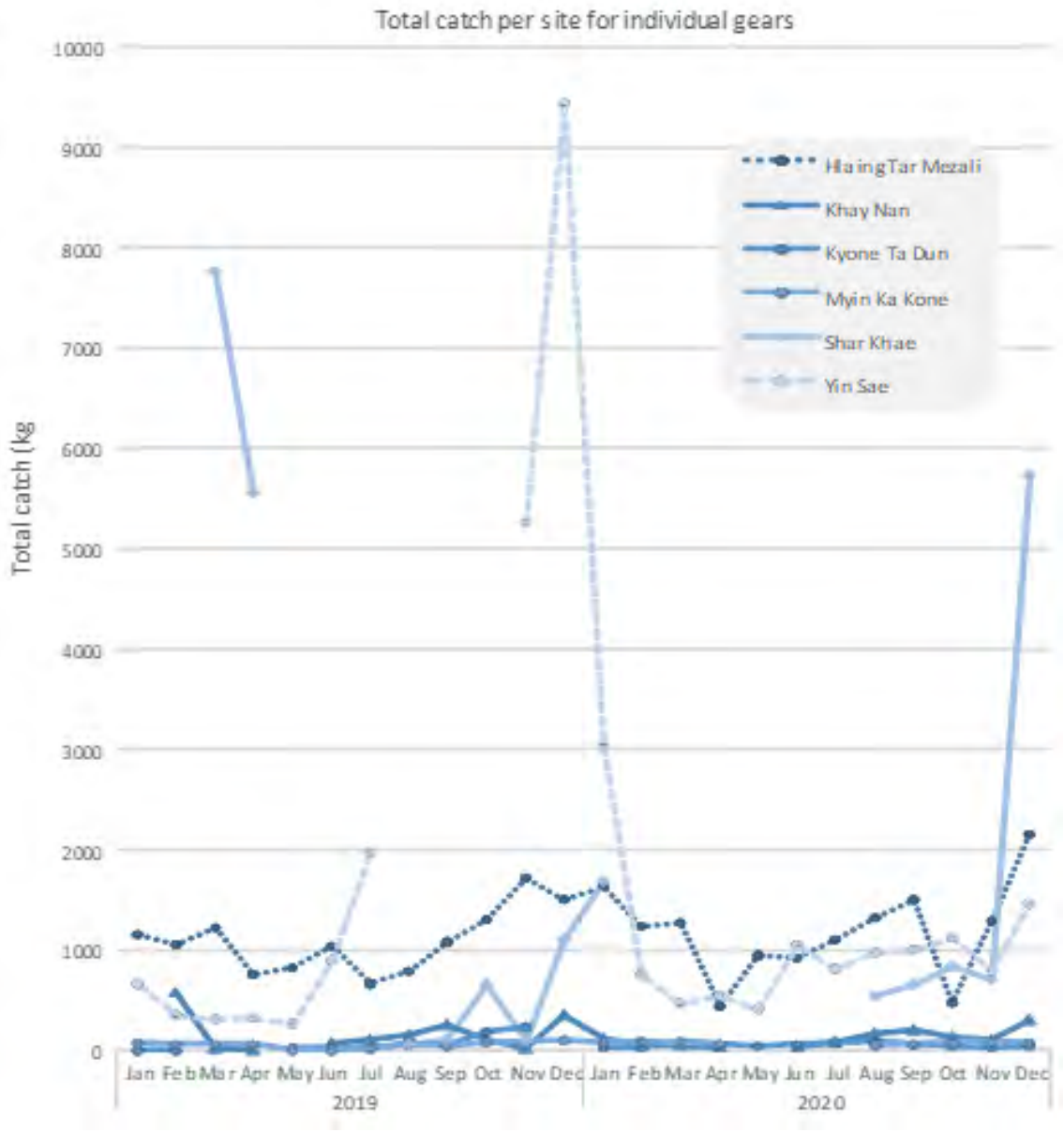
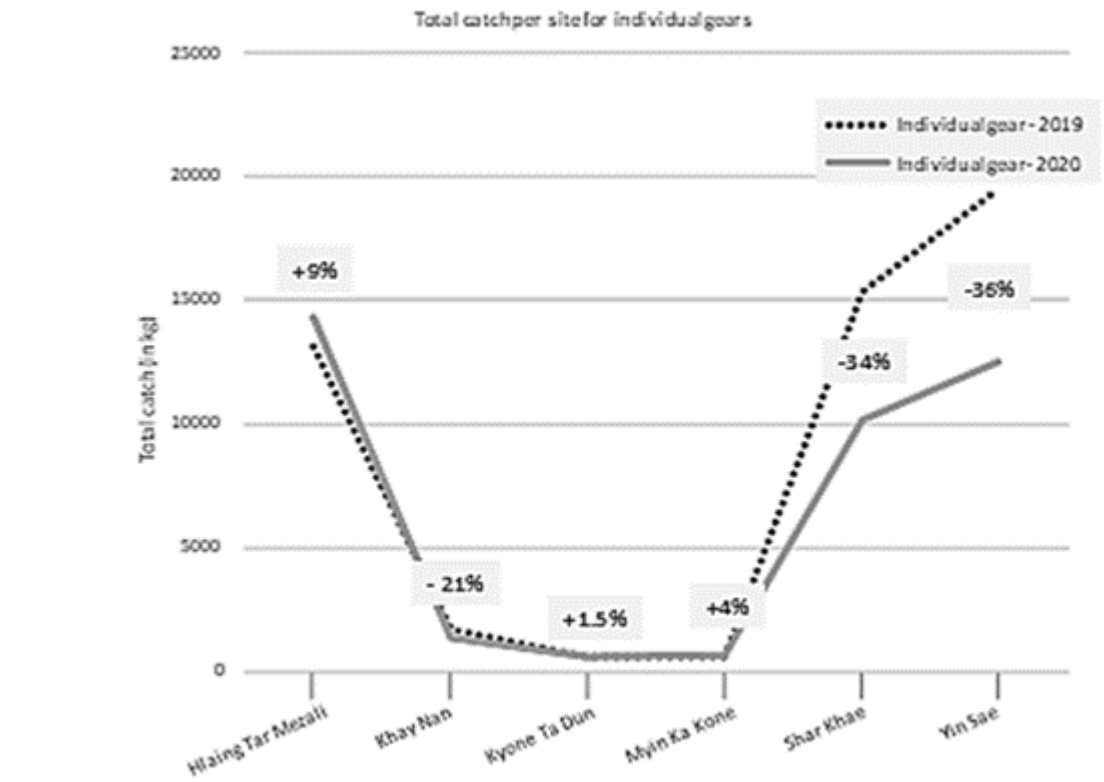


Figure 10: Catches of individual gears (in kg) per month and year in each study site

NB When Yin Sae and Shar Khae are excluded from the graph, the catch of individual gears in other sites also shows a slightly higher yield around December and January.

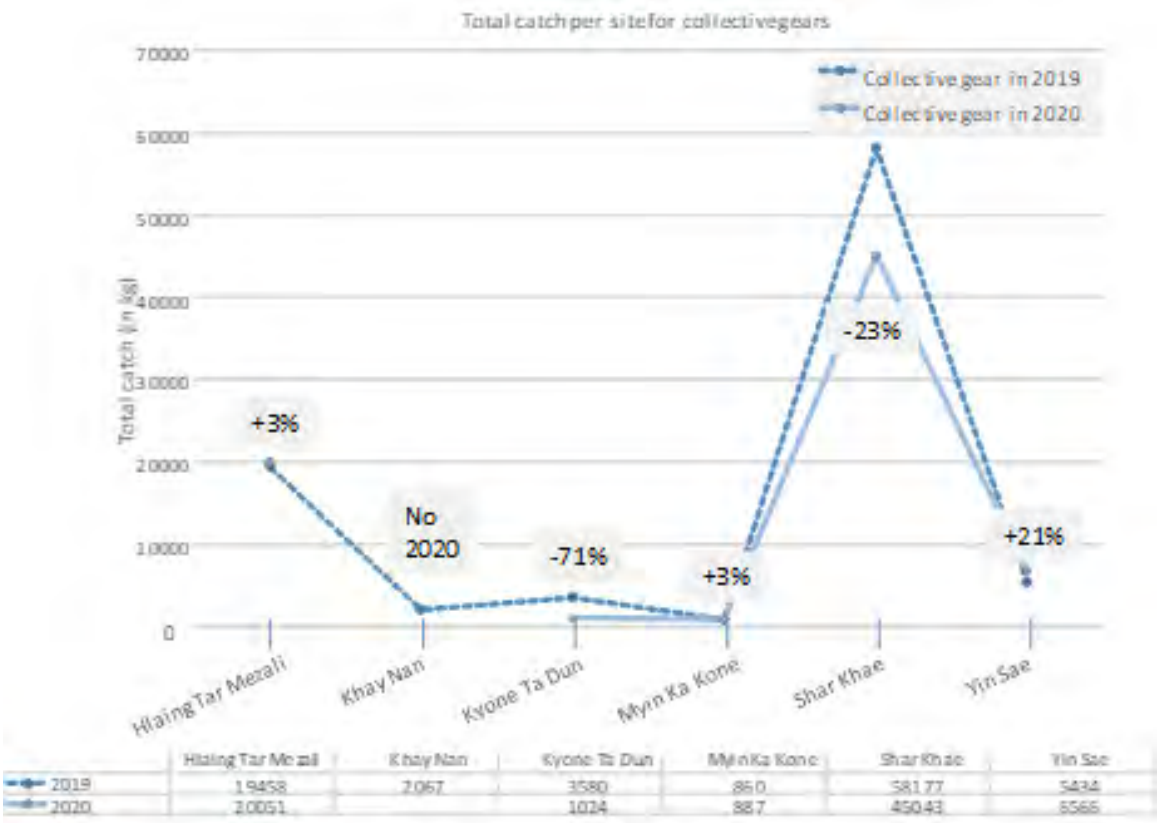
A **temporal** comparison of catches of individual gear in each site between 2019 and 2020 shows that the total catch remained similar between 2019 and 2020 in Hlaing Tar Mezali, Khay Nan, Kyone Ta Dun and Myin Ka Kone (1.5 to 21% variation), but decreased by a third in 2020 in Shar Khae and in Sae likely due to Covid restrictions on fishing during that period.



	Hlaing T. Mezali	Khay Nan	Kyone Ta Dun	Myin Ka Kone	Shar Khae	Yin Sae
2019	13134	1721	623	652	15363	19527
2020	14330	1356	632	678	10158	12503

Figure 11: Catches of individual gears in each site in 2019 and 2020

A comparison of catches of collective gear in each site between 2019 and 2020 shows that the total catch remained similar between 2019 and 2020 in Hlaing Tar Mezali, Myin Ka Kone and Yin Sae, increased by 21% in Yin Sae, but decreased by 23% in Shar Khae and by 71% in Kyone Ta Dun.



	Hlaing Tar Mezali	Khay Nan	Kyone Ta Dun	Myin Ka Kone	Shar Khae	Yin Sae
2019	19458	2067	3580	860	58177	5434
2020	20051		1024	887	45043	6566

Figure 12: Catches of collective gears in each site in 2019 and 2020

Based on the following characteristics, two sites were chosen for the inter-site comparison: Khay Nan and Yin Sae. Both sites have developed management, are both lease areas, and had a mixed S-E-P performance score. The main difference between both sites is that Khay Nan is located in a floodplain whereas Yin Sae is located in a creek/lake.

Figure 13: Comparison framework for an inter-site analysis: the case of Khay Nan and Yin Sae

The sites were compared using three indicators; 1) total species richness, 2) gillnet CPUE, and 3) average weight of top 5 species.

1)There were 26 species recorded in Khay Nan, and 33 species in Yin Sae. One would expect a higher species diversity in the open floodplain environment, rather than in the controlled creek setting.

2)Gillnet CPUE was higher in Khay Nan (floodplain), two-to threefold, than it was in the creek environment (Yin Sae)

3)The average weight of five dominant species in both sites was compared. Large fish species tended to be larger in Yin Sae than they were in Khay Nan. For small species no difference was observed between both sites.

Socio-Economic monitoring

The aim of the socio-economic survey was to assess the performance of CBFM pilot sites. The socio-economic conditions of fishing and non-fishing households was assessed through a household survey. The survey was made up of different sections: 1) household information, 2) Aquaculture & fisheries, 3) Nutrition, and 4) Structure and functioning of the CFG. The idea behind the survey was to establish a benchmark of the socio-economic status of households in the area surrounding a lease in order to track changes over time, through follow-up surveys. In total, 615 households from 33 villages were surveyed across twelve sites, (Table 3).

Ref #	Site Name	License Type	Township
1	Hlaing Tar Mezali	Tender	Maubin
2	Ale Met Kun	Leasable	Maubin
3	Inn Gyi	Leasable	Hinthada
4	Nga Wun Taein	Leasable	Hinthada
5	Yin Sae	Leasable	Lemyethna
6	Shar Khae	Leasable	Hinthada
7	Kaka Yo	Tender	Labutta
8	Ayar Taw	Tender	Labutta
9	La Har Gyi	Leasable	Danubyu
10	Kyone Ta Dun	Leasable	Thabaung
11	Khay Nan	Leasable	Thabaung
12	Myin Ka Kone Myint Thaung Tan	Tender/Open	Mawlamyinegyun

Table 3. Socio-economic monitoring study sites

The survey was conducted three times (a baseline, mid-line, and end-line survey) between December 2018 and December 2020. Data collection was conducted by 5 research teams (Pathein University, Yangon University, Maubin University, Dagon University and the DOF) under the FRDN. Each team was responsible for a number of sites (2-3) where they had to conduct the socio-eco questionnaire and collect and analyse the data.

The main livelihood in the surveyed sites was farming, followed by fishing, and wage labour. Aquaculture and fish trading weren't important sources of income for households in the selected study sites. No significant differences were seen across survey rounds in the relative importance of different livelihoods for household income, (Figure 14). Fishing

households depended mostly on fishing as main source of income, for non-fishing households farming, wage labour, and 'other' were the main sources of income.

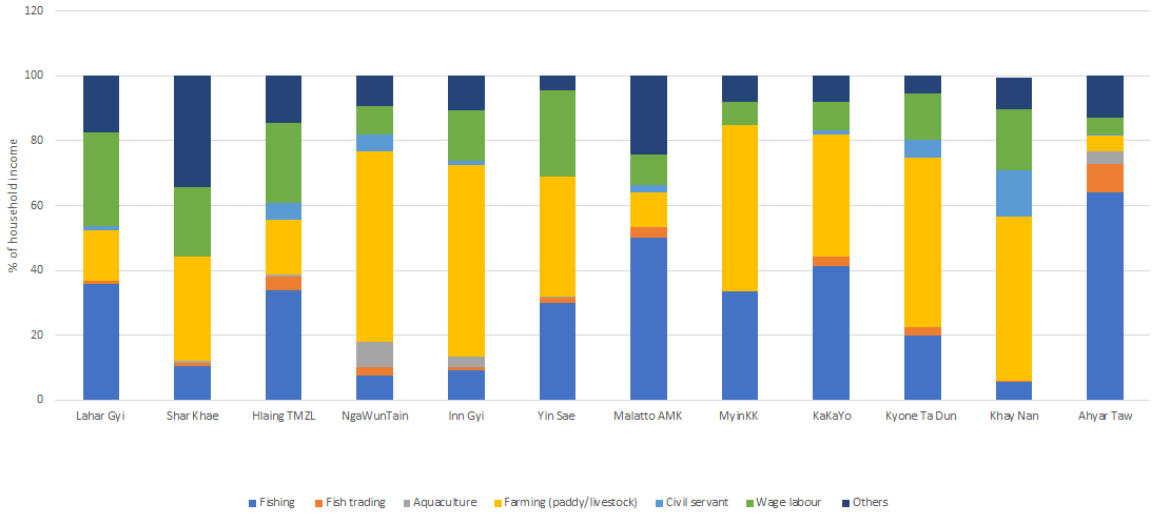


Figure 14: Average relative proportion of household income by livelihood (2018-2020), by site

Household fish consumption didn't show major differences across seasons. For some sites the highest fish consumption was recorded in the period May-Aug., while in others fish consumption was highest in Sep.-Dec. In most sites fish purchases were higher than fish catches for most households, indicating the importance of locally available, affordable fish and fish products. The highest fish purchases were seen in January-April, which is also the period with the most reported food shortages. This is due to the lower water levels, leading to lower fish catches for this period. **Fish purchases** were lowest in 2020, possibly as a result of lower disposable household income or lack of availability due to restrictions associated with the Covid-19 pandemic. Fishing households purchased less fish on average than non-fishing households did, both across years and across seasons, (Figure 15).

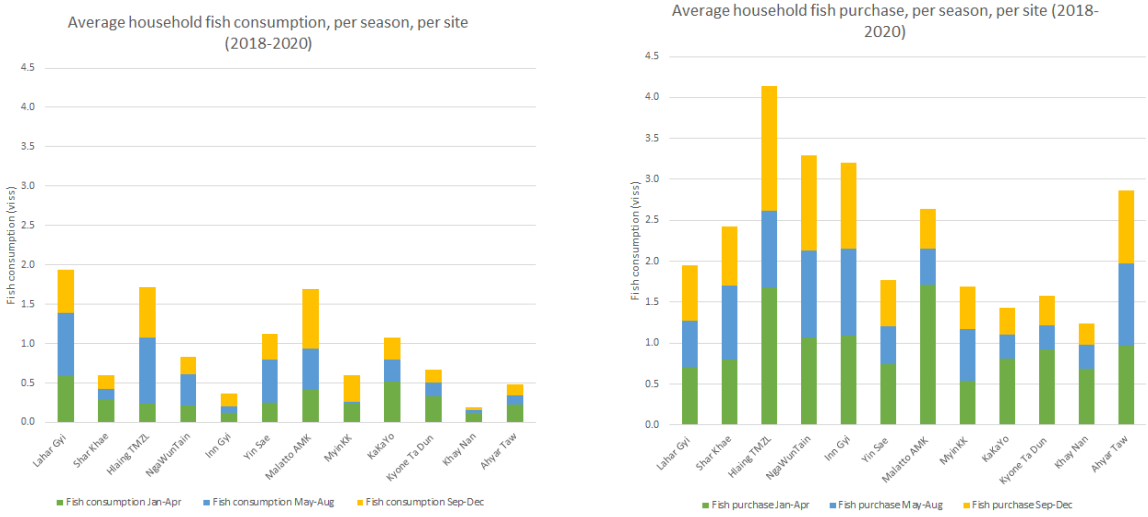


Figure 15: Average household consumption and purchase per season, per site (2018-2020)

Although in most sites most respondents were **aware of the existence of a CFG** in their area, very few households were actually members of said CFGs. There was a significant difference in the awareness and membership of CFGs between fishing and non-fishing households, with awareness and membership being much higher for fishing households. More research and understanding are needed to find out why non-fishing households are

generally not aware of or members of the CFG and what role a CFG might play for non-fishing households.

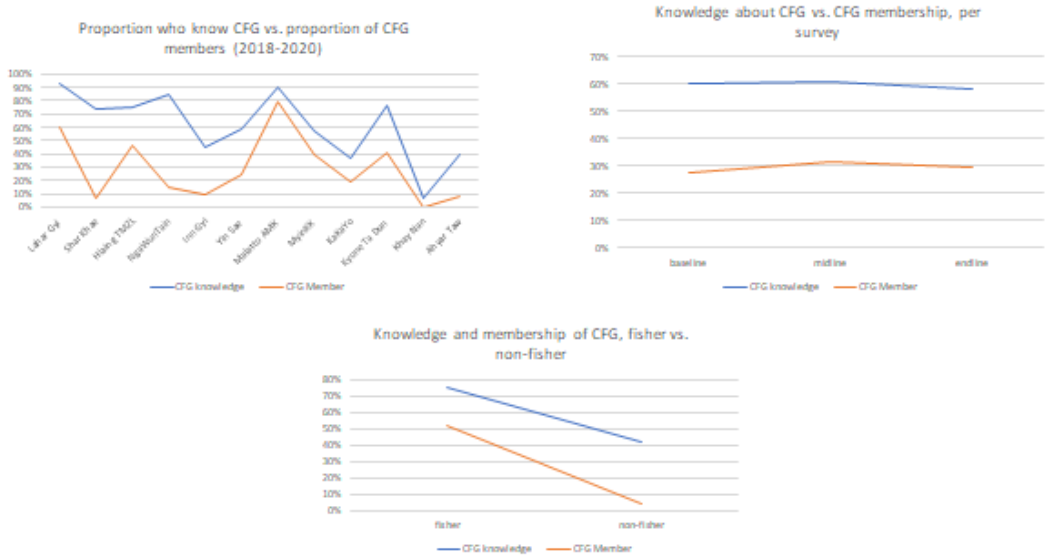


Figure 16: Awareness to and knowledge of CFGs compared across stakeholder groups

In most sites, only around a third of respondents were convinced of the **usefulness of conservation zones** in fish areas. The number of conservation zones set up in the study sites was also relatively low (four out of twelve sites had a no-fish zone, where local NGOs had conducted awareness raising activities or provided technical support). More work is needed to highlight the importance and usefulness of conservation zones, and assistance is needed in establishing and managing said conservation zones.

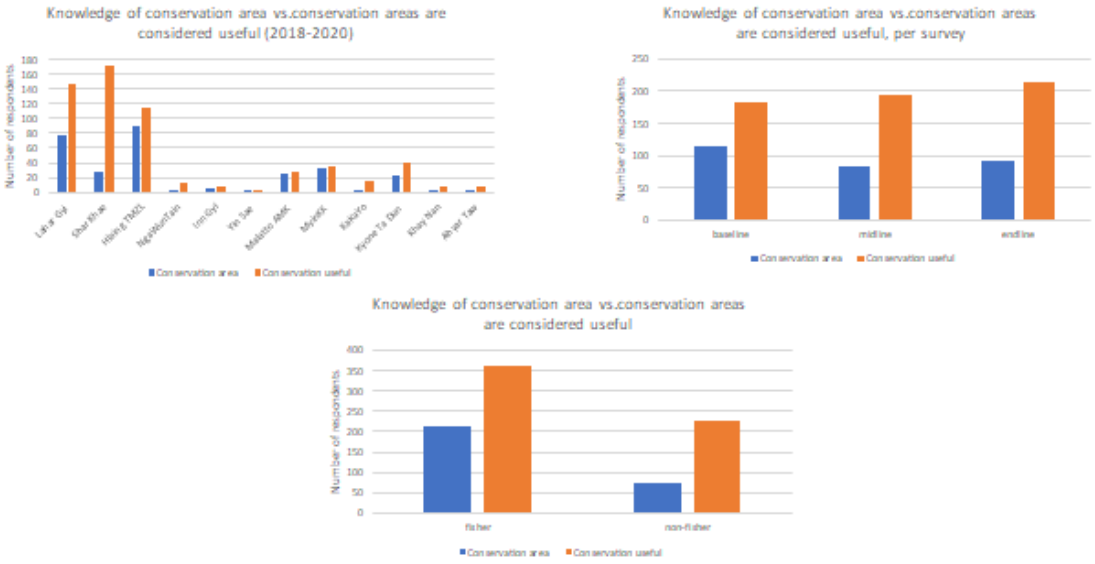
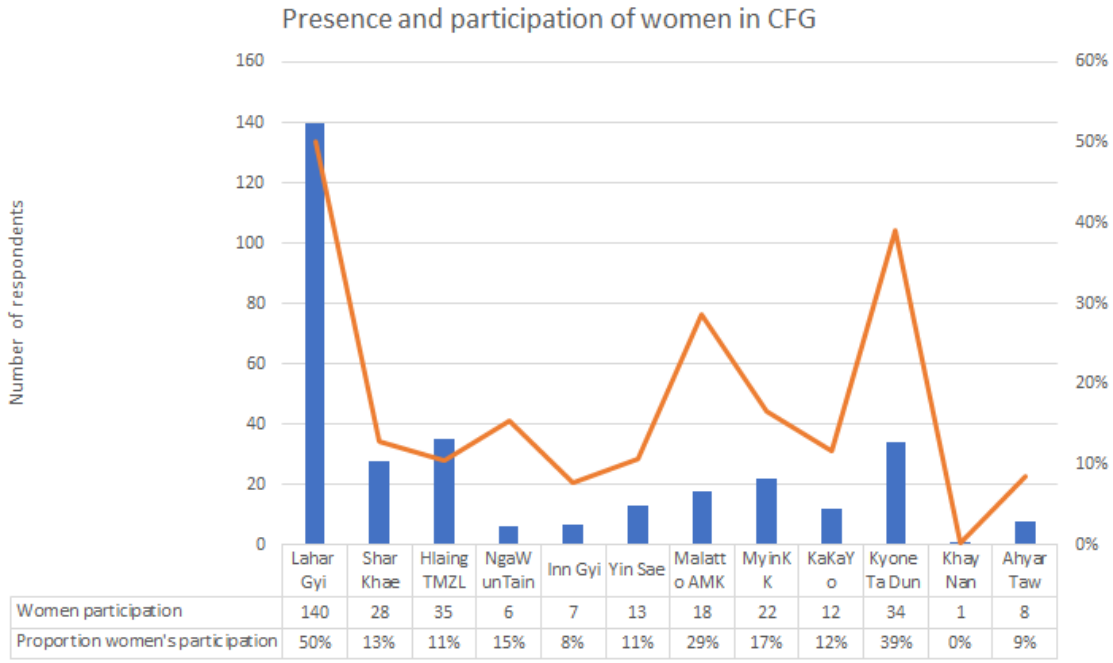


Figure 17: Prescence of conservation areas and usefulness thereof

Participation by women was low in most sites, and around half in Lahar Gyi. Women's participation in the CFG was higher in sites where local fishing communities had interacted

with NGOs or fisheries development associations who highlighted the importance and benefits of women's participation.



	Lahar Gyi	Shar Khae	Hlaing TMZL	NgaW unTain	Inn Gyi	Yin Sae	Malatt o AMK	MyinK K	KaKaY o	Kyone Ta Dun	Khay Nan	Ahyar Taw
Women participation	140	28	35	6	7	13	18	22	12	34	1	8
Proportion women's participation	50%	13%	11%	15%	8%	11%	29%	17%	12%	39%	0%	9%

Figure 18: Participation of women in the CFG

In Lahar Gyi, around half of the respondents mentioned that women actively participate in the CFG. In other sites, the percentage of respondents stating women participate actively was between 0% and 29%. The numbers represent the number of respondents who answered "yes" to the question if women participated in the CFG, it does not represent the number of women actively participating. In some cases and in other projects, a woman's participation was as replacement of a man fisher or farmer (e.g. husband, uncle, son, etc.). Sites where participation of women is between 1/4th and half of total respondents (Lahar Gyi, Malatto AMK, Kyone Ta Dun) were sites that had had previous interaction with NGOs and local fisheries development organisations and had awareness of the potential benefits and importance of including women in the CFG activities.

The **main benefits of being CFG members** that were mentioned in the socio-economic survey were a) higher fish catches, b) higher income, c) easier to sell fish, and d) less conflicts with other fishers, (Figure 19).

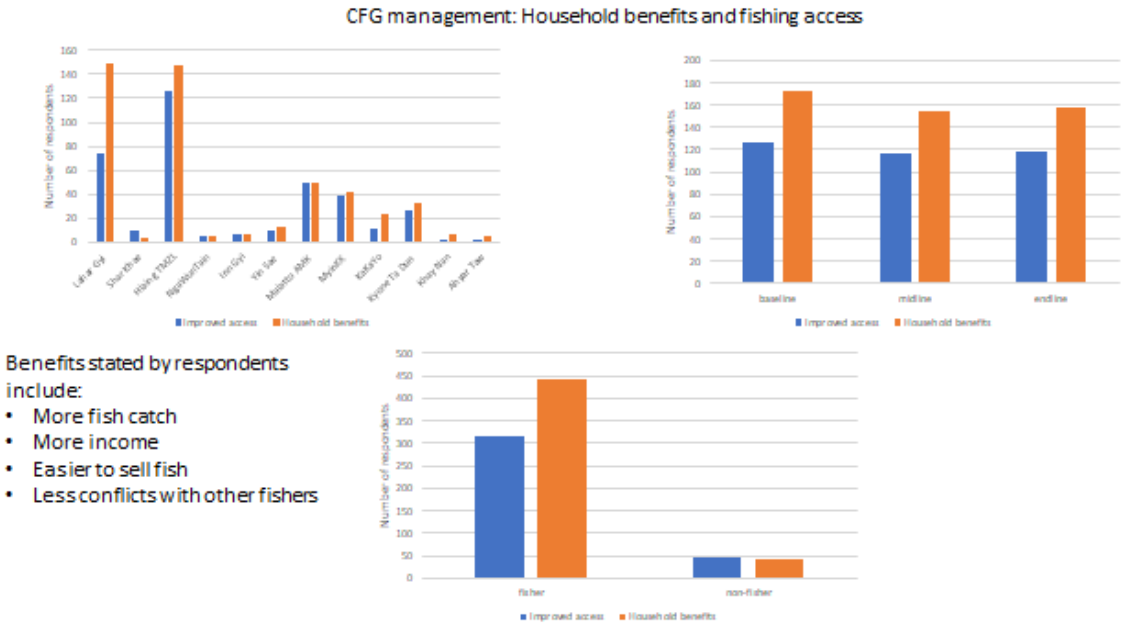


Figure 19: Main benefits of being CFG members

The site where access to the fishery has improved the most was Malatto AMK. Nearly 80% of respondents there stated that access to the lease had improved as a result of being a member of the CFG. In Khay Nan and Ayar Taw, almost no one (1% and 2% respectively) mentioned that access to the lease had improved for CFG members. Respondents were more positive about general benefits derived from being a CFG member. Again, in Malatto AMK nearly 80% of respondents said their household benefited from being a CFG member. In other sites it ranged from around half (Lahar Gyi, 53%, and Hlaing Tar Mezali, 45%) to one third (Kyone Ta Dun, 37%, and Myin KK, 32%) to less than 5% of surveyed households claiming their household benefited as members of the CFG (Shar Khae and Khay Nan, 2%).

In summary,

- Most fishers were aware of the existence of a CFG in their area
- Fishers were convinced of the usefulness of conservation areas; a number which increased every year
- Fishing households consume more fish than non-fishing households
- Fish consumption is highest in May-August, while fish purchases are highest in September-December
- Farming and fishing were the two most important livelihoods in the survey sites
- The number of respondents stating conservation areas are useful increased year on year
- Women's participation in the CFG was fairly limited (site with the highest score had 50% women participants)

FRDN training

The university teams working under the scope of the FRDN on the socio-economic and bio-monitoring surveys were provided ongoing capacity development and training on data collection, compilation, analysis and reporting. The particular topics addressed during the training courses were determined by questioning the research teams on their needs, reviewing data sets and reports and was decided one week in advance. Based on the topics highlighted by the research teams a training outline and practice exercises were prepared.

Three days of training were organised. The first day centred around the bio-monitoring survey (data collection, data entry, data analysis), two days focused on the socio-economic data and reporting, and the last day was used to refresh the activities from the previous days and address any remaining questions and uncertainties. After each day participants were asked to highlight what went well and what they felt was lacking or still needed to be addressed. The most recent of which was held in January 2020.

Community Fisheries Management Interventions

The project activities aimed to gain an understanding of the **current fisheries management practices** and to **design interventions to improve these practices**. The performance of CBFM was assessed using Sustainability, Equity and Productivity (S-E-P) indicators in each of 6 sites from the bio-monitoring survey (Figure 8) and 14 indicators from the socio-eco survey across 12 sites, (Figure 20). Sites were given a score based on the proportion of respondents who answered yes to a set of questions relating to management, conservation, gender, access rights, etc.

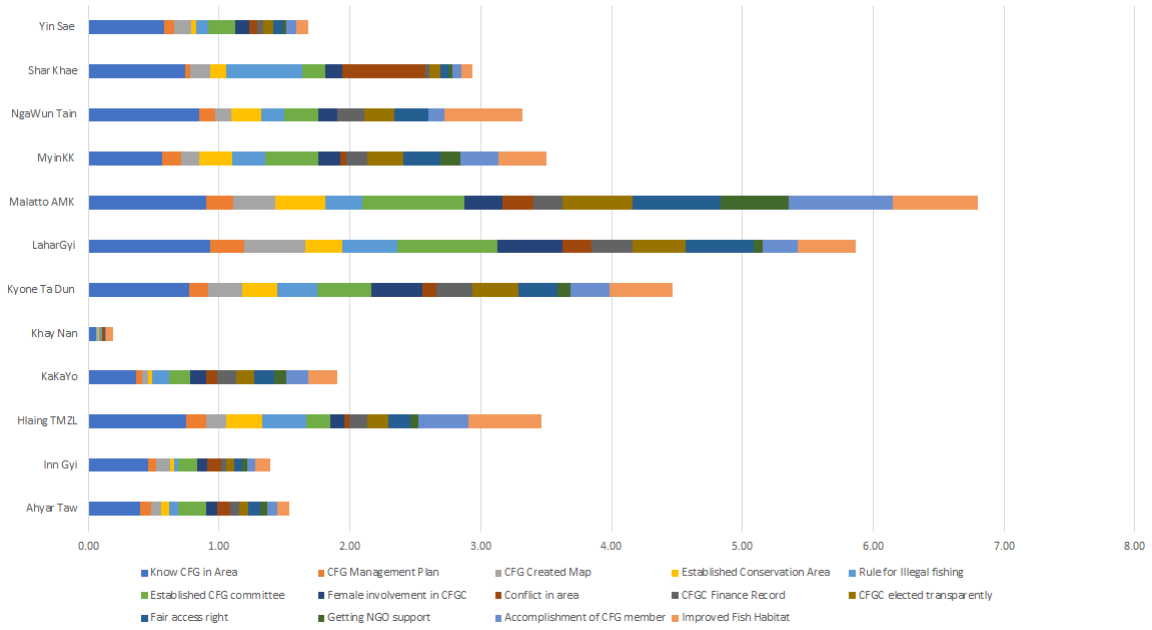


Figure 20: CFG Management assessment score

Sites that scored higher were, in general, sites where **NGOs or local fisheries associations were present** and had organised awareness raising activities or fisheries management workshops, highlighting the impact these activities can have down the line. Malatto Aung Met Kun came out as the site with the highest score for the CFG management performance. The high score for Lahar Gyi can be explained by the fact that local NGOs have been conducting awareness raising activities in this area concerning CBFM for a while before it was selected as a pilot MYFISH 2 site. The expenses for the establishment of a non-fishing zones in HlaingTMZL, Inn Gyi and Kyone DaDun sites were covered by WorldFish, that also conducted awareness raising and training activities in those sites. A similar approach was taken by local NGOs in Myin Ka Kone and Lahar Gyi. The local communities and CFG members now have a better understanding of inland fisheries law and have reduced the practice of illegal fishing methods in those areas, established a restricted fishing zone and realized the benefits of conservation areas. Improved collaboration was being developed between local CFG groups and Department of Fisheries to manage the fishing areas together.

In total, three additional pilot study sites for management interventions were selected; 1) Kyone Ta Dun, Inn Gyi and HlaingTMZL. A brief outline of activities in Inn Gyi, below.

Inn Gyi

Inn Gyi lease is located in Inn Gyi village, Hinthada Township, Hinthada district. It is a permanent lake cover an area of 38ha (96 acre). The lake connects to a large river, Nhawun River, through a channel that is designated under two other leases. Movement of fish between the lakes and the river through the channel is considered constrained by the two leases. See map of the lease with proposed non-fishing area.

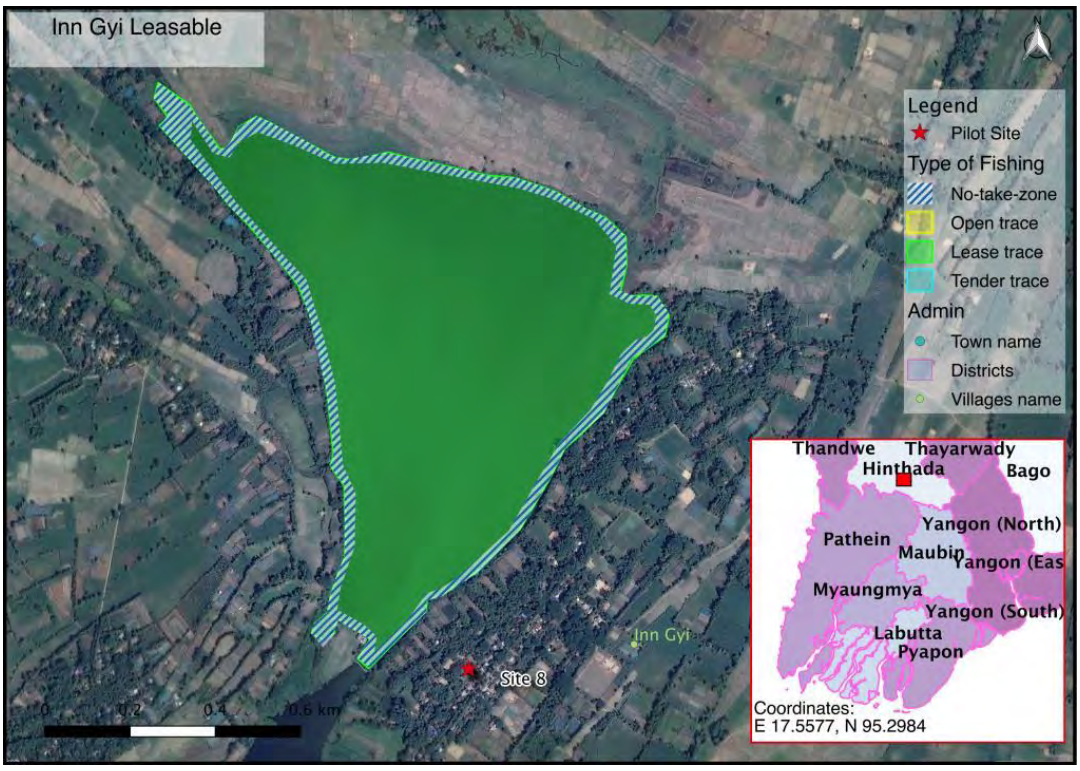


Figure 22: Inn Gyi lease

Inn Gyi activities included the identification of current problems by the community fisheries groups and to develop solutions and action plans that could be implemented together with DoF and WF. The main problems that were identified during the facilitation workshop were limited awareness of conservation practices, degradation of fish habitats and decreasing fish stocks and no effort to restock the lease with fingerlings. Potential solutions were discussed and possible activities that could be led by the community fisheries groups were determined.

The CFG committee determined to stock fingerlings in the lease and establish no-fishing zones in the lake. The committee discussed the action plan together with the members and the local Department of Fisheries. On 5th October 2019, the DoF township officer and the WF team participated in the restocking. 100,000 fish fingerlings (rohu, mrigal, and catla) were released in the lease. More than half (60,000) of these fingerlings were purchased using CFG funds and were released into the designated no-fishing zone.

Plate 1 Inn Gyi conservation zone

Plate 2 Inn Gyi restocking

Fisheries Information Centre

The fisheries information centre (FIC) is a digital database of research papers, reports and information related to fisheries in Myanmar. It was set up and launched in 2016 at the DoF office, Yangon. In the beginning, it wasn't accessible 24h/24h. The digital library contained 356 documents in total.

In 2017, the MYFish2 project wanted to improve the process and tried to reach the information to the users. The DoF library team and WF staff planned a FIC tour to the universities and explained how to register on FIC, how to search for and use the documents. The FIC team discussed with professors of the Zoology Department to collect full research papers or abstracts. The team developed user guidelines and promoted it among members of the Myanmar Fisheries Network. Now, the digital library is accessible online 24h/24h and 1,550 different users (updated by March 2021) visited the website www.dof-myanmar-fic.org a total of 1,249 times. In 2021, the Department of Fisheries committed to maintain the functioning of FIC long-term.

List of documents on the FIC – March 2021

Sr.No	Resource Type	Quantity	Remarks
1	Books	55	Fisheries Statistics
2	Journals	141	Research Articles and Journals
3	Laws	48	National Fisheries Laws, State/Region fisheries Laws Inland Fisheries Laws
4	Posters	35	Projects
5	Conference Proceedings	32	

Sr.No	Resource Type	Quantity	Remarks
6	Project Reports	241	Project Documents and Research Reports
7	Training Books	42	
8	Theses	62	Abstracts and Full Texts
Total		**656**	

8 Impacts

Following on from the successful MYFISH-1 ACIAR funded project, this second and final phase has focused on the inland capture fisheries in the Ayeyarwady Region which covers most of the Ayeyarwady Mega-Delta. The characteristics of the latter are typical of a sinking anthropogenically impacted deltaic system (Syvitski, J., Kettner, A., Overeem, I. ***et al.*** Sinking deltas due to human activities. *Nature Geosci* **2,** 681–686 (2009). https://doi.org/10.1038/ngeo629). Such deltas often suffer from a combination of upstream and delta-based activities, including illegal sand mining and water abstraction, combined with land use policies designed to promote rice production rather than sustainable fisheries management. This has a negative impact on the fisheries. In some cases, large-scale pond aquaculture has affected floodplain fisheries by blocking access by fisherfolk to the fisheries and impeding drainage and connectivity from the floodplains to nearby rivers. Some of the leasable fisheries documented by this project (Appendix 13 and 13a&b) have been lost as revenue collating mechanisms to local authorities (DoF report translation Appendix 14). Rice-Fish culture has emerged as a viable option to counteract the loss of inland aquatic biodiversity by the reduction of agrochemical usage and the adherence to better management practices for rice, water and fish production (see sister project results FIS-2016-135). In this context, the project has investigated fisheries management systems designed to improve freshwater fish production at a range of production sites chosen for their representativeness. The project's impact, in both social and biological terms, is viewed by collaborating stakeholders from fishing communities and the authorities whose task it is to ensure the sustainability of the aquatic food production systems by using the research carried out by local universities in the delta under the guidance of WorldFish.

8.1 Scientific impacts – now and in 5 years

For over half a century the people of Myanmar and the scientific community in particular have not benefited from a stable political environment where research is prioritized and the results used to inform policy decisions. During this project's implementation period a combination of the Fisheries Research Development Network (FRDN) coupled with the Fisheries Information Center (FIC) and capacity building from WorldFish and Myanmar Fisheries Partnership (MFP) members has allowed local research staff to develop their scientific skills both social and natural. This has led to the inclusion of community based fisheries management in local fishery laws (2018) and the research results ready for publication now. It is difficult to say what the impact in 5-years' time will be as the military takeover on February 1, 2021 has stifled the interaction between fisherfolk, local authorities and the scientific community. That said the country continues to rely on aquatic food as the main source of animal protein, a fact that the *de facto* government is well aware, should result in improved sustainable management drawing on the results from this project. The concern is that some of the scientists who helped with the research under this project may not continue as they look for employment options elsewhere in Southeast Asia.

8.2 Capacity impacts – now and in 5 years

All stakeholders participating in this project have benefited from the capacity building work at fisher, research worker and fisheries administration levels both local and national. The participatory monitoring and data collection work carried out by fisherfolk is the result of their interest and the capacity building opportunities provided by a mix of university and Department of Fisheries staff who were in turn trained by WorldFish experts from Myanmar and nearby Cambodia. The training provided to fisher communities and the value chain operators included a number of youths and women who often participate in post-harvest activities. Data analysis skills, of importance for local university staff, were improved by the interaction of WorldFish scientists. Five years hence it is expected that the capacity building at all levels will help the local Ayeyarwady Region with improved fisheries management.

Mechanisms have been put in place to receive future funding via the FRDN. Scientific exchange networks under the MFP will ensure that capacity building will continue for the local NGO/CBOs by interactions with the international NGO and scientific communities linked to them. Although links to the Government are currently difficult, the Myanmar Fisheries Federation (MFF), a private sector apex body, continues to act as a nexus for fishing communities and the feedback needed by the authorities regarding fisheries co-management aspects promoted by this project.

8.3 Community impacts – now and in 5 years

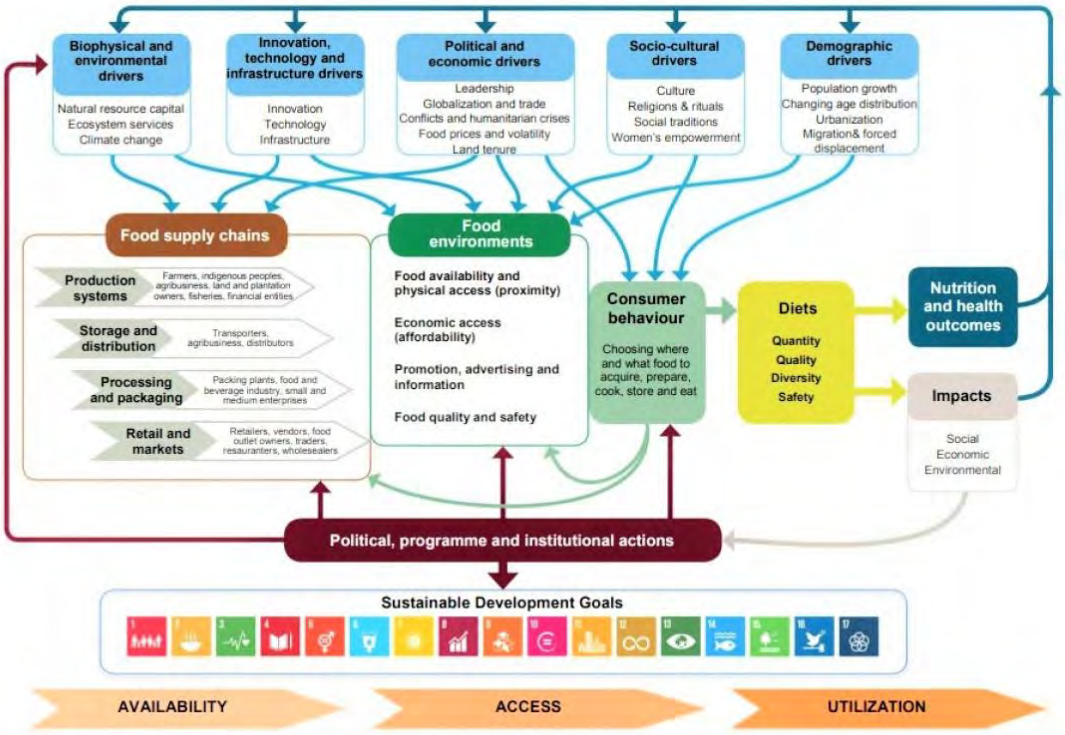
The fisher communities and those involved in fish value chains have participated actively in all aspects of this project. In terms of sustainability, this is of particular importance regarding the interactions with and between local university and DoF scientists. During the COVID-19 pandemic and current political turmoil, community networks provided the means to ensure food provision is possible. Price fluctuations, access to cash and movement restrictions have resulted in a strengthening of communities, which needs to be documented for future times of crisis: climate change or politically induced. WorldFish, IFPRI, IRRI and IWMI (CGIAR entities) have been documenting the impacts on communities via contacts established under this project and others (Appendix 15a&b COVID-19 impact papers).

8.3.1 Economic impacts

Inland fisheries are extremely valuable both in terms of their net worth and contribution to fisher and value chain operator livelihoods. Around 3 million people in the Ayeyarwady Delta alone depend on these the inland fisheries. The inland hilsa fishery, one small but high value component of the Ayeyarwady Delta freshwater fisheries, is estimated to be worth over USD700 million per annum with around 1.6 million fishers employed (http://pubs.iied.org/16675IIED). The leased fisheries generate greater amounts, especially when the 'hidden harvest' is included (Hidden Harvests). The total economic value (TEV) of the Ayeyarwady Delta fisheries has not been calculated and the contribution to the livelihoods of around 5% Myanmar's population needs further attention. Under the new One-CGIAR, WorldFish will contribute to the Asian Mega Delta analysis to establish the impacts of climate change on three Asian mega-deltas: the Ganges, Ayeyarwady and Mekong Deltas. The ACIAR MYFISH 2 research results provide an important baseline for this study.

8.3.2 Social impacts

As with community and capacity building aspects, the social impacts from being actively involved in the improved management of a fishery are fundamentally important. At present this is not seen at all sites studied and future interventions post COVID-19 need to ensure cross-visits by fisher groups to view the advantages of improved community-based activities. Fishers and their families become part of the management system and are no longer simply a means of harvesting fish from a fishery controlled by the lease owner. Fishery management committees typically include local authorities, village leaders and elected members of the fisher associations. Regulations are agreed and fines imposed on fishers, association members or outsiders, who break the rules. In many cases there is a degree of tolerance for landless families who are not members of the association and not classified as fisherfolk but extract fish for their household needs by means of a cast-net or hook and line. The impact of COVID-19 added to the current political situation will no doubt have exerted additional pressures/drivers on the fisheries studied under this project. The data collected by this ACIAR funded research will serve as an important baseline on which to measure the impacts of these added drivers as noted in the Conceptual framework of food systems for diets and nutrition. Source: HLPE. 2017.



Source: HPLE (2017).

8.3.3 Environmental impacts

As noted above the Ayeyarwady Delta is severely impacted due to anthropogenic activities that cause the delta to sink. When coupled with climate change aspects, causing rising sea levels, increased incidence of storm events, aseasonal rainfall and temperature rise, the need to ensure improved inland fisheries management is evident. Other areas of ACIAR research are looking at the connectivity aspects and the need for improved irrigation systems to provide fish passages round tidal barrages and other infrastructure associated with irrigation systems. WorldFish, IWMI and the FAO produced as set of guidelines for fish in irrigation systems, which took evidence from the MYFISH 2 project: (FAO, WorldFish and IWMI. 2020. Increasing the benefits and sustainability of irrigation through the integration of fisheries - A guide for water planners, managers and engineers. Colombo. https://doi.org/10.4060/cb2025en). Further WorldFish investigation looking at the vulnerability of inland capture fisheries under climate change also used the research work under MYFISH 2 (Climate risk assessment for fisheries and aquaculture-based adaptation in Myanmar). The ACIAR funded Rice-Fish project (FIS-2016-135) in Myanmar has also been implemented in the Ayeyarwady Delta, where land use reforms and use of better management practices have helped to improve water management and reduce the use of pesticides in the floodplain fishery environments where rice is grown in the dry season. Unfortunately, not all sites studied have established conservation (no-take) zones with only 33% having these areas established. There is strong evidence from neighbouring Bangladesh that the establishment of sanctuaries for the hilsa fishery has improved landings and the average size of fish caught (Appendix 16). Over the next five years the adoption of both improved fisheries management and rice-fish systems will result in increased fish production and incomes for farmers and fishers alike (Dubois, M. J.; Akester, M.; Leemans, K.; Teoh, S. J.; Stuart, A.; Thant, A. M.; San, S. S.; Shein, N.; Leh, Mansoor; Moet, Palal Moet; Radanielson, A. M. 2019. Integrating fish into irrigation infrastructure projects in Myanmar: rice-fish what if…? Marine and Freshwater Research, 70(9):1229-1240. https://doi.org/10.1071/MF19182).

8.4 Communication and dissemination activities

The research carried out by FRDN members and the peer-reviewed papers listed in this report under publications will be posted on the Fisheries Information Center (FIC) website http://dof-myanmar-fic.org/ which is managed and maintained by the Department of Fisheries. The information exchange network under the Myanmar Fisheries Partnership (MFP) is an informal institution that continues to share information even under the current political complications. This demonstrates the positive impact from the ACIAR funded MYFISH 2 project that will continue and strengthen over the next five years as the member entities press on with their research in Myanmar and other Southeast Asia countries. Of importance the work by WorldFish in Cambodia where the Community Fish Refuges (CFR) provide evidence of the links between rice landscapes and capture fisheries associated with them (Integrating nutrition and gender into Community Fish Refuge-Rice Field Fisheries system management: A practitioner's guide https://hdl.handle.net/20.500.12348/4870). ACIAR has assisted the development of a theory of change document for the rice field fisheries in Cambodia, which has also drawn upon the MYFISH 2 experience in Myanmar.

9 Conclusions and recommendations

The project 'Improving fishery management in support of better governance of Myanmar's inland and delta fisheries' started at a time of optimism in Myanmar when the nascent democracy showed a real opportunity for improved natural resource management including fisheries. The research and associated capacity building have generated a wealth of information regarding the process of change towards greater involvement by the fisher communities that depend on inland capture fisheries. Local government officials including the Ayeyarwady Regional Minister have responded to the MYFISH research which assisted with this reformational process helping with the drafting and approval of the 2018 Regional Fisheries Law and its subsequent 2019 enactment which allows community-based fisheries management.

The MYFISH established Myanmar Fisheries Partnership (MFP) and the work by its members, from both Myanmar and a range of global entities, provides evidence of the role of research and research coalitions in negotiating different stakeholder interests within newly claimed and invited spaces of engagement. It also illuminates the dynamic and fragile nature of these spaces in the context of broader political upheaval, and the important roles that economic incentives and vested interests play in policy and regulatory reform.

The project has delivered its objectives and provided the Myanmar Government and Private sector with the wherewithal to improve inland capture fisheries management. The improvements have not been dramatic as changes to systems based on centuries of revenue generation priorities over biodiversity protection will inevitably take time. Furthermore, the double shock caused by COVID-19 and military coup d'état have underlined the complexity of inland capture fisheries and the way communities interact with them. The fact that the project has socio-economic and biodiversity case studies as a baseline for the pre-shock situation will now allow the participating stakeholders, including the fisher folk, to better assess how management systems can achieve the required resilience.

1. Conclusions

The initial characterisation of leasable fisheries as a simple dichotomy between individual and community managed systems was found to be overly simplistic and a more accurate assessment needed to consider tenure as operating along a spectrum from individual to community tenure. This had implications for understanding and assessing their performance and required the development of a more nuanced framework for analysis incorporating a number of 'intermediary' systems between these extremes, Table 1.

The performance of the different management regimes were assessed across four broad domains; the natural environment, institutions and governance, people and livelihoods and external drivers. Across all domains the individual and mixed tenure systems were considered the worst performing with short term profit as the primary motivation, an inequitable distribution of benefits and little concept of conservation or concern for the sustainability of the ecosystem. The quasi community and community tenure systems outperformed the individual and mixed tenure systems across all domains, particularly the equitable access to and distribution of benefits. However similar to all management systems the natural environment performed poorly in most cases and the capacity to manage the lease was initially low but seen to improve through attendance at meetings and trainings and in some cases by dividing up the lease into smaller management units. NGO support and good relations with the DoF we also strong indicators of successful performance.

The performance of community managed leases and community fishery management interventions was further assessed through ongoing socio-economic and biological monitoring undertaken by universities and the DoF under the umbrella of the FRDN. The capacity requirements of the FRDN team as well community fisher groups and local

authorities was perhaps lower than expected and necessitated that the project focus primarily upon the capacity development of stakeholders through ongoing on the job and needs based trainings and awareness raising.

The bio-monitoring survey was implemented in six sites and monitored mainly fish production, abundance, and fishing effort. Species diversity was lower than expected when comparing to other surveys in the Ayeyarwady Delta (AD). Most survey sites had medium productivity and quite high production only one site (Myin Ka Kone) had low production and also low productivity. The socio-economic survey aimed at gathering household information on a number of topics: household information, Aquaculture & fisheries, Nutrition, and Structure and functioning of the CFA. The socio-economic survey was administered in twelve sites, totalling 615 households in 33 villages.

The performance of the community fisheries management systems in the survey sites were assessed using 14 socio-economic indicators and the three indicators used in the bio-monitoring survey (equity, productivity, and sustainability). Sites that received higher scores were sites where NGOs or local fisheries associations had been present for some time and where pilot sites were provided with funding, training and awareness raising for management interventions. Illegal fishing was seen to have reduced in these sites and a shift in mindset towards the idea of sustainably oriented management interventions and the benefits it could provide.

Participation and engagement of women in the CFG was low in most sites due to structural inequalities such as the granting of fishing licenses primarily to men and social norms such as the perceived role of women in fisheries. In sites where NGOs had previously organised awareness raising activities or run projects involving women, participation was higher than in other sites.

Overall, the proportion of households stating they had benefitted from being CFG members was quite mixed (ranging from 80% to less than 5%). The main benefits were mentioned to be easier access to the lease, higher production, higher income, and less conflicts with other fishers.

2. Recommendations

Given the heterogeneity of systems, locations, fishing practices, scale and political climate the biomonitoring and socio-economic assessments allow the use of indicators such as species richness, catch per unit effort among others to inform all stakeholders about the benefits of improved fisheries management. It is therefore recommended that commitments are sought from the Myanmar Fisheries Federation (MFF) as the private sector apex body in the Myanmar fisheries sector to use the monitoring tools developed under this project to inform policy makers and fisher communities alike. The FRDN links between Myanmar research organisations, the Department of Fisheries as legislators and the MFF in representation of all fishers provides the foundation for continued support.

It is recommended to strengthen CFAs in order to ensure enforcement of rules and regulations, reduction of illegal fishing, improve collaboration with the government and other institutions, and reduce the impact of anthropogenic activities on the health of the lease. Better collaboration with non-fishers regarding management of the lease and multiple uses of water (e.g. reducing agricultural runoffs or waste disposal) could have a beneficial effect on the natural environment in the lease, sustaining or improving biodiversity and production. It is recommended to include local communities in the CFAs to allow them access to the lease, while at the same time diversifying livelihoods to reduce fishing pressure on the lease.

It is recommended to continue organising yearly capacity building activities with the partner institutions under the scope of the FRDN. This can be done by organising training

workshops on research design, data analysis, scientific reporting as well as through collaboration in the implementation of research projects in fisheries research in Myanmar.
As the results of the assessment have shown that sites where NGOs were previously present had received higher scores, it is recommended to foster collaboration between local NGOs, government institutions (DOF), and local fishing communities to strengthen the CFG management system and improve performances. It is also recommended to continue the monitoring programme in order to be able to discern seasonal or temporal patterns in the abundance and productivity of the different survey sites. As fishing with collective gears is seasonal, it could be useful to diversify livelihood options for fishers to reduce the importance of individual fishing operations during this period.

In order to ensure the long-term sustainability of CFAs policies need to be developed enabling the long-term lease of fishing grounds by a CFA and to strengthen the financial capacity of CFAs managing leases. National community fisheries guidelines for freshwater fisheries would be beneficial as well as more effective enforcement of illegal fishing.

Approaches applying a gender transformative (GTA) perspective that emphasise intersectionality (i.e., multiple social identities), the participation and effective engagement of women in decision making and a shift in gender norms and behaviours (through targeted interventions along the value chain where current practices limit the equal opportunities and aspirations of women), are recommended.

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11 Appendices

Appendix 1: Rapid Appraisal of Agricultural Innovation Systems

Appendix 2: Fisheries Co-Management guidelines

Appendix 3: Biomonitoring Report

Appendix 4: Case Studies - biological

Appendix 5: Case Studies - socioeconomic

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RAAIS: Rapid Appraisal of Agricultural Innovation Systems (Part I). A diagnostic tool for integrated analysis of complex problems and innovation capacity

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ABSTRACT

This paper introduces Rapid Appraisal of Agricultural Innovation Systems (RAAIS). RAAIS is a diagnostic tool that can guide the analysis of complex agricultural problems and innovation capacity of the agricultural system in which the complex agricultural problem is embedded. RAAIS focuses on the integrated analysis of different dimensions of problems (e.g. biophysical, technological, socio-cultural, economic, institutional and political), interactions across different levels (e.g. national, regional, local), and the constraints and interests of different stakeholder groups (farmers, government, researchers, etc.). Innovation capacity in the agricultural system is studied by analysing (1) constraints within the institutional, sectoral and technological subsystems of the agricultural system, and (2) the existence and performance of the agricultural innovation support system. RAAIS combines multiple qualitative and quantitative methods, and insider (stakeholders) and outsider (researchers) analyses which allow for critical triangulation and validation of the gathered data. Such an analysis can provide specific entry points for innovations to address the complex agricultural problem under study, and generic entry points for innovation related to strengthening the innovation capacity of agricultural system and the functioning of the agricultural innovation support system. The application of RAAIS to analyse parasitic weed problems in the rice sector, conducted in Tanzania and Benin, demonstrates the potential of the diagnostic tool and provides recommendations for its further development and use.

1. Introduction

The Agricultural Innovation System (AIS) approach has become increasingly popular as a framework to analyse, and explore solutions to, complex agricultural problems (e.g. Hall et al., 2003; World Bank, 2006). The AIS approach evolved from a transition from technology-oriented approaches, to more systems-oriented approaches to agricultural innovation (e.g. Klerkx et al., 2012a). Within the AIS approach, innovation is perceived as a process of combined technological (e.g. cultivars, fertilizer, agronomic practices) and non-technological (e.g. social practices such as labour organization or institutional settings such as land-tenure arrangements) changes (Hounkonnou et al., 2012; Leeuwis, 2004). Such changes occur across different levels (e.g. field, farm, region), and are shaped by interactions between stakeholders and organisations inside and outside the agricultural sector (Kilelu et al., 2013; Klerkx et al., 2010).

Adopting an AIS approach to study complex agricultural problems has important implications for research. First, it requires an analysis that acknowledges and integrates the different dimensions, levels and stakeholders' interests associated with the problem under review. Second, it necessitates a holistic understanding of the innovation capacity of the agricultural system in which the complex problem is embedded (Hall, 2005). Third, it requires insight in the structural conditions provided by the agricultural innovation support system that can enable or constrain innovation in the agricultural

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system (Klerkx et al., 2012b; World Bank, 2006). Fourth, it requires a thorough understanding of the interactions between complex agricultural problems, innovation capacity in the agricultural system and the agricultural innovation support system.

Despite the recent development and application of a variety of methods that can support AIS analyses (e.g. World Bank, 2012), the potential of the AIS approach to address complex agricultural problems remains underutilized in many fields of study (e.g. Schut et al., 2014a). Four main reasons for this were identified. First, methods used for the analysis of complex agricultural problems generally have a narrow focus, rather than a holistic view. They support the analysis of a specific dimension (e.g. the economic dimension in Beintema et al., 2012), level (e.g. the national level in Temel et al., 2003), or stakeholder group (e.g. farmers in Amankwah et al., 2012; Totin et al., 2012). Second, studies that do include analysis of multiple dimensions of problems (e.g. Singh et al., 2009), interactions across different levels (e.g. Douthwaite et al., 2003) or multi-stakeholder dynamics (e.g. Hermans et al., 2013) often have limited attention for the integrated analysis of these features of complex agricultural problems. Third, studies that integrate the analysis of multiple dimensions of problems, interactions across different levels and multi-stakeholder dynamics (e.g. Lundy et al., 2005; van Ittersum et al., 2008) have limited attention for understanding innovation capacity in the agricultural system and the functioning of the agricultural innovation support system. A fourth reason is that the majority of AIS studies are conducted *ex-post* (e.g. Basu and Leeuwis, 2012), lack a clear structure to delineate system's boundaries (Klerkx et al., 2012b), or are based on comprehensive studies which take considerable time (e.g. Jiggins, 2012). Although such studies provide a better understanding of the drivers of innovation in agricultural systems, their diagnostic ability to identify entry points for innovation to overcome complex agricultural problems is limited.

Based on the above review of the availability, scope and use of methods for AIS analyses, we have developed and tested a diagnostic tool that can support the Rapid Appraisal of Agricultural Innovation Systems (RAAIS). RAAIS fits within a tradition of 'rapid appraisal approaches' used in the field of agriculture, including the Participatory (Rapid) Rural Appraisal (Chambers, 1994), Rapid Appraisal of Agricultural Knowledge Systems (RAAKS: Engel, 1995) and the Rapid Appraisal of Potato Innovation Systems (Ortiz et al., 2013). RAAIS integrates and builds upon existing (agricultural) innovation system concepts and combines multiple methods of data collection. The objectives of RAAIS are to provide a coherent set of (1) specific entry points for innovation to address complex agricultural problems, and (2) generic entry points that can enhance innovation capacity of the agricultural system and the performance of the agricultural innovation support system. The aim of this paper is to provide a conceptual framework (Section 2) and a methodological framework (Section 3) for RAAIS. Based on its application in a study on parasitic weeds in rice production in Tanzania and Benin, we reflect on the extent to which RAAIS is able to meet its objectives, and provide recommendations for further development and use of RAAIS (Section 4), followed by the main conclusions (Section 5).

2. Conceptual framework for RAAIS

The agricultural innovation system – including both the agricultural system and its innovation capacity and the agricultural innovation support system – may be very good at tackling some complex agricultural problems, but may be incapable to deal with others (Hung and Whittington, 2011; Markard and Truffer, 2008). It underlines that understanding complex agricultural problems, innovation capacity in the agricultural system, and the functioning of the agricultural innovation support system requires integrative analysis. Despite of their interrelated character, we deem it useful for analytical purposes to first address them separately (Sections 2.1, 2.2 and 2.3), before showing their embeddedness (Section 2.4).

Table 1
Examples of stakeholder groups and diversity within stakeholder groups.

Stakeholder groups	Diversity within stakeholder group
1. Farmers	Smallholder farmers, agro-industrial farmers
2. Non-governmental organisations (NGO) and civil society organisations	(Inter)national agricultural networks and associations, cooperatives, development organisations, donors
3. Private sector	Input and service providers (e.g. seed and agro-dealers, private extension services), agricultural entrepreneurs (e.g. processors, traders, retailers, transport companies)
4. Government	Politicians, policymakers, extension and crop protection officers
5. Research and training	National agricultural research institutes, agricultural education and training institutes, universities, international research institutes

2.1. Complex agricultural problems

Complex agricultural problems are defined as problems (1) that have multiple dimensions (Schut et al., 2014b), (2) that are embedded in interactions across different levels (Giller et al., 2008), and (3) where a multiplicity of actors and stakeholders are involved (Funtowicz and Ravetz, 1993). Regarding the first, complex agricultural problems are an interplay of biophysical, technological, social-cultural, economic, institutional and political dimensions. To exemplify this, we use a case by Sims et al. (2012), who analyse constraints for the upscaling of conservation agriculture in sub-Saharan Africa. They demonstrate how import taxes on steel, but not on imported agricultural machinery (institutional dimension), disadvantage manufacturers in developing locally adapted agricultural equipment such as no till planters (technological dimension) for effective soil conservation for sustainable crop management (biophysical dimension). Concerning the second, the dimensions of complex agricultural problems often have different implications across different levels. Mitigating the impact of agro-industrial biofuel production on food security, for instance, will require different strategies when approached at the national level (e.g. policies avoiding agro-industrial biofuel production in regions where pressure on agricultural land is already high) or at the farm household level (e.g. balancing the allocation of household labour to on-farm crop production and off-farm plantation work) (Schut and Florin, under review). Nevertheless, the different levels are interrelated, and consequently, coherent multi-level strategies are required. Regarding the third, complex agricultural problems are characterised by the involvement of a multitude of actors, stakeholders and the organisations they represent (Hounkonnou et al., 2012; Ortiz et al., 2013) (Table 1). Actors include about anyone that can be related directly or indirectly to a problem, or the potential solution. Stakeholders are those actors or actor groups with a vested interest in addressing the problem (McNie, 2007) and their participation in exploring solutions to complex agricultural problems is perceived as a critical success factor (e.g. Giller et al., 2011). Stakeholder participation can provide enhanced insights in the different dimensions of the problem, and the types of solutions that are both technically feasible, and socio-culturally and economically acceptable (Faysse, 2006). However, stakeholder groups are no homogeneous entities and often focus on their own, rather than a common, interest (Leeuwis, 2000).

2.2. Innovation capacity in the agricultural system

The agricultural system is defined as the "operational unit of agriculture" including all actors and organisations at local, regional and national levels involved in the production, processing and commercialization of agricultural commodities (Spedding, 1988). Consequently, innovation capacity in the agricultural system is defined as the ability of these actors and organisations to develop new and mobilise existing competences (including knowledge, skills and experiences) to continuously identify and prioritise constraints and opportunities for innovation in a dynamic systems context (Leeuwis et al., 2014).

Following the typical system boundaries used in generic (i.e. non-agricultural) studies of innovation systems (Carlsson et al., 2002; Papaioannou et al., 2009; Wieczorek and Hekkert, 2012), we conceptualise the agricultural system as a combination of interrelated institutional, sectoral and technological subsystems. The institutional subsystem comprises different types of institutions, which are the formal and informal rules and structures that shape perspectives and practices (Leeuwis, 2004). In this paper we examine six types of institutions; policy, research, education and training, extension, markets and politics across different aggregation levels (e.g. national, regional or district) (e.g. Cooke et al., 1997; Freeman, 1988, 1995). The sectoral subsystem is defined around a commodity or segments of a value chain (e.g. rice or cocoa) (e.g. Blay-Palmer, 2005; Gildemacher et al., 2009). The analysis of the sectoral subsystem seeks to understand interactions between, for instance, access to credit, inputs and services, agricultural production, post-harvest activities, trade, marketing and consumption related to the functioning of that value chain (e.g. Thitinunsomboon et al., 2008). Within the agricultural system, different sectoral subsystems can exist and interact. Technological subsystems are defined around an existing or novel technology (e.g. irrigation, mechanised weeding) or field of knowledge (e.g. integrated pest management) to address a particular problem that may well cut across different sectoral subsystems (Carlsson and Stankiewicz, 1991; Chung, 2012; Hekkert et al., 2007).

2.3. The agricultural innovation support system

The agricultural innovation support system provides the structural conditions that can enable (when present) or constrain (when absent or malfunctioning) innovation within the agricultural system and its subsystems (Klein Woolthuis et al., 2005; van Mierlo et al., 2010; Wieczorek and Hekkert, 2012) (Table 2). Structural conditions include (1) adequate knowledge infrastructure in the form of research, education and extension, physical infrastructure and assets such as roads and vehicles, and functional communication and finance structures, (2) institutions comprise clear regulatory frameworks and their proper implementation and enforcement, (3) interaction and collaboration between multiple stakeholders in the agricultural system, and (4) stakeholder capacities (e.g. literacy and entrepreneurship) and adequate human and financial resources (e.g. number of extension officers and funds for their backstopping). The analysis of the presence and functioning of these structural conditions contributes to a better understanding of what constraints or enables innovation capacity in the agricultural system (e.g. limited multi-stakeholder collaboration), as well as how the structural conditions provided by the agricultural innovation support system stimulate or hamper this (e.g. incentive structures for different stakeholder groups to collaborate).

The set-up of the agricultural innovation support system may be good at supporting incremental 'system optimisation' that reproduce the current state of affairs, but less good at supporting 'system transformation' that can lead to radical innovations. For example, the presence of an effective top-down, technology-oriented agricultural extension system can enable the dissemination of crop protection solutions through a technology transfer approach. However, the existence of this system can form a constraint for the promotion of agro-ecological approaches through participatory, farmer-led experiments. Consequently, to achieve system transformation, both the agricultural system and the agricultural innovation support system should undergo continuous adaptation (Hall et al., 2004; Spielman, 2005).

Table 2
Structural conditions that enable or constrain innovation in systems (based on Klein Woolthuis et al., 2005; van Mierlo et al., 2010; Wieczorek and Hekkert, 2012).

Structural conditions for innovation	Description
Infrastructure and assets	Knowledge, research and development infrastructure; physical infrastructure including roads, irrigation schemes and agricultural inputs distribution; communication and financial infrastructure.
Institutions	Formal institutions including agricultural policies; laws; regulations; (food) quality standards; agricultural subsidies; Monitoring and Evaluation (M&E) structures; organisational mandates; market (access) and trade agreements; informal institutions such as social-cultural norms and values.
Interaction and collaboration	Multi-stakeholder interaction for learning and problem-solving; development and sharing of knowledge and information; public-private partnerships; networks; representative bodies (e.g. farmers association); power-dynamics.
Capabilities and resources	Agricultural entrepreneurship; labour qualifications; human resources (quality and quantity); education and literacy rates; financial resources.

2.4. Interactions between complex agricultural problems, innovation capacity in the agricultural system and the agricultural innovation support system

The integrated analysis of complex agricultural problems, innovation capacity of the agricultural system and the performance of the agricultural innovation support system can provide a coherent set of specific and generic entry points for innovation (Fig. 1). Specific entry points for innovations relate to those innovations that directly contribute to addressing the complex agricultural problem under study. Generic entry points for innovation related to strengthening the innovation capacity of agricultural system and the functioning of the agricultural innovation support system. For example, to reduce fruit waste in developing countries, existing technologies for conserving fruits can be adapted to fit the local context (specific entry point for innovation of the technological subsystem). This may trigger access to export markets (specific entry point for innovation of the sectoral subsystem) and require certification policies to supply such fruit export markets (specific entry point for innovation of the institutional subsystem). To support the development, implementation and enforcement of certification policies, the establishment of a national agricultural certification bureau may be required (generic entry point for innovation). The existence of such a bureau can provide an incentive for investing in the export of other agricultural products, for instance, vegetables, that, in turn, can trigger the development or adaptation of conservation technologies to reduce vegetable waste. The above example shows how structural adaptations of the agricultural innovation support system can enhance innovation capacity to addressing the complex agricultural problem under review (fruit waste), but can also have a spill-over effect on addressing other complex agricultural problems (vegetable waste). Furthermore, the agricultural innovation support system can provide conditions that support innovation in the agricultural sector more generally, for instance through innovation

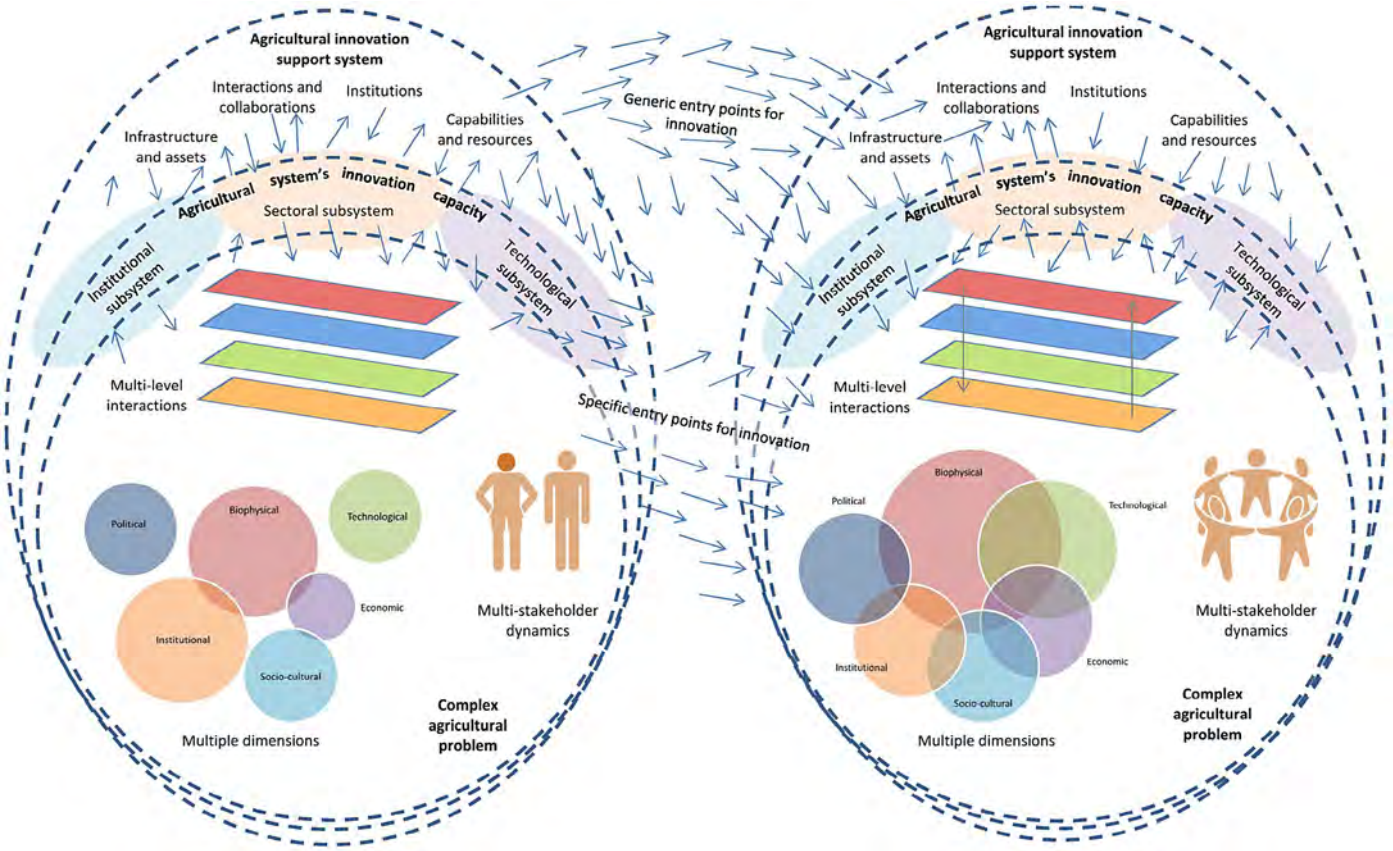

Fig. 1. Schematic representation of the dynamic interactions between complex agricultural problems (multiple dimensions, multi-level interactions and multi-stakeholder dynamics), innovation capacity of the agricultural system (including its institutional, sectoral and technological subsystems), and the structural conditions within the agricultural innovation support system that can enable or constrain innovation capacity in the agricultural system (infrastructure and assets, institutions, interaction and collaboration, and capabilities and resources). RAAIS provides insight into the current state of the system (on the left). RAAIS provides specific and generic entry points for innovation that can guide a transition towards the desirable state of the system (on the right) in which the complex agricultural problem is addressed, and the innovation capacity in the agricultural system has increased. Generic entry points for innovation can have a spill-over effect in terms of addressing other complex agricultural problems than the one under review.

policy or funding schemes that affect multiple institutional, sectoral and technological subsystems.

3. Methodological framework for RAAIS

3.1. Selection criteria for methods

RAAIS is a diagnostic tool that combines multiple methods of data collection. Building on existing experiences with rapid appraisal approaches and (participatory) innovation systems analysis, five criteria for the selection of methods have been identified.

1. Methods should be diverse, rigorous, and be able to generate both qualitative and quantitative data. This enhances the credibility and strength of the analysis (Spielman, 2005). Qualitative data provide the basis for the identification and analysis of the different dimensions of complex agricultural problems, and structural conditions enabling or constraining the innovation capacity. Such data may also provide narratives regarding the underlying causes and historical evolution of constraints. Quantitative data analysis can build on this by providing (descriptive) statistics and trends on, for instance, the distribution of constraints across different levels, stakeholder groups or study sites.
2. Methods should facilitate both 'insider' and 'outsider' analysis. Insider analysis implies data analysis by stakeholders who can provide highly detailed explanations of specific phenomena based on their knowledge and experiences. However, insiders such as farmers or policymakers often have an incomplete or insufficient critical view of the broader agricultural system or the agricultural innovation support system. Consequently, it is important to complement insider analysis by outsider analysis of data by researchers (van Mierlo et al., 2010). By combining insider and outsider analysis, the delineation of the systems boundaries is done in a participatory way, by stakeholders and researchers.
3. Methods should be able to target different stakeholder groups across different levels. When studying complex agricultural problems, it is essential to include different groups of stakeholders, their perceptions on what constitutes the problem, and what are perceived feasible or desirable solutions (Faysse, 2006; Ortiz et al., 2013).
4. Methods should be able to target stakeholders individually, in homogeneous groups and in heterogeneous groups so as to capture individual, group and multi-stakeholder perceptions on problems and solutions. Discussion and debate in both homogeneous and heterogeneous stakeholder groups generally provide a rich analysis of complex problems and potential solutions. Furthermore, multi-stakeholder interaction may reveal asymmetric power-relationships that are necessary to understand innovation capacity in the agricultural system. On the other hand, power-relationships, group pressure, or mutual dependencies between stakeholders may result in situations where sensitive

questions are avoided, or receive socially desirable responses. Methods that target stakeholders individually are more likely to provide insights in such questions (International Institute for Sustainable Development, 2014).

5. Methods together should provide sufficient detail on the complex agricultural problem under review, the innovation capacity in the agricultural system, and the functioning of the agricultural innovation support system (World Bank, 2012).

Combining different types of methods and data collection techniques provides an opportunity to triangulate and validate data. Depending on the nature of the agricultural problem under review and the available resources and time, different types of data collection methods can be used for RAAIS, taking into account the above criteria for method selection.

3.2. Methods of data collection

Based on the five criteria, four complementary methods for data collection were selected to be part of RAAIS (Table 3).

3.2.1. Multi-stakeholder workshops

Multi-stakeholder workshops mainly focused on the insider analyses of innovation capacity in the agricultural system and the structural conditions provided by the agricultural innovation support system. A participatory workshop methodology facilitates different groups of stakeholders to – individually and in homogeneous and heterogeneous groups – identify, categorise and analyse constraints for innovation in the agricultural system. Depending on the type of problem, workshops can be organised with stakeholders representing national, regional and/or district levels or, for instance, across different study sites where a specific problem is eminent. To keep the workshops manageable, and to stimulate interaction and debate, the participation of a maximum of 25 participants per workshop is proposed; for instance consisting of five representatives of the five different stakeholder groups in Table 1. As much as possible, each group should be a representative sample with respect to, for instance, gender, age, income, or ethnic groups. The workshops should be held in the language that all participants speak, and be facilitated by someone who is familiar with the cultural norms, has affinity with the problem, and understands the realities of the different stakeholder groups. The proposed workshop methodology consists of 13 Sessions subdivided into three categories, with each their own focus: (1) identifying constraints, (2) categorising constraints, and (3) exploring specific and generic entry points for innovation. Figure 2 and Table 4 provide an overview of the 13 Sessions, their sequence and relations, and their specific objective in RAAIS.

Workshops are designed to take approximately 1 day. Besides the facilitator, a note-taker documents the outcome of the different sessions and captures discussions among participants. Workshop facilitation and note-taking protocols ensure that the workshop organisation, facilitation and documentation is standardized, which is essential for comparing or aggregating the outcomes, for instance, across different study sites.

A crucial element in the workshops is the use of coloured cards. At the start of the workshop (Session 1), each of the stakeholder groups is assigned a different colour. During Session 2, each participant individually lists five constraints or challenges they face in their work and writes them down on their coloured cards. If five stakeholder groups are equally represented, this results in 125 cards. During Session 3, the participants discuss within their stakeholder groups the listed constraints, explore overlapping issues and jointly develop a stakeholder group top-5. If necessary, constraints can be reformulated based on discussions within the group. Each of the stakeholder groups use their top-5 throughout the rest of the

Table 3
Methodological framework indicating how different methods for data collection correspond with the selection criteria for methods.

Methods for data collection / Selection criteria for methods	Type of data			Insider/ outsider		Stakeholder group							Stakeholder involvement			AIS analysis		
	Qualitative	Quantitative		Insider	Outsider	Farmers	NGO/ civil society	Private sector	Government	Research and training	Individual	Homogeneous groups	Heterogeneous groups	Complex agricultural problems	Innovation capacity in the agricultural system	Agricultural innovation support system
Multi-stakeholder workshops	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Semi-structured in-depth interviews	✓	✓			✓		✓	✓	✓	✓	✓			✓	✓	✓
Questionnaires		✓			✓	✓			✓		✓	✓		✓		
Secondary data analysis	✓				✓			N/a				N/a		✓	✓	✓

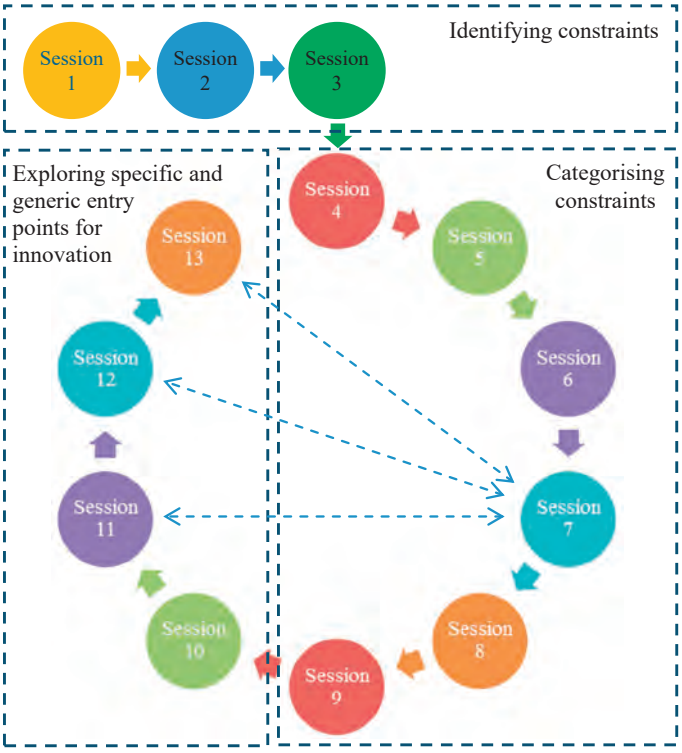

Fig. 2. The relation between the 13 Workshop Sessions and their sequence, subdivided over the three categories. The dotted arrows indicate relations between the different sessions in terms of triangulation and validation of data.

sessions during the workshop; hence 25 cards (five cards per stakeholder group) (Photo 1–4).

The use of the coloured cards facilitates the analysis of different sessions during and after the workshops. As the cards are coded and recycled throughout the successive sessions, photographs can be taken to capture the results (for example Photo 1 and 4). Such photographs can be analysed after the workshop, and can also be used to validate the note-taker's data. Furthermore, the cards provide insight into the relations between constraints identified by different stakeholder groups (Photo 2 and 3). Combining the results from different sessions can stimulate integrative analyses, for instance, combining data resulting from Sessions 5 and 6 provides insight in the structural conditions for innovation across different levels. Similarly, the outcome of Sessions 7 and 11 can be compared to triangulate the data, as both seek to identify key constraints for innovation in the agricultural system.

3.2.2. *Semi-structured in-depth interviews*

To guide the semi-structured interviews, a topic list is prepared and fine-tuned for each interview. Using a topic list provides a degree of flexibility to identify and to anticipate interesting storylines related to the problem under review, and allows validation of data that was gathered during previous interviews or during the workshops. Interviews should take a maximum of 1 hour, ensuring a high level of attentiveness of both the respondent as well as the interviewer. Sampling of interview respondents should follow a stratified approach, to ensure that stakeholders representing different study sites, different stakeholder groups, and different administrative levels are included. Within those strata, respondents can be selected purposive or based on snowball sampling where interview respondents make suggestions for who else should be included in the sample (Russell Bernard, 2006). The sample size can be based on the concept of "saturation," or the point at which no new information or themes are observed in the interview data (Guest et al., 2006). Interviews can be recorded and transcribed electronically. From an ethical point of view, interviewees should give permission for interviews to be recorded, and researchers should ensure confidentiality of all interview data. Recording may not always be desirable, as the voice recorder can create a barrier between the researcher and the respondent, especially when it comes to discussing politically sensitive issues. Instead of recording, detailed notes can be taken and transcribed electronically. The transcribed interviews can be coded. Ideally, interviews are conducted and coded by two researchers, which will enhance the quality of the analysis.

3.2.3. *Surveys*

Based on the workshops and the interviews, some of the constraints may be eligible for broader study among specific groups of stakeholders through the use of surveys. Such surveys may provide more insights in, for example, the socio-economic impacts of climate change on smallholder agriculture in specific regions, the quality of agricultural extension received by farmers in addressing complex agricultural problems, or access to agricultural inputs for male or female headed households. Surveys are not necessarily limited to farmers, but can also be conducted with any of the other stakeholder groups involved. For the data to be complementary, surveys should be completed in the same study sites as where the workshops were organised and among a representative sample of the targeted stakeholder group. To achieve that, a stratified random sampling strategy can be used to identify respondents across different study sites, levels or stakeholder groups. A (efficient) sampling method that allows for optimal allocation of resources can be used to determine the sample size (e.g. Whitley and Ball, 2002).

3.2.4. *Secondary data collection*

Secondary data are written data with relevance for the analysis of the complex agricultural problem, innovation capacity of the agricultural system or the functioning of the agricultural innovation support system. Examples are policy documents, project proposals and reports, laws or legal procedures, project evaluations, curricula for agricultural education and training, (agricultural) census and organisational records such as charts and budgets over a period of time. The sampling of secondary data is not clear cut. Key agricultural documents such as agricultural policies or agricultural research priorities should be included. These documents can refer to other relevant data. Furthermore, secondary data is often provided during, or following interviews. Insights from secondary data can be verified in interviews with stakeholders (e.g. the extent to which policy is implemented and enforced).

4. RAAIS' ability to provide specific and generic entry points for innovation and lessons learnt from its application

We tested RAAIS through a case study aimed at analysing constraints and opportunities for innovation to effectively address parasitic weeds in rain-fed rice production systems in Tanzania (April–October 2012) and Benin (June–August 2013). The results from RAAIS in Tanzania are elaborated in Schut et al. (2014c). Data were gathered across national, zonal, regional and district levels. Multi-stakeholder workshops (with 68 participants in Tanzania and 66 participants in Benin) were organised in three study sites (districts) in Tanzania and Benin where parasitic weeds are eminent. In-depth interviews were held with representatives of national-, zonal-, regional- and district-level representatives of farmer cooperatives and associations, NGO/ civil society, private sector, government and research and training institutes (42 in Tanzania, 65 in Benin). Across the three study sites in the countries, a

Table 4
The 13 Workshop Sessions subdivided over the three categories, and their specific activities and objectives in the RAAIS.

Categories	Sessions	Activities	Objective(s)
Identifying constraints	1. Opening and participant introduction	Participants (1) introduce themselves and receive information about the workshop methodology; and (2) are subdivided over different stakeholder groups (e.g. groups identified in Table 1)	• To ensure an equal representation of participants over the different stakeholder groups
	2. Individual brainstorming about constraints	Participants individually identify five constraints they face in their work	• To make an inventory of general constraints in the agricultural system faced by stakeholders
	3. Developing a top-5 of constraints in stakeholder groups	Participants (1) discuss constraints within respective stakeholder group; (2) develop an stakeholder group top-5 of constraints; (3) present the top-5 to other stakeholder groups; and (4) discuss within and between stakeholder group(s)	• To gain insights in the key constraints in the agricultural system as faced by different stakeholder groups • To create awareness and stimulate learning among stakeholders
Categorising constraints	4. Categorising constraints along different types of institutions	Participants (1) categorise top-5 constraints as policy-, research-, education and training-, extension-, markets- and/ or politics-related; (2) present results to the other groups; and (3) discuss within and between the stakeholder group(s)	• To gain insights in how key constraints relate to the different types of institutions (institutional subsystem) • To create awareness and stimulate learning between stakeholders
	5. Categorising constraints along structural conditions that can enable or constrain innovation	Participants (1) categorise top-5 constraints along the structural conditions drivers of innovation (Table 2); and (2) discuss within and between the stakeholder group(s)	• To gain insights in how the stakeholder constraints relate to structural conditions provided agricultural innovation support system and whether these enable or constrain innovation capacity • To create awareness and stimulate learning between stakeholders
	6. Categorising constraints across different (administrative) levels within the institutional subsystems	Participants (1) categorise top-5 constraints across different administrative levels (e.g. national, regional, district); (2) discuss results with other stakeholder groups; and (3) discuss within and between the stakeholder group(s)	• To gain insights in how key constraints relate to different institutional (administrative) levels • To identify and analyse interactions between different levels • To create awareness and stimulate learning between stakeholders
	7. Identifying relationships between constraints, and identifying key constraints	Participants (1) jointly discuss and identify relations between the different constraints; (2) identify constraints or challenges that are central in the analysis; and (3) discuss within and between the stakeholder group(s)	• To analyse relationships between different constraints • To identify key constraints • To create awareness and stimulate learning between stakeholders • Identify generic entry points for enhancing the innovation capacity in the agricultural system
	8. Categorising constraints along the sectoral subsystem	Participants (1) categorise stakeholder group top-5 constraints along the segments of the value chain; and (2) discuss within and between the stakeholder group(s)	• To analyse constraints along the sectoral subsystem • To create awareness and stimulate learning between stakeholders
	9. Categorising constraints along different technological subsystems	Participants (1) categorise top-5 constraints along different technological or knowledge fields; and (2) discuss within and between the stakeholder group(s)	• To analyse constraints along different technological subsystems • To create awareness and stimulate learning between stakeholders
Exploring entry points for innovation	10. Exploring constraints stakeholder groups can solve themselves versus problems that can only be solved with or by others	Participants (1) categorise top-5 constraints as: 'can be solved within the stakeholder group', or 'can only be solved in collaboration with other stakeholder groups'; and (2) discussion within and between the stakeholder group(s)	• To identify constraints that require collaboration between stakeholder groups • To create awareness and stimulate learning between stakeholders • Identify entry points for innovation in the agricultural system
	11. Exploring constraints that are easy/ difficult to solve	Participants: (1) categorise top-5 constraints as relatively 'easy' or 'difficult' to address; and (2) discuss within and between the stakeholder group(s)	• To explore which constraints require system optimisation (easy to address) and those that require system transformation (difficult to address) • To create awareness and stimulate learning between stakeholders • To triangulate data with Session 7 (are key constraints perceived to be easy/ difficult to address) • Identify entry points for enhancing the innovation capacity in the agricultural system
	12. Exploring constraints that are structural/ operational	Participants categorise top-5 constraints along a four-step gradient, ranging from 'very structural', 'structural', 'operational' and 'very operational' challenges and constraints	• To distinguish between structural constraints that require specific innovation, and more structural problems that require generic innovation. • To create awareness and stimulate learning between stakeholders • To triangulate data with Sessions 7 and 11 (relation between key constraints how these are perceived by stakeholders) • Identify generic entry points for enhancing the innovation capacity in the agricultural system
	13. Identifying priorities and solution strategies	Participants (1) jointly discuss and develop an overall top-5 of constraints; and (2) jointly identify potential strategies to address these constraints	• To explore opportunities for addressing systems constraints through multi-stakeholder collaboration • To explore similarities and differences with the key systems constraints identified in Session 7 • Identify key entry points for innovation

socio-economic farmer survey (152 in Tanzania, 182 in Benin) was held to study the impact of parasitic weeds on rain-fed rice farming (see N'cho et al., 2014 for more information). In Tanzania, a farmer-extensionist survey (120 farmers, 30 agricultural extension officers) was held to explore the effectiveness of the national agricultural extension policy across the three study sites (see Daniel, 2013 for more information). Additionally, for both countries, secondary data including crop protection, extension and general agricultural policy, national research priorities, agricultural census and agricultural training curricula were analysed. Data gathering and initial analysis took around three months for each of the countries, and involved two researchers. We first conducted the in-depth interviews, followed

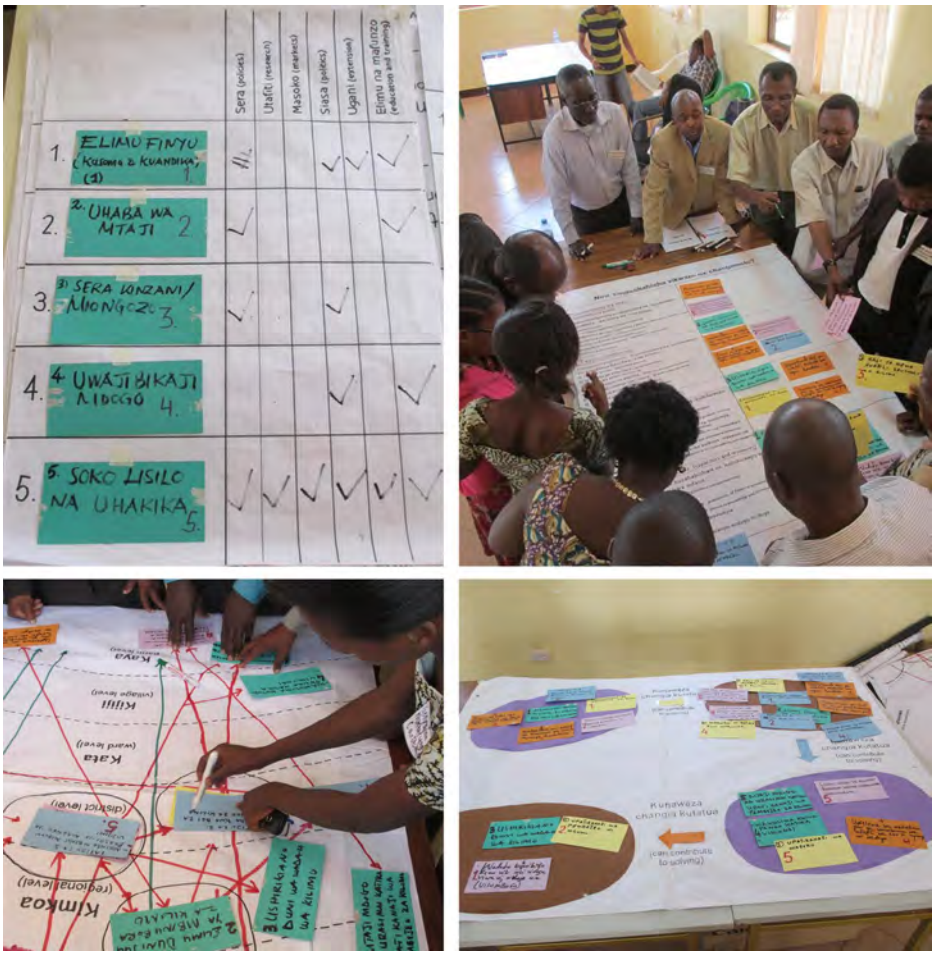

Photo 1–4. Photo 1 (top left): Top-5 of constraints of NGO/ civil society representatives and their categorisation under the different components of the institutional subsystem (Session 4). Photo 2 (top right): The categorisation of the top-5 of the different stakeholder groups along different structural conditions that can enable or constrain innovation (Session 5). Photo 3 (bottom left): The identification of relationships between different constraints (arrows), and key problem (circled cards) (Session 7). Photo 4 (bottom right): The categorisation of the top-5 of the different stakeholder groups along a four-step gradient ranging, from structural to operational constraints (Session 12). Photos were taken by M. Schut during multi-stakeholder workshops in Tanzania held in October 2012.

by the multi-stakeholder workshops. In Tanzania, both the socio-economic farmer survey and the farmer-extensionist survey were held after the interviews and workshops. In Benin, the socio-economic farmer survey was held preceding the in-depth interviews and workshops. Secondary data collection occurred throughout the fieldwork. Below, we will further reflect on the main objectives of RAAIS, as well as provide recommendations for further improvements and use of RAAIS, using our experiences from Tanzania and Benin.

4.1. RAAIS' ability to provide specific entry points for innovation to address complex agricultural problems

RAAIS contributed to an integrated understanding of different problem dimensions, multi-level interactions, and multi-stakeholder dynamics related to parasitic weed problems. With regard to the different problem dimensions, interviews demonstrated a potential relation between, for example, the preference for growing local, aromatic rice varieties (social-cultural dimension), the low capacity of farmer to purchase certified seeds (economic dimension), and the spread of parasitic weed seeds through the local rice seed system (technological dimension). Additionally, analysis of workshop data revealed how the untimely and insufficient availability of agricultural inputs provided by the government (institutional dimension) and limited interaction and collaboration among networks of key stakeholders (political dimensions) form additional bottlenecks for addressing such problems. It created awareness that describing and explaining complex agricultural problems, and exploring and designing solutions is unlikely to be successful if the different problem dimensions are analysed and treated separately (Hall and Clark, 2010; Spielman et al., 2009).

Data gathering across different levels (national, region, and district level) enabled the analysis of the interactions and (mis)matches between different levels (Cash et al., 2006). An example that emerged during the workshops and the interviews is Tanzania's national export ban, that prohibits export of agricultural produce (e.g. of rice) as long as the country has not been declared 'food secure'. This national export ban influences local market prices, and consequently, also farmers' willingness and ability to invest in, for example, purchasing agricultural inputs such as fertilizers and seeds (e.g. Poulton et al., 2010). This, in turn, provided an opportunity to identify entry points for innovation across different levels, which has been identified as a critical factor for addressing complex agricultural problems (e.g. Giller et al., 2008, 2011). As expected, and confirming previous reports (e.g. van Mierlo et al., 2010), the participatory analysis of multi-level interactions showed that stakeholders (insiders) often identify constraints at the level they represent (Schut et al., 2014c). This was complemented by our analysis as researchers (outsiders) of the multi-level interactions regarding the parasitic weed problems.

The involvement of different groups of stakeholders was essential for enhancing the credibility, validity and quality of RAAIS, as well as for delineating the boundaries of the agricultural system and the agricultural innovation support system, which is considered a key challenge when using AIS approaches to analyse complex agricultural problems (Klerkx et al., 2012b). Furthermore, stakeholder participation provided a better understanding of the feasibility and acceptability of solutions for stakeholder groups. Although we believe that the stakeholder groups included in the testing of RAAIS (Table 1) provide a good starting point, other stakeholder groups (for instance the media) may be included in the sample (e.g. Ortiz et al., 2013) depending on the type of complex agricultural problem under review. The triangulation of data resulting from the different methods enabled us to validate findings, and to verify strategic communication by stakeholders, for instance, to verify how the extension system as described by policymakers in interviews, functioned in reality according to surveyed farmers.

4.2. RAAIS' ability to provide generic entry points for innovation

RAAIS demonstrates interactions between complex agricultural problems, innovation capacity of the agricultural system – consisting of institutional, sectoral and technological subsystems – and the agricultural innovation support system. For example, applying fertilizer (technological subsystem) in rain-fed rice production is seen as a promising management strategy to reduce infection levels of *Rhamphicarpa*, one of the parasitic weeds involved in the study, and mitigate negative effects of the parasite on rice yields (Rodenburg et al., 2011). However, as was highlighted during the RAAIS workshops in both in Benin and in Tanzania, fertilizers are difficult to access in rural areas. In Benin, there is no well-developed private agro-dealer network and distribution infrastructure to support the supply of agricultural inputs. Furthermore, interviews showed that the public extension and input supply systems in Benin focus on the cotton sector, rather than on cereal crops (sectoral subsystems). In Tanzania, a private agro-dealer network and distribution infrastructure exists, but structures controlling the quality of fertilizers (institutional subsystem) are functioning sub-optimally according to interviewed government officials. In some areas, fake agro inputs are dominating the market, resulting in a limited trust and willingness to invest in applying fertilizer according to farmer representatives who participated in the workshops. The example shows how the absence or poor performance of fertilizer distribution infrastructure, limited farmer-extensionist interaction and lack of functional institutions for quality control (being structural conditions for innovation) constrain the innovation capacity in the agricultural systems and its technological (in this case fertilizer) and sectoral (the rice value chain) subsystems. Another example is based on secondary data analyses that demonstrated the lack of an operational strategy to address parasitic weeds in Tanzania and Benin. In both the interviews and workshops, stakeholders highlighted the general lack of interaction and collaboration between stakeholders in the agricultural sector (being a structural condition for innovation) as one of the main reasons for the absence or poor implementation of parasitic weed and other agricultural policies and strategies.

The aforementioned examples demonstrate how RAAIS can support the identification of generic entry points for innovation. Such innovations can directly contribute to addressing the complex agricultural problem under review, but can also have a spill-over effect in terms of addressing broader constraints that hamper the innovation capacity in the agricultural system. For example, the lack of stakeholder interactions and collaboration in the agricultural system can provide an entry point for the adaptation of the structural conditions in the broader agricultural innovation support system, for example through investments in innovation brokers or multi-stakeholder platforms (Kilelu et al., 2013; Klerkx et al., 2010). Such structural adjustments can facilitate multi-stakeholder collaboration in tackling parasitic weed as well as other complex agricultural problems.

4.3. Lessons learnt from applying RAAIS and recommendations for further improvement

Based on our experiences in Tanzania and Benin, we recommend conducting RAAIS in an interdisciplinary team of researchers with expertise on different dimensions of complex agricultural problems and on different data collection methods (Hulsebosch, 2001). Other suggestions include the experimentation with other combinations of methods, and on different types of complex agricultural problems. The workshop methodology could be made more interactive, in the sense of directly feeding back results of the sessions to participants to stimulate reflection and validate analyses during the workshops. Post-workshop surveys could provide additional insight into whether stakeholders felt they could freely raise and discuss their ideas and needs.

The multi-stakeholder workshops, but also the surveys, presented a rather static picture of the complex agricultural problem under review and the innovation capacity of the agricultural system in which the problem is embedded. However, initial workshops and surveys could function as a baseline, to which future workshops and surveys can be compared. Other methods such as secondary data analysis or in-depth interviews present a more dynamic image of how, for example, collaborations between stakeholders evolve over the years. Our experiences in Tanzania and Benin show that ensuring social differentiation among workshop participants, interviewees and survey respondents (e.g. of different gender of age) was challenging, as, for example, the majority of workshop participants were male. Specific Workshop Sessions could have more attention for categorisation and priority setting by different gender or age groups. The facilitation of the multi-stakeholder workshops ensured that different stakeholder groups could raise and discuss their ideas (Hulsebosch, 2001). Despite such efforts, unequal power relations and differences in the ability to debate and negotiate that inherently exist between groups may have played a role. In line with our expectations, politically sensitive issues were more freely discussed in individual interviews as compared to multi-stakeholder setting.

The combination of different methods of data collection was essential. In terms of the sequence of data collection, we recommend to first conduct and analyse the RAAIS multi-stakeholder workshops to identify constraints, and subsequently conduct the in-depth interviews and surveys that can provide more insight in the distribution and underlying root causes of these constraints. The workshops then provide a 'fast-track' approach to identifying entry points for innovation, that can subsequently be validated and explored in more detail using the in-depth interviews and stakeholder surveys. This would furthermore increase the 'rapidness' of RAAIS as a diagnostic tool.

An updated version of the RAAIS multi-stakeholder workshops has been used to identify constraints, challenges and entry points for innovations related to the 'sustainable intensification of agricultural systems' in Burundi, the Democratic Republic of Congo, Rwanda, Nigeria and Cameroon under the CGIAR Research Programme for the Humid Tropics (Humidtropics) (Schut and Hinnou, 2014). Several of the recommendations made in this paper, including the revised sequence of methods for data collection and the use of post-workshop participant questionnaires, have been implemented and tested successfully. Some of the bottlenecks identified, such as social differentiation (e.g. gender and age groups) among workshop participants remained problematic and require further attention. At the end of the Humidtropics RAAIS workshops,

participants developed action plans to address the prioritised constraints (Workshop Session 13). This required an extension of the workshops of half a day. The development and implementation of the action plans forms an important element for continued stakeholder collaboration in multi-stakeholder platforms.

5. Conclusions

This paper demonstrates the potential of RAAIS as a diagnostic tool that can support and guide the integrated analysis of complex agricultural problems, innovation capacity in the agricultural system, and the performance of the agricultural innovation support system. RAAIS combines multiple qualitative and quantitative methods, and insider (stakeholders) and outsider (researchers) analyses which allow for critical triangulation and validation of the gathered data. Such an analysis can provide specific entry points for innovations to address the complex agricultural problem under study, and generic entry points for innovation related to strengthening the innovation capacity of agricultural system and the functioning of the agricultural innovation support system.

Recommendations for further improvement include using RAAIS for the analysis of other types of complex agricultural problems, using other combinations of methods of data collection, and providing directly feedback to workshop participants to stimulate reflection and validate workshop outcomes. An adapted sequence of data collection methods in which workshops provide a 'fast-track' approach to identifying entry points for innovation, followed up by more in-depth interviews and stakeholder surveys would increase the RAAIS' diagnostic capacity. The participatory development of concrete action plans based on RAAIS can provide a basis for continued multi-stakeholder collaboration to operationalise and implement specific and generic entry points for innovation.

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Introduction and Background – *2 pages*

Fisheries resources provide essential food and employment for the people, communities and countries who depend on them. If they are managed properly they can continue to provide those benefits indefinitely for future generations. But finding ways of achieving this has proved challenging. Where marine resources are viewed as 'belonging to everyone' it has been very difficult to establish rules and regulations that will be widely observed and followed and enforcing rules and regulations that resource users do not understand or regard as illegitimate has usually been impossible. As an alternative, a collaborative approach to fisheries management, where institutions and resource users, supported by scientific research, work together to identify key issues and agree on appropriate rules and regulations to make fisheries sustainable has proved increasingly popular and successful worldwide. In some fisheries, these approaches are difficult to implement, but in coastal waters where monitoring, control and surveillance of fishing activity is possible and fishing communities feel a closer link with the inshore resources that they depend on, co-management has gained increasing acceptance.

Over the past decade, in response to growing democratisation in Myanmar, a number of natural resources conservation, fisheries and forestry community-based or co-management project initiatives have been operating under the broader umbrella of the Ministry of Agriculture, Livestock and Irrigation as well as the Ministry of Natural Resources and Environmental Conservation. Important experience has been gained in facilitating and setting up "Locally Managed Marine Areas", "Community Forestry", "Marine Protected Areas", etc. Several national and international NGOs and organizations like the FAO, FFI, Helvetas, IUCN, LCG, NAG, PPI, SDC, Smithsonian Institute, WCS, WorldFish, etc., have been engaging with fishing communities pursuing a variety of objectives and using various approaches, methods and tools.

The lack of standardisation for the facilitation of co-management processes has the advantage that organizations and communities can pilot different approaches, gain different experiences, and learn what works well and what does not work that well in the Myanmar context and has helped the growing interest in the country in co-management approaches to natural resource management.

For inshore marine fisheries, the Department of Fisheries (DoF) has been particularly proactive in supporting the introduction of fisheries co-management and in developing an appropriate regulatory framework that was intended to be incorporated into the up-coming new Marine Fisheries Law where a chapter on Fisheries Co-Management was already included in the draft version developed in 2019-20.

In June 2019, the DOF convened a Fisheries Co-Management Stakeholder Forum aimed at experience sharing within the broader co-management agenda of the DoF. The Forum participants from government, national and international organisations and NGOs shared valuable experiences of on-going project initiatives on community-based and co-management of natural resources, including forests and land, but with a special focus on fisheries in Myanmar.

One of the central recommendations of the Fisheries Co-Management Stakeholder Forum was to conduct a joint assessment of fisheries co-management initiatives in Myanmar in order to inform the development of a common set of guidelines on inshore fisheries co-management for Myanmar that would seek to mainstream good practice and experience in Myanmar and best practices from international experience.

This work was initiated in early 2020 and the current outline for these inshore fisheries co-management guidelines represents a preliminary output of this work based on extensive consultation with the Department of Fisheries, civil society partners and international organisations and NGOs concerned with fisheries in the country.

1. Fisheries Co-Management – *5-6 pages*

1.1 What do we mean by 'manage'?

Key messages

- To manage something means to take responsibility for it.
- It does not just mean 'protect' or 'conserve', it means to use a resource (in our case fish) in a way that it is useful for us and will continue to be useful for us…in other words to use it 'sustainably'.
- Obviously, if we use a resource until it is finished, it will not be useful anymore…not to us and not to anyone.
- So to 'manage' a resource includes both 'using' a resource and converting it into something useful for us (food, fish for sale, etc.) AND protecting and conserving it, so that we (and our children, and our children's children) can keep using it in the future.
- The key point about management is that it involves US (people, individual fishers, communities, governments) taking RESPONSIBIILITY for how we use the resources at our disposal.

1.2 Why should we 'manage' fisheries?

Key messages

- We 'use' fisheries resources for food and nutrition, for income, to create livelihoods for ourselves, our families, and our communities.
- For generations we have used fisheries without worrying too much about whether we might be affecting fisheries resources in any way and we have been happy to think that the sea is big and that it is not possible for those resources to be 'used up' or 'finished', no matter how much we fish.
- But now, there are a lot more of us and we have much more sophisticated and effective means of catching fish at our disposal.
- …and as a result, ALL of us can now see that it IS possible to 'use up' or 'finish' fisheries resources.
- We do this by catching more fish than can be replaced by natural regeneration. Instead of catching just some big, mature fish that have already produced eggs, we catch EVERYTHING – big and small, young and old, fish that eat other fish AND the other fish that they eat.
- We also do it by damaging the marine environment that fish depend on to survive (coral reefs, seagrass beds, rich sea floors, mangrove swamps), by changing and damaging the connections between the land and the sea, and by polluting freshwater, the sea and the air (CO_2, litter and waste, plastic, oil and chemicals, etc.).

- But if we decide to 'manage' fisheries we are saying: 'That's enough!' The sea DOES belong to everyone, and because it belongs to everyone all of us MUST TAKE RESPONSIBILITY for how we use it….and use it responsibly.
- To do this we need 'management'
- 'Management' requires rules on which fishers, communities, wider groups of resource users and government have agreed.

1.3 Why 'co-management'?

Key messages

- Managing fisheries in seas such as those around Myanmar is challenging – tropical multi-species fisheries with many different scales and types of fishing operation are involved.
- This makes managing fisheries difficult and enforcing regulations (if not all fishers accept them) challenging.
- A Fisheries Department with the task of 'managing' fisheries in Myanmar would need to be extremely well-resourced and extremely efficient in its operations to be able to cover effectively the long coastline of Myanmar, its bays and channels, the coastal swamps and all the islands and the coral reefs around. While the Fisheries Department may do the best job possible with the resources it has, operating by itself, it has an almost impossible task.
- 'Co-management' can provide a viable alternative. 'Co-management' means that the responsibility for managing fisheries is shared between government, fish harvesters, local communities, fish processors and buyers, and local governments. The involvement of all the people who have an interest in fishing – the 'stakeholders' – means that they have a much better chance of managing the long and varied coastline and inshore waters of the country.
- Different rules and regulations may need to be developed for different areas and types of fishing activity. Only local people who live and work in fisheries in those areas know what sort of regulations are most appropriate for their areas and the fishing operations they carry out.
- In a country that believes in democracy, it is also important that the people whose livelihoods depend on fisheries play a leading role in making decisions about how to manage those fisheries. Every stakeholder should have an equal chance to participate in decision making process.
- Co-management is a big challenge. If government is to 'share' responsibility for management, 'rules of the game' need to be established. What can government do and NOT do? What can fishing communities do and NOT do? Where do the rights, roles and responsibilities of different stakeholder groups start and finish? How will they work together to take decisions about fishing and fisheries management? Who will make fisheries management plans and how will they be approved? How can 'experts' from the scientific community get involved and what should their role be? Once rules and regulations have been agreed upon by fishing communities and government, who will

enforce them and how? What powers do different stakeholders have to punish people who break the rules?

- These are just some of the key questions that need to be answered if 'co-management' arrangements are to work.

1.4 What results are we trying to achieve?

Ensuring that livelihoods dependent on fishing have a future and can be passed on to future generations.

Fishing is an important means for many people in Myanmar to make a living, earn income, have food on their table for themselves and their families, and give those people satisfaction because that is the profession that they know and identify with. These 'fisheries livelihoods' include catching fish, processing fish, selling fish, transporting fish, running markets for fish and exporting fish to distant markets and other countries. And obviously if you take all these different professions into account, there are a huge number of people in Myanmar whose livelihoods depend on fisheries. Equally obviously, all of these 'livelihoods' depend on there being fish to catch. So by 'managing' fisheries we are trying to protect these 'livelihoods'.

Fishing and working in fisheries is also a way of life. For some people it is a way of life they want to lead and that allows them to identify themselves as "fishers". By 'managing' fisheries we are making sure that this option will still be there for future generations.

Fish for food

Most fish is caught so that people can eat it. And in Myanmar, fish is a very important part of people's diet. Fish based products such as fish paste and fish sauce are fundamental ingredients in the meals of every Myanmar household. Fish is an extremely high-quality food – fish is good for you! It has high quality protein that helps children to grow up healthy and smart, and it provides many micronutrients that are not available in other foods. So if there is no more fish, the question is also: what do we eat instead of fish?

By managing fisheries, we will be ensuring that this supply of high-quality food, and the tradition of eating fish-based products in Myanmar, is available in the future and for future generations.

Healthy Seas

Fish are just one part of the mass of life that makes up the oceans and seas. Like almost every bit of life that lives in the ocean, they are important, not just to us but to the health of the ocean as a whole. The enormous diversity of life in the sea is all linked together – if you remove too much of one form of life (such as fish) it will affect all the other forms of life around it as well. So extracting too much fish from the sea will not only affect the amount of fish available in the future, it can affect the overall health of the ocean.

Because the sea is so big, and we cannot see much below the water, it is easy to think that it does not matter what we take out of the ocean (or what we dump into it) because there will always be more. But this is not true. If we use the resources in the sea without paying attention to maintaining the balance of different lifeforms that live there, there is a risk that it will stop being the rich productive system that sustains a way of life, livelihoods and income for so many people The water will still be there but what lives in it will be very different from what we think of as the 'sea'.

The role of fisheries in the local and national economy

Fish are a 'renewable' resource – given the chance they regenerate and can continue to provide a source of food, income and livelihoods indefinitely. It is perfectly possible to fish 'sustainably' –everyone involved in fishing needs to understand that management will produce benefits for them and that it is in their interests to obey the rules and regulations that it involves. They also need to understand that, with a changing

climate, a well-managed fishery can play an important role in reducing the vulnerability of coastal communities to unpredictable climate events and patterns.

Rules can be about how much fish people catch where and when they fish, about, and about the methods they use to fish. If these are in place and enforced, fish represent a rich and sustainable economic resource– for the people who catch fish, for the communities who depend on fisheries, for people in the value chain for fish, and for consumers. It also produces benefits for people beyond those involved directly in fisheries related activities. Fishing and fish trading generates income and wealth that can be invested in other areas of the economy such as roads, schools, health centres or services that depend on the surplus income generated from the fishing industry.

There are costs involved in managing fisheries – systems for management have to be created; research into the best way to do management has to be carried out; ways of making sure that the benefits of management reach those people who are most affected by it have to be set up so that they have clear incentives to follow management rules; mechanisms for deciding on those rules and regulations, and enforcing them, have to be established. But the costs of investing in fisheries management are NOT expensive compared to the future benefits that good fisheries management can generate. What is truely expensive is to exploit a resource like fisheries unsustainably until it is degraded and no longer has the chance to regenerate. Then its true value as a ‘renewable’ and sustainable economic resource has been lost for ever.

2. Overview of Fisheries Co-Management– *5-6 pages*

2.1 How do we know co-management can work?

- *Some examples from around the world*
- Experience from South-East Asia (Philippines, Cambodia, Indonesia)
- Experience from other developing countries (Chile, South Africa)
- Experience from more developed countries (U.K., New Zealand, Canada)
- Evidence that co-management of fisheries can not only change the ways we use fish but also change the way people, communities and governments perceive the natural environment more generally.

2.2 How do we know it will work in Myanmar?

- Description of experience of the Sustainable Coastal Fisheries project
- Description of experience in the Gulf of Mottama project
- Description of World Fish experience
- Description of WCS experience
- Description of FFI experience

2.3 What can we learn from experience in Myanmar so far?

Key messages

- There is a significant recognition among fisheries resource users that action to sustain resources is required.
- Local communities have the capacities and incentives to take on a role in co-management.
- Many operators in the fisheries value chain, where they have been engaged in the co-management process, have been supportive and understand that better management is in their interest.
- The capacity of government to adopt a role as an 'enabler', creating the appropriate legal, regulatory and institutional framework and devolving power and decision-making to communities and local government is a key challenge.

2.4 What are the alternatives?

Key messages

- Do nothing! – *portrait of the results of doing nothing*
- Let government worry about it – *portrait of the results of letting government worry about it*
- Let someone else do it (and we will reap the benefits) – *portrait of the results of letting someone else worry about it*

3. The Fisheries Co-Management Process - What does it look like? – *2-3 pages*

Key messages

- Setting up fisheries co-management arrangements, and making them work, is complex and time-consuming. This is because it inevitably involves diverse groups of people all of them with different sets of interests and priorities. Coming up with arrangements that satisfy them all is challenging.
- The process will vary from place to place, depending on many factors.
- But at the core of ANY process, will be a RECOGNITION among resource users that there is an ISSUE regarding the resources that they use, and that they need to TAKE ACTION to address it. And to take action, they need some form of ORGANISATION.

- Arriving at this key starting point might be the result of resource users, and the communities in which they live, making their own analysis of the issue and the action required to meet it. Or it might be the result of a discussion and analysis FACILITATED by other actors – government, civil society, NGOs, INGOs, researchers.
- Organisation among resource users is key. It enables them to take collective action and engage with institutions and actors from outside the community more effectively.
- The precise FORM of that organisation may vary depending on the FUNCTIONS that communities want it to perform. For example, a Fisheries Co-Management Committee, or a Community Fisheries Committee should be organised to perform the functions (and achieve the results) that community members define for that organisation. But if the issue around which the community decides to organise is different (for example a more general community development issue like local water pollution) the form of the organisation might be different – at some stage a specific Fisheries Co-Management Committee might become a sub-committee of that organisation.
- Deciding on precise FUNCTIONS before deciding on the FORM of organisations is important – for community-level organisations, it is important to 'craft' institutions to fit with the

function that its members have defined for it. And that may change – what 'fits' for communities in Tanintharyi may be different from what 'fits' in Rakhine.

- Regulations for co-management need to leave scope for local-level adaptation in terms of the organisations they establish to manage their fisheries, and to adapt to the regional, district and township context.
- Facilitation can play an important role in helping communities to better understand the issues they are encountering and how they might relate to patterns of resource use. But whoever is doing the facilitation, it is important that they remember that their role is to FACILITATE – to make it easier for resource users, communities and local organisations, and the various actors involved in the co-management process, to come to their OWN DECISIONS (not make choices for them).

- Fisheries Co-management is largely concerned with the RELATIONSHIPS between local-level organisations of resource users and a range of other stakeholders in the co-management process. That means it is about coming up with definitions of the ROLES and RESPONIBILITIES of different actors and how they RELATE to one another.
- These actors will include:

  People involved in the fisheries 'value chain'

  - Local resource users (and their representative organisations)
  - Local fish traders and processors (who should be included in organisations with other local resource users)

- Other resource users (from other communities, other areas, different scales of operation or even different countries) and their organisations (if they are organised)
- Other service providers for fisheries (boat builders, mechanics, net makers, etc.) whose livelihoods equally depend on fishing and their organisations (if they are organised)
- Larger-scale fish businesses (fishing enterprises, fish traders, processors, exporters, etc.) and their organisations.

Institutions involved in administration and decision -making at different levels

- Organisations of resource-users
- Community and local-level institutions (village heads or administration)
- Township and local government
- District, provincial and regional government
- Union-level government (including the Department of Fisheries and other key Ministries)

Facilitating agencies

- Government (although ideally their role should be to ENABLE - provide the legal, regulatory and administrative framework - rather than FACILITATE)
- Civil society such as associations of concerned citizens
- NGOs
- International NGOs or foundations with projects in Myanmar
- Researchers, from Universities or other academic institutions.

- As each of these sets of actors has very different roles and responsibilities in the Fisheries Co-management Process, the guidance that follows has been divided into specific guidance for each of these key groups.

4. FISHERIES CO-MANAGEMENT GUIDANCE for DIFFERENT STAKEHOLDER GROUPS

Fisher harvesters – *6 pages*

- **Who you are and what you normally do**
  - *A portrait of different fish harvesters, their activities and their characteristics (men, women, older people, youth, children, etc.)*
- **What do you have to do differently?**
  - *A portrait of how fish harvesters need to organise, talk, plan and behave responsibly at sea*
  - Getting organised
  - Setting up an organisation
  - Defining objectives, roles and responsibilities
  - Accommodating conflicting or contrasting interests and priorities
  - Being inclusive
- **Why should you do it?**
  - *A portrait of the benefits – secure livelihoods, livelihoods for children and future generations, better environment, engagement with government and civil society, good governance, capacity to make choices for themselves, empowerment*
- **What are your rights?**
  - Right to a livelihood
  - Right to make decisions about how fisheries resources are used
  - Right to demand support for actions to manage the resource
- **What are your responsibilities?**
  - Deliberating on issues and coming to decision
  - Recognising and managing conflict
  - Seeking out the support and facilitation needed to make the right decisions
  - Engaging with and involving other stakeholders in discussions and decision-making
  - Engaging with the necessary levels of administration, government and bureaucracy
  - Deciding what you are managing (fisheries management units) – fish, areas, fishing activity, fishing period
  - Establishing rules and regulations
  - Enforcing rules and regulations
  - Collecting and spreading information
  - Monitoring and reviewing progress
  - Identifying problems and consulting on how to address them
  - Establishing and maintaining your 'independence' – decision-making, financial,
- **What are your strengths that you can bring to the process? How to use your strengths?**
  - Day-to-day contact, observation and knowledge about the resource, the sea and how they change
  - Knowledge passed down from generations
  - Knowing your rights and responsibilities
  - Power to make a difference and make choices
  - Peer pressure

- **What are the opportunities and challenges you face?**
    - Need to ensure a day-to-day livelihood for yourselves and your families
    - Dealing with and adapting to change
    - Maintaining and effective organisation
    - Dealing with different levels of the administration, government and bureaucracy
    - Dealing with 'facilitating' agencies
    - Dealing with research and 'science'
    - Dealing with 'distant' actors (i.e. larger fishing enterprises, foreign fishers, large scale fish processors and traders).
- **How to take advantage of those opportunities and overcome those challenges?**
    - Organisation and collective action
    - Planning ahead
    - Thinking about how other stakeholders see the issues and 'putting yourself in their shoes'
    - Reframing problems and challenges to find new ways of addressing them
    - Ways of resolving conflicts with other resource users and communities
    - Seeking out common ground to resolve conflicts

Co-Management Organisations and Committee Members – *8 pages*

- Who you are and what you normally do?
- What do you have to do to support fisheries co-management?
- Why should you do it and how will you benefit?
- What are your rights?
- What are your responsibilities?
- What are your strengths that you can bring to the process? How to use your strengths?
- What are the opportunities and challenges that you face?
- How to take advantage of those opportunities and overcome those challenges?

Local fish traders and processors – *6 pages*

- Who you are and what you normally do?
- What do you have to do to support fisheries co-management?
- Why should you do it and how will you benefit?
- What are your rights?
- What are your responsibilities?
- What are your strengths that you can bring to the process? How to use your strengths?
- What are the opportunities and challenges that you face?
- How to take advantage of those opportunities and overcome those challenges?

Other resource users and service providers in fisheries – *4 pages*

- Who you are and what you normally do?
- What do you have to do to support fisheries co-management?
- Why should you do it and how will you benefit?

- What are your rights?
- What are your responsibilities?
- What are your strengths that you can bring to the process? How to use your strengths?
- What are the opportunities and challenges that you face?
- How to take advantage of those opportunities and overcome those challenges?

Larger-Scale Fish Businesses – *6 pages*

- Who you are and what you normally do?
- What do you have to do to support fisheries co-management?
- Why should you do it and how will you benefit?
- What are your rights?
- What are your responsibilities?
- What are your strengths that you can bring to the process? How to use your strengths?
- What are the opportunities and challenges that you face?
- How to take advantage of those opportunities and overcome those challenges?

Community leaders – *6 pages*

- Who you are and what you normally do?
- What do you have to do to support fisheries co-management?
- Why should you do it and how will you benefit?
- What are your rights?
- What are your responsibilities?
- What are your strengths that you can bring to the process? How to use your strengths?
- What are the opportunities and challenges that you face?
- How to take advantage of those opportunities and overcome those challenges?

Facilitating organisations (NGOs, civil society) – *8 pages*

- Who you are and what you normally do?
- What do you have to do to support fisheries co-management?
- Why should you do it and how will you benefit?
- What are your rights?
- What are your responsibilities?
- What are your strengths that you can bring to the process? How to use your strengths?
- What are the opportunities and challenges that you face?
- How to take advantage of those opportunities and overcome those challenges?

Researchers – *6 pages*

- Who you are and what you normally do?
- What do you have to do to support fisheries co-management?
- Why should you do it and how will you benefit?
- What are your rights?
- What are your responsibilities?

- What are your strengths that you can bring to the process? How to use your strengths?
- What are the opportunities and challenges that you face?
- How to take advantage of those opportunities and overcome those challenges?

Township and local government – *8 pages*

- Who you are and what you normally do?
- What do you have to do to support fisheries co-management?
- Why should you do it and how will you benefit?
- What are your rights?
- What are your responsibilities?
- What are your strengths that you can bring to the process? How to use your strengths?
- What are the opportunities and challenges that you face?
- How to take advantage of those opportunities and overcome those challenges?

National and regional government (DoF*)– 10 pages*

- Who you are and what you normally do?
- What do you have to do to support fisheries co-management?
- Why should you do it and how will you benefit?
- What are your rights?
- What are your responsibilities?
- What are your strengths that you can bring to the process? How to use your strengths?
- What are the opportunities and challenges that you face?
- How to take advantage of those opportunities and overcome those challenges?

STRATEGY FOR BIOLOGICAL MONITORING IN FISHERY MANAGEMENT STUDY SITES

Eric Baran[1], Romain Langeard[1], Win Ko Ko[2], Zayar Min[2], Khine Thazin[2], Hsu Mon Aung[3], Thadoe Wai[3]

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EXECUTIVE SUMMARY

Selection of sites for biomonitoring

The 14 study sites identified by the project can be primarily classified according to their environment: i) sites along the coast, ii) sites in floodplains and iii) creeks and oxbow lakes

In estuarine sites, given the open environment and the mobility of coastal resources, one cannot expect a relationship between fishery management initiatives at the community level and fish abundance or fish diversity. In floodplain sites, external factors largely alter or even blur the relationship between local fishery management and medium-term trends in fish abundance and diversity. It is in lakes and small creeks not flooded during the rainy season that a relationship between local fishery management and fish yield or diversity is most likely to be identified. Yet two sites from floodplain and coastal environments need to be kept for development of the M&E methodology.

For these reasons, we propose 8 sites for biomonitoring; 6 correspond to creeks and oxbow lakes:

- Site 1: Ah Kae Chaung Wa in Dedaye Township (coastal environment).
- Sites 2: Hlaing Tar Mezali and 4: Pa Thwei Ahtet Mektun in Maubin Township;
- Sites 7: Yin Sae in Hinthada Township;
- Sites 8: Shar Khae and 13: Kyone Ta Dun in Pathein Township; and
- Site 14: Khay Nan in Pathein Township (large floodplain)
- Site 15: Myin Ka Kone in Labutta Township.

Biomonitoring experiences in the region

A review of similar projects and studies shows the diversity of approaches in fisheries biomonitoring, the frequent collaboration of scientists with fishers, the necessary involvement of local surveyors, and the challenge in quantifying the fishing effort – which can be expressed in many ways.

Opportunities and constraints in partnerships

Partner universities have no experience in scientific fishing according to a fixed protocol. Each university has scientists qualified and available for the study but these can dedicate a few days per month only to the study. All teams require training about the protocol, data management and analysis, and reporting.

Fishing gears and monitoring requirements

Seven gear categories were identified in relation to monitoring requirements:

- One gear operated by one fisher, with regular operations and catch accessible in the boat or at landing site (bag nets / stow nets)
- One gear operated by one fisher, with operations at various times and catch accessible in the boat or at landing site (bottom drift nets, drift gill nets, set gill nets and trammel nets)
- One gear operated by one fisher, with operations at various times, and catch accessible for monitoring only in the fisher's basket (cast nets and push nets)
- One gear operated by multiple fishers; operations at various times and catch accessible at landing site (beach seine nets)
- One gear operated by multiple fishers; operations at various times and catch shared between several fishers without being landed (net fences and plain water seine nets)
- Several gear units operated by one fisher; operations at various times and catch accessible from the fisher or at landing site (eel traps, long lines, mud crab traps, fish traps and prawn traps)

- One fishing system operated by multiple fishers, harvest done at once at the end of a season and catch shared between several fishers ("gyan" system and water pumping).

Methodology recommended

We recommend a focus on Catch Per Unit Effort by species and by site. This implies measuring i) number of individuals and weight per species, and ii) unit effort, with subsequent analyses of CPUE, species diversity in catches, dominant species in catches, and the relative evolution over time of these three indicators. We do not recommend inclusion of length, weight and reproductive stage observations in the present monitoring.

The diversity of situations and gears calls for an adaptive approach. We recommend partner teams to work with fishers and monitor the gears they use.

Given project objectives and configuration, it is recommended to monitor in each site i) the gear with the largest catch, and ii) the gear used by most people, and iii) gill nets (at least three fishers using gill nets). We could not detail all gears possibly used in each site, but illustrate the monitoring approach for eight common gears; it is recommended to follow the same principles with other gears.

For each gear and for each fishing operation, surveyors will need a 30 minutes time window to identify fish species caught and their weight. All surveyors and self-surveyors (fishers recording their own catch) should report to a senior surveyor who will supervise and compile data for university researchers. These researchers will provide training, instructions, supervise data collection and control the accuracy of data gathered.

Data sheets should include three main sections: identification, fishing effort and catch. Surveyors should be provided with a pre-established list of 30 dominant or commercially important species, for inland and brackish sites respectively.

Observations and warnings

Biomonitoring in this project will not allow assessing fish stock nor productivity in each site. Similarly, it will provide information about fish diversity in the catch of each site, but not overall fish biodiversity.

Several Community Fishing Groups among the study sites have limited or no resource management system in place. For these sites, no correlation will be found between "co-management" (actually limited to social sharing arrangements) and production or sustainability – but they could be considered on the contrary as "no management" control sites.

The number of sites that can be studied is not compatible with the requirements of a formal statistical approach. However, international literature shows that such number of study sites allows analysing, as planned, management initiatives and their benefits.

The duration of the project (2 years of data) is also too short to allow significant conclusions about biological outcomes of fishery management. The biomonitoring being put in place must then be seen as the beginning of a long-term initiative.

1. INTRODUCTION

The present document is a review of the possible options for the development of a monitoring and evaluation program aimed at assessing the outcome of fisheries management on the fish resource. This review is part of the WorldFish/DoF project "Improving fishery management in support of better governance of Myanmar's inland and delta fisheries" (MYFish 2, 2017-2020), whose aim is to assess different management practices in the Ayeyarwady Delta and evaluate their outcomes in terms of productivity, equity and sustainability.

Thus, one of the objectives of the project consists in developing a Monitoring and Evaluation system (M&E) to "monitor the development of community fishing groups (CFGs), their functioning and their performance, from a social, economic and environmental perspective**.**

The present review is part of Component 2 of the MYFish 2 project; the latter corresponds to the baseline survey, monitoring and evaluation of 14 community-managed fisheries in the Ayeyarwady Delta. The approach includes engagement of government, NGOs and community fisheries organisations in the testing fishery management practices. It builds on *Activity 2.1: Identify and agree on pilot research sites across agro-ecologies (delta and freshwater) that include a variety of management approaches*. In this context, the present review is focused on practical options to put in place a biomonitoring system focused on identifying:

1. co-management practices that contribute best to fish production and protection of natural resources
2. adaptions to fishery management practices that could strengthen the sustainability of fish-production systems

We review below conclusions from site analyses, followed by conclusions from meetings with partners and more generally about the research framework to be considered.

2. REVIEW OF STUDY SITES

As detailed in the companion report “Rapid assessment of 14 fisheries management study sites in the Ayeyarwady Delta” (Langeard et al. 2018), the sites can be clustered according to one major criterion: their environmental context. This criterion is not independent from the initial selection of the 14 sites among many more possible study sites, as the project tried to review sites in different environments, in particular along a salinity gradient.

Based on this environmental criterion, three main categories of sites have been identified:

1) **Sites along the coast**, open and subject to a strong marine influence
2) **Sites in floodplains** get completely flooded in the wet season
3) **Creeks and oxbow lakes** that constitute stand-alone water bodies whose hydrological connection with floodplains and large rivers is limited.

These sites are also subject to three broad qualitative levels of fishery management, and the report mentioned above provides a summary of their respective situation:

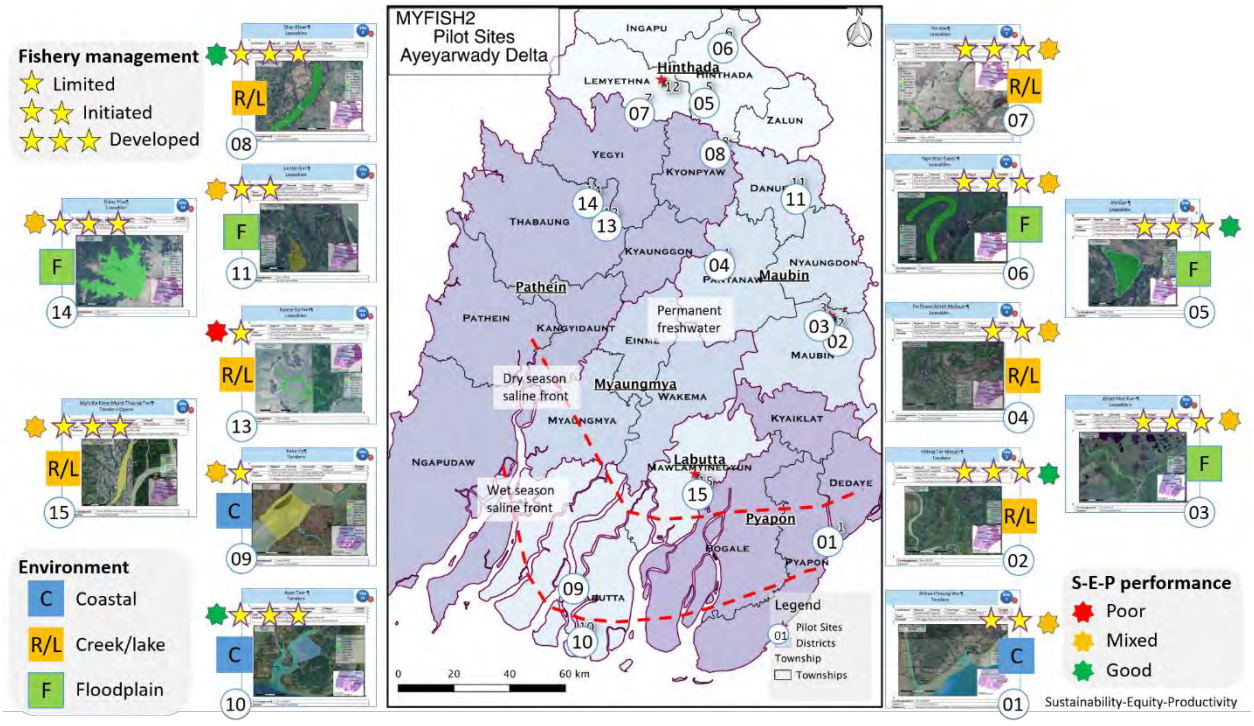


Figure 1: Overview of main environmental and management characteristics in the 14 sites identified

The three environmental categories of sites are of very different nature when bio-monitoring is considered:

1) **in estuarine sites**, aquatic resources originate mainly from the sea and the coastal zone, in particular through migrations (e.g. hilsa, sea bass, Wallago catfish). The abundance of these resource in a given fishing site depends on a diversity of factors, in particular the annual and seasonal climate variability influencing the recruitment of coastal pelagic species, the annual variability of coastal currents influencing species distribution, the variable contribution of rivers to nutrient supply in the coastal zone, or the intensity of the inshore fishery (see Day 1981).

In such very open estuarine environment, **it is impossible to expect a tangible relationship between fishery management initiatives at the community level and fish abundance or fish diversity**.

2) **In floodplain sites**, fish abundance is heavily influenced by the annual replenishment triggered by the annual flood pulse (Junk et al. 1989), in particular the **white fish** component of the stock (Welcomme 2001). This makes local fish yield largely influenced by annual river flow variability, in particular flood level, duration and timing (Welcomme et Halls 2001), but also by connectivity in waterways (Halls et al. 1999, Bolland et al. 2011) and by infrastructure development upstream of the study site (Baran and Myschowoda 2009, Ziv et al. 2012). **Thus, external factors in floodplains sites largely alter or even blur the relationship between local fishery management and medium-term trends in fish abundance and diversity.**

3) Out of the three environmental configurations mentioned above, **lakes and small creeks** not flooded during the flood season **are, relatively speaking, the sub-system most likely to allow identify a relationship between local fishery management and fish yield or diversity**, as they are the sites most independent from distant influence and therefore.

Thus, in order to minimize the influence of external factors and maximize the chances of identifying a correlation between fishery management activities and outcomes in terms of fish yield and fish diversity in the catch, the study should focus in priority on (oxbow) lakes and sites along creeks. These six sites correspond to:

- Sites **2: Hlaing Tar Mezali** and **4: Pa Thwei Ahtet Mektun in Maubin Township;**
- Sites **7: Yin Sae in Hinthada Township;**
- Sites **8: Shar Khae** and **13: Kyone Ta Dun in Pathein Township;** and
- Site **15: Myin Ka Kone in Labutta Township.**

Furthermore, from a capacity building perspective, and in order to integrate the diversity of fishing methods in different environments, **a couple of sites from coastal and floodplain environments might be also selected for monitoring** – even though the conclusions derived from surveys might be subject to reservations. The sites the most representative of their respective cluster are:
Site **14: Khay Nan in Pathein Township (large floodplain)** and site 10: Ayar Taw in Labutta Township (coastal saline zone). However, all partners -including Labutta DoF- noting that site 10 is particularly remote and hard to reach, it is recommended to select instead, for practical and logistical reasons, **site 1: Ah Kae Chaung Wa in Dedaye Township (coastal environment)**.

See illustration in Figure 2.

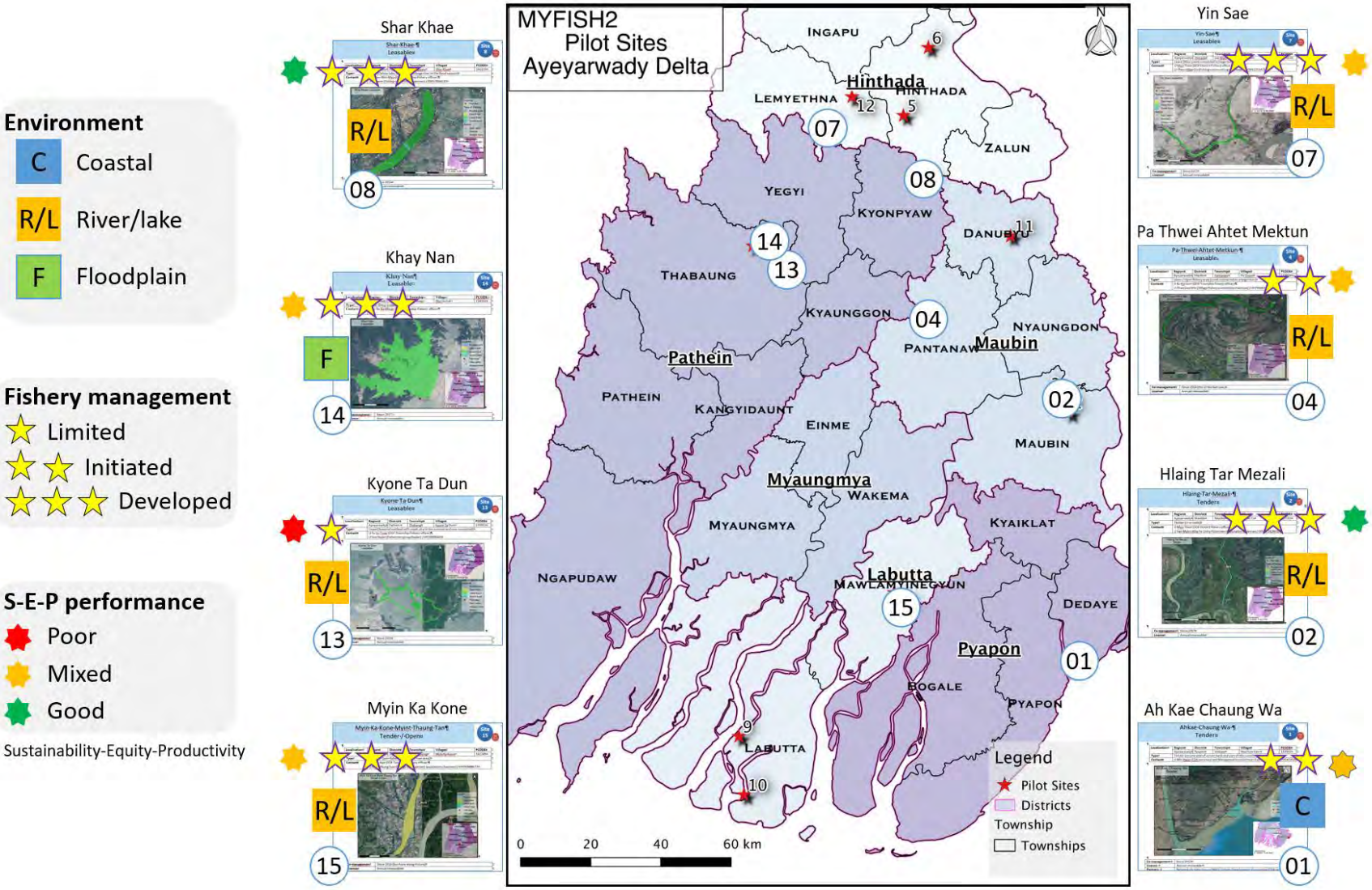


Figure 2: Sites recommended for biomonitoring

Table 1: Main characteristics of the 8 sites proposed for biomonitoring based on ecological features

Site	Township	Site name	Type	Environment	Salinity	Beneficiaries	Feature	Access rights	Resource protection measures	Stocking
1	Dedaye	Ahkae Choung Wa	Tender	Coastal	Brackish	10 villages, 167 CFG members	Semi-private "CFG"	Open access at all times if small gear	Limited	No
2	Maubin	Hlaing Tar Me Zali	Tender	Creek and/or lake	Freshwater	15 villages, 1314 CFG members	Real democratic co-management	Open access in flood season if small gear	Developed	No
4	Pantanaw	Pa Thwei Ahtet Metkun	Lease	Creek and/or lake	Freshwater	13 villages, 300 CFG members	Real co-management	Open access at all times at places	Limited	No
7	Lay Myet Hmar	Yin Se	Lease	Creek and/or lake	Freshwater	1 village, 138 CFG members	Real democratic co-management	Open access in flood season	None	No
8	Kyonepyaw	Shar Kae	Lease	Creek and/or lake	Freshwater	12 villages, 82 CFG members	Real democratic co-management	Fee-based access to all	Developed	Yes
13	Thabang	Kyone Ta Dun	Lease	Creek and/or lake	Freshwater	1 village, 60 CFG members	Semi-private "CFG"	Open access in flood season	None	No
14	Thabang	Khay Nan	Lease	Floodplain	Freshwater	1 village, 62 CFG members	Real co-management	Open access in flood season	Limited	Yes
15	Mawlamying	Myin Ka Kone	Open	Creek and/or lake	Freshwater	1 village, 62 CFG members	Real democratic co-management	Open access permitted	Developed	No

3. BIOMONITORING EXPERIENCES IN THE REGION

Biological monitoring has been in operation for several years in Myanmar's neighbouring countries; a brief review of the main experiences in relation to fisheries management provides some insights about common practices and challenges.

In Thailand, the Department of Fisheries monitors fish abundance, diversity, population structure and distribution of inland fish. This information is complemented with sampling of species, size and catch composition at ports and markets. The methodology most used is based on spatial and temporal sampling in sites and at times representing habitats and seasons of interest. Assessments are carried out in at least five study sites and four sampling months (Oopatham Pawaputanon 2003).

In Indonesia, in a project very similar to MyFish 2, studies were conducted in three provinces to identify ecological, social and institutional aspects and benefits in river fisheries "harvest reserves" (Hoggarth et al. 2003a). The project monitored 10 study sites during 13 to 14 months, and **sampling included "control" sites** with no reserves. The biological part of the monitoring (Hoggarth et al. 2003b) used multi-mesh gillnets (standardized protocol implemented by the project team) and was focused on number and weight of fish per unit effort (Unit Effort: *m^2 of multi-mesh gillnet/hour*), number of species per unit effort and average weight of individual fish.

In Bangladesh, WorldFish conducted a study aimed at assessing the impact of co-management interventions on fishery resources in 7 rivers (WorldFish Center 2007). Monitoring was done during 6 years and covered management activities (closed seasons or areas, fishing restrictions, habitat management and sanctuaries), fishing activities and overall catch and effort. A **preliminary gear census** showed that fishers used more than 100 types of fishing gears in 11 broad categories. The monitoring program was based on gears that fishers use, and recorded the average number of gear units per day to estimate total fishing effort. Therefore the effort unit was in that case was gear-days or person-days (Unit Effort: *gear days.year^{-1}*). Routine protocol consisted in assessing during regular spot surveys the gears in operation, as well as total catch and species from each gear type (kg/gear/day or kg/person/day). Overall, fishing activity was observed during 4 to 8 days per month and per site, and total gear-related fishing effort per month was inferred from this sample. Overall production was estimated by summing all estimated production for all gear types each year.

Cambodia has seen several fish monitoring studies, starting with the large scale attempt of the Mekong River Commission (Stamatopoulos 1995). However the part of the project attempting to monitor all middle-scale and small-scale gears was discontinued in 1997, due to excessive complexity, staff requirements and costs (Van Zalinge 2003), with a remaining focus on one single bagnet fishery ("Dai fishery") used to monitor trends only (Halls et al. 2013).
More recently, Hortle et al. (2008) quantified the yield and value of the rice field fishery, monitoring the fishing effort and catch of local fishers in nine sites (four times each month in each site during one season). Fishers used their usual gears, and effort was the number of man-days fishing (the exact time each gear was used during each day was not recorded). Fishers kept their catches for the surveyors to identify species and their biomass, and sub-samples of the five most common fish species were selected for length monitoring.

In the Mekong Basin, the Mekong River Commission has put in place four main fish monitoring programs (Halls et al. 2013); these include the “dai fishery” mentioned above in Cambodia, a “lee trap” monitoring in Laos, a monitoring program based on the catch of fishers and a fish larvae program.

The “dai fishery” would correspond in Myanmar to a bagnet or stownet fishery. The parameters monitored during the fishing season (flood recession time) are catch (biomass), effort, species composition and length-frequency for main species. Data are gathered by DoF enumerators. Sampling is done on randomly selected *dai* units, stratified by municipality, lunar phase and *dai* type. Catches are sub-sampled to provide estimates of catch by species and length-weight data.

The “lee trap” fishery is specific to the braided streams and waterfalls environment of Khone Falls in Laos and has no equivalent in Myanmar. Monitoring was focused on the relative abundance and biomass of fish migrating through channels, as indicated by mean daily lee trap catch rates. Monitoring was originally conducted during 3 times per week, five weeks each year (migration period, in May-June).

The basinwide monitoring program of small-scale fishers recruited up to three fishers at each monitoring site, in 40 then 23 sites. Fishers recorded in logbooks their daily catch by species (weight, number of fish, and maximum fish length) and effort (hours fished by gear type and size. This program was further developed by the SciCap project (Boon et al. 2016) into a four-component approach: fishers noting daily catch records in logbooks; “community researchers” (specially trained fishers) gathering and checking the information of fishers; community researchers and DoF/project staff doing bi-monthly surveys and technical expert bi-annual supervision. The monitoring also involved use by partner fishers of GIS devices and cameras for automated identification of species at DoF later on (cross-checking). Data noted by fishers consist of total catch weight, species identification and weight by species, recording of standard length and individual weight for ten fish of each species, gear type and size, quantity of gear type, location of gear type, time set and time recovered

The above examples shows the diversity of approaches in fisheries biomonitoring, the frequent collaboration of scientists with fishers, the necessary involvement of local surveyors (who can be trained fishers) and the challenge in quantifying the fishing effort – which can be expressed in many ways.

4. TECHNICAL OPTIONS FOR BIOMONITORING

Technically, there are four main approaches to monitor biomass harvested and diversity:

- **sampling the resource with a standard gear** and a rigorous fixed protocol (e.g. gill nets recommended by the FAO, trammel nets used by the Fishery Administration in Cambodia, etc.);
- **monitoring the catch of fishers** by working with them. In that case, the unit of effort in one fisher-day, regardless of the gear.
- **logbooks filled by fishers.** This option is similar to the previous one, but the work is done by fishers themselves. It requires training of these fishers and reliance on their records, as the information is impossible to check.
- **monitoring of landings.** This methods is common to monitor trends in fish yields. This approach is used by the Fishery Administration in Cambodia and the Mekong River Commission along the Mekong.

We review below the pros and cons of each method:

Sampling the resource with a standard gear

Pros: this provides the most reliable assessment of trends in the resource, and results comparable in multiple sites. The uses of trammel nets in particular ensures the lowest selectivity, i.e. the best diversity assessment.

Cons: this requires sampling by a trained team and an intensive schedule in order to cover seasonal variability and migration pulses in all environments, plus moon- and tide-related variability in coastal environments. Sampling itself is physically demanding. Panels of gill nets constitute a standard methodology (e.g. Lévêque et al. 1988), but their catch is very low and very dependent on the skills of the person who sets them. Trammel nets are forbidden in Myanmar (for being too effective); university scientists consulted do not know how to operate them and it is not recommended to start using them with fishers, even under university supervision. In several sites areas barrages could be considered, but they are subject to a strong seasonality, and the effort unit is very difficult to determine (Livingston 1987, Acosta 1997).

Monitoring the catch of fishers

Pros: this allows integrating the change of gears by fishers to follow seasonal changes in species availability. Monitoring fish in the boat also allows identifying the destination of the different fish sorts (trade, self-consumption, processing, etc.), i.e. socioeconomic info gathered at the same time as biological information.

Cons: this approach is suitable to small-scale fishing using a diversity of small gear, but is not so relevant to large systems such as oxbow lakes where the catch depends mainly on one large harvesting system operated once or a few times a year. The selection of partner fishers needs to be carefully done, since their wealth influences the choice of gear and therefore the nature and size of target fish. Ideally, the approach requires a panel of fishers combining wealthy and poor fishers using different gears.

Logbooks filled by fishers.

Pros: records can be daily, or at least more frequent than with a team of surveyors. This allows a good coverage of the fish diversity, as well as the temporal and spatial diversity in the fishing area.

Cons: this approach requires training of fishers and reliance on their records, as the information is impossible to check. Taxonomic identification in particular is in the hand of fishers, and is often limited to that of local fish names.

Monitoring of landings

Pros: this methods minimizes the sampling effort and allows the integration of a larger number of fishers. Sampling can be done ideally when the boat lands.

Cons: this approach is exposed to the risk of seeing the catch split, right in the boat, between fish for sale (landed for marketing) and fish for self-consumption (landed later, after sampling). It is also very unlikely that lease owners let the project team sample the annual yield of a productive oxbow lake or closed water body generating substantial profit.

5. MAIN FISHING GEARS TO BE MONITORED

In May 2018 the project did not know enough about the dominant fishing gears in each site. This information is essential for the design of a monitoring program tailored to each site or cluster of sites. Information was subsequently upgraded during a series of focused visits in June and July 2018, in order to get a description precise enough to underpin a detailed work program for partners in charge of the field monitoring. The questionnaire used during these additional surveys is provided in Annex A, and results in Annex B.

Surveys about gears were conducted in seven sites: #2 Hlaing Tar Me Zali (lease in Maubin Township), #4 Pa Thwei Ahtet Metkun (lease in Pantanaw Township), #7 Yinn Se (lease in Lay Myet Hmar Township), #8 Shar Kae (lease in Kyonepyaw Township), #10 Ayar Taw (tender in Labutta Township Pyin Salu Sub-township), #14 Khay Nan (lease in Thabang Township), and #15 Myin Ka Kone (open fishery in Mawlamying Township).

Questions in each site were focused on i) the three main gears catching most fish (be they individual or collective, in particular in the case of oxbow lakes harvested collectively), **and ii) the three main gears used by most individual fishers** (in order to identify gears contributing most to family fishing).
Results are summarized below in Table 2.

An analysis of frequencies and ranking of gears in study sites shows (Table 3) that:

- **Among gears catching most fish, the most common gear type is seine net** - either beach seines or plain water surrounding seines. These are followed by set gill nets (sometimes of very long length; e.g. 1 km long nets in Ah Kae Chaung Wa).
- **Among gears used by most people, set gill nets dominate**. They are followed by a diversity of small gears such as traps, drift nets, long lines or cast nets.

Overall, results show a large diversity and limited similarity between sites.

The diversity of gears used calls for an analysis of monitoring requirements of each gear type (Table 4). In this analysis, we summarize:

- how many fishers operate a given gear (need to monitor an individual or a group of fishers);
- when the gear is operated (at regular predictable times or at various times depending for instance on tides, moon phase, flood or fisher's availability);
- where/when the fish is accessible for identification and quantification (with fisher or at landing site, with one fisher or shared between multiple fishers, etc.)

Table 2: Gears with the largest catch or used by most fishers in sites surveyed

Site Name	**Gear #1 with the largest catch**	**Gear #2 with the largest catch**	**Gear #3 with the largest catch**
Myin Ka Kone	Trammel net (*Nga thalauk pike*)	Net fence (*Pike bawoun*)	Bottom drift net (*Nga poke thin pike*)
Shar Khae	Beach seine net (large; *Kalar pike*)	Beach seine net (small; *Swae pike*)	#NA
Ayar Taw	Bag-net / stow net (for mysids; *Kyar pike*)	Bag-net / stow net (for fish; *Kyar pike*)	Net fence (*Pike bawoun*)
Hlaing Tar Mezali	Seine net (*Chon wai pike*)	Beach seine net (*Wai pike*)	Bag-net / stow net (for fish; *Kyar pike*)
Pa Thwei Ahtet Metkun	Seine net (*Chon wai pike*)	Set gill net (*Tar pike*)	Fish basket trap (for fish; *Myone*)
Yin Sae	Beach seine net (*Wai pike*)	Beach seine net (large; *Kalar pike*)	Cast net (*Le pyit con*)
Khay Nan	Beach seine net (*Wai pike*)	Beach seine net (*Wai pike*)	Water pumping
Site Name	**Gear #1 used by most people**	**Gear #2 used by most people**	**Gear #3 used by most people**
Myin Ka Kone	Bottom drift net (*Nga ponenar pike*)	Set gill net (*Tar pike*)	Eel trap (*Nga shint pone*)
Shar Khae	Set gill net (*Tar pike*)	Set gill net (*Tar pike*)	Push net (*Yin tun*)
Ayar Taw	Mud crab trap (*Ganan paing*)	Long line (*Nga hmyar tann*)	#NA
Hlaing Tar Mezali	Set gill net (*Tar pike*)	Cast net (*Le pyit con*)	Fish trap (for fish; *Myone*)
Pa Thwei Ahtet Metkun	Drift gill net (*Nga phe aung pike*)	Set gill net (*Tar pike*)	Fish trap (for fish; *Myone*)
Yin Sae	Set gill net (*Tar pike*)	Trap (for fish; *Myone*)	Long line (*Nga hmyar tann*)
Khay Nan	Set gill net (*Tar pike*)	Cast net (*Le pyit con*)	Prawn trap (*Pazun hmyone*)

Note: There is some confusion in the names locally used for seine nets or fence nets. For instance in Shar Khae, the gear is named “beach seine” (*Kalar pike*) and is indeed designed as a beach seine (i.e. with a larger central panel and smaller lateral panels), but this gear is actually used as a purse seine within the “*gyan*” system concentrating fish. In other places, a seine net (*Chon wai pike*) is used as a fence net (*Pike bawoun*) while another smaller seine net (*Swae pike*) is used to harvest fish inside the enclosed area. A clarification about seine nets is proposed in Annex C.

Table 3: Frequency of gears catching most or used by most people in study sites

Gear with the largest catch
Beach seine net (*Wai pike*)
Seine net (*Chon wai pike*)
Beach seine net (large; *Kalar pike*)
Bag net / stow net (for mysis; *Hmyin kyar pike*)
Bag net / stow net (for fish; *Kyar pike*)
Net fence (*Pike bawoun*)
Trammel net (*Nga thalauk pike*)
Set gill net (*Tar pike*)
Beach Seine net (small; *Swae pike*)
Bottom drift net (*Nga poke thin pike*)
Trap (for fish; *Myone*)
Cast net (*Le pyit con*)
Water pumping

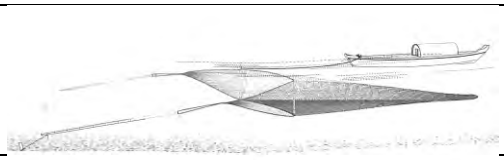
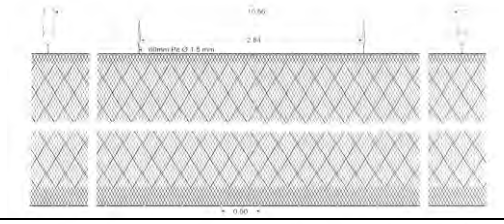
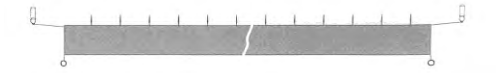
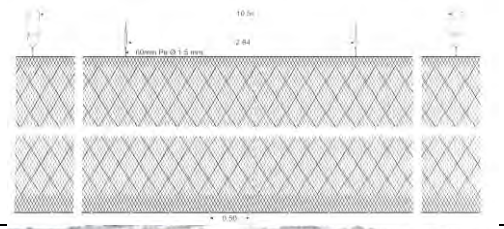
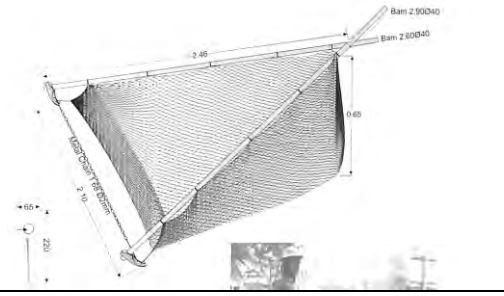
Color code
Very common
Common
Used
Minor use

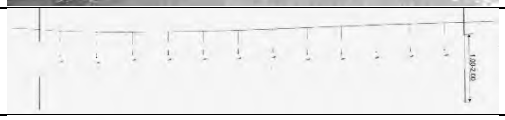
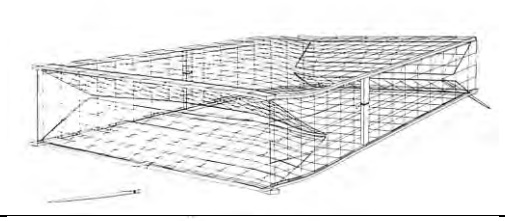
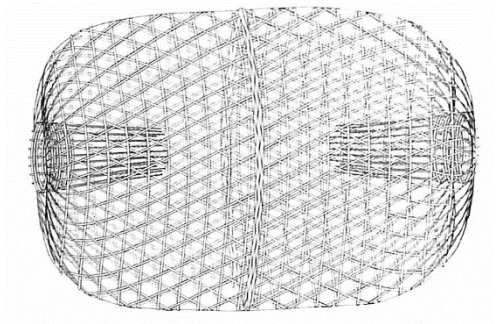
Gear used by most people
Set gill net (*Tar pike*)
Trap (for fish; *Myone*)
Cast net (*Le pyit con*)
Bottom drift net (*Nga ponenar pike*)
Drift gill net (*Nga phe aung pike*)
Long line (*Nga hmyar tann*)
Mud crab trap (*Ganan paing*)
Eel trap (*Nga shint pone*)
Prawn trap (*Pazun hmyone*)
Push net (*Yin tun*)

The analysis allows identifying **seven gear categories** in relation to monitoring requirements (Table 4):

1) *One gear operated by one fisher* (i.e. agreement to monitor to be secured with individuals one by one), with *regular operations* (i.e. monitoring can be scheduled long in advance) and *catch accessible on the boat or at landing site*, i.e. not dispersed and easily accessible for identification and quantification: bag nets / stow nets → **monitoring of several individual partner fishers at pre-set times; the catch can be monitored in one place for each partner fisher.**
2) One gear operated by one fisher, with *operations at various times* (i.e. need local presence to adapt on short notice to the fisher's decision to fish or not), and catch accessible on the boat or at landing site: bottom drift nets, drift gill nets, set gill nets and trammel nets → **monitoring of individual partner fishers while adapting daily to their activity; the catch can be monitored in each boat or at landing site.**
3) One gear operated by one fisher, with operations at various times, and *catch accessible for monitoring only in the fisher's basket* (no boat nor landing site): cast nets and push nets → **monitoring of individual partner fishers while adapting daily to their activity and walking with them.**
4) *One gear operated by multiple fishers* (i.e. agreement to monitor to be secured with all participants or after identification of their leader); operations at various times and catch accessible at landing site: beach seine nets → **monitoring of the catch of a group of fishers while adapting daily to their activity; the catch can be monitored in one single place.**
5) One gear operated by multiple fishers; operations at various times and *catch shared between several fishers without being landed* (usually sharing between boats, making the catch difficult to access and monitor): net fences and plain water seine nets → **monitoring of the catch of a group of fishers while adapting daily to their activity; the surveyor(s) must follow individual fisher(s) and *sample* the overall catch in different boats or places while also quantifying the total catch.**
6) *Several gear units operated by one fisher* (e.g. traps); operations at various times and *catch accessible with the fisher or at landing site* (fisher's boat or bag, or upon landing): eel traps, long lines, mud crab traps, fish traps and prawn traps → **monitoring of individual partner fishers while adapting daily to their activity; the surveyor(s) must follow individual fisher(s) in different boats or places.**
7) *One fishing system operated by multiple fishers*, *harvest done at once at the end of a season* (e.g. emptying of a pond by dragging a fence net or pumping water out; sudden large yield, lack of time to monitor and need to sub-sample) and catch shared between several fishers: "*gyan*" system and water pumping → **monitoring of the catch of a group of fishers a few times a year; challenging sub-sampling of a sudden large yield often swiftly shared between several fishers.**

Table 4: gear types and their characteristics relevant to monitoring

Gear	Illustration	Monitoring
Bag net / stow net (*Kyar pike*)		1 gear 1 fisher Regular operations Catch on the boat or at landing site
Bottom drift net (*Nga poke thin pike*)		1 gear 1 fisher Operations at various times Catch on the boat or at landing site
Drift gill net (*Nga phe aung pike*)		
Set gill net (*Tar pike*)		
Trammel net (*Nga thalauk pike*)		
Cast net (*Le pyit con*)		1 gear 1 fisher Operations at various times Catch with fisher
Push net (*Yin tun*)		
Beach seine net (large; *Kalar pike*)		1 gear multiple fishers Operations at various times Catch at landing site
Beach seine net (small; *Swae pike*)		
Beach seine net (*Wai pike*)		

Gear	Illustration	Monitoring
Net fence (*Pike bawoun*)		1 gear multiple fishers Operations at various times Catch with (several) fishers
Seine-net (*Chon wai pike*)		
Eel trap (*Nga shint pone*)		1 fisher multiple gears Operations at various times Catch with fisher or at landing site
Long line (*Nga hmyar tann*)		
Mud crab trap (*Ganan paing*)		
Prawn trap (*Pazun hmyone*)		
Trap (for fish; *Myone*)		
Gyan system	Fence pulled by fishers	1 system, several fishers Operation at once Catch with several fishers
Water pumping	Fish collection in dry pond	

6. PARTNERSHIPS: OPPORTUNITIES AND CONSTRAINTS

The project integrates a collaboration with national partners through the Fisheries Research and Development Network (FRDN) for the monitoring of the study sites. Five different partners were met: Hinthada and Pathein Universities, Yangon and Dagon Universities, and the Network Activities Group (NAG), an NGO active in fisheries.

In the case of universities, the following points were systematically explored:

1. Experience of the university in biological sampling
   Type of sampling; Log books? Questionnaires?
2. Data analysis experience
3. Reporting experience
4. Possible timing of sampling
   Months the university is available, biologically suitable timing
5. People who can be involved in the project
   Number of people, qualifications, frequency of field work?

These points were followed by some brief discussion about costing, sites and support needed. Similar points were discussed with NAG, while integrating the different context and constraints for this NGO.

The points common to all universities are:

- **All universities are willing to engage** in the project and have staff available to do so
- **No university scientist or student has ever done fishing by themselves;** they have no experience of handling fishing gears but have, at best, worked with fishers catching fish for them or through questionnaires.
- It is challenging to integrate this monitoring to the theses of PhD students as this activity i) may not match with their respective topics already defined or ii) would be too short to be the theme of specific PhDs. Similarly, this monitoring could be a theme for MSc research studies over 6 months or one year, but the challenge is then the constant topic – considering that MSc research topics need to change from batch to batch. As a consequence, **it is better to design the monitoring as consultancy contracts with teachers** who will set aside their time and students' time to do the work. The funding can then be used to either finance some theses or material investments at the university.
- **Each team could be available a few days each month to do the sampling**. Sampling can take place each month of the year, with limitations in March-April which is the examinations season.
- **All teams will require clear guidance about what to do, where, and how to do it**. In particular they recommend, before the monitoring starts**, training about i) the protocol** to be implemented; ii) **data management and analysis** (in Excel); and iii) **reporting** (standards, expectations, templates).

7. DEFINING A BIOMONITORING PROTOCOL

7.1 Purpose and context of the biomonitoring

The MYFish 2 project, by design, assigns three purposes to data gathering, in particular in biology (biomonitoring):

- **observation of different fishery management systems**, in view of defining a typology and drawing conclusions about the outcomes of each system from a resource perspective;
- **management**, by gathering data about a set of indicators relevant to the management of each fishery;
- **capacity building**, i) of partners universities and NGOs under the FRDN umbrella, in order to improve their experience in fishery management, but also ii) of the DOF, by ultimately proposing a light field-based fishery monitoring protocol able to complement the current institutional desk-based statistical data production system, as recommended by the FAO or the National Water Resources Committee (BOBLME 2014, HIC 2017)

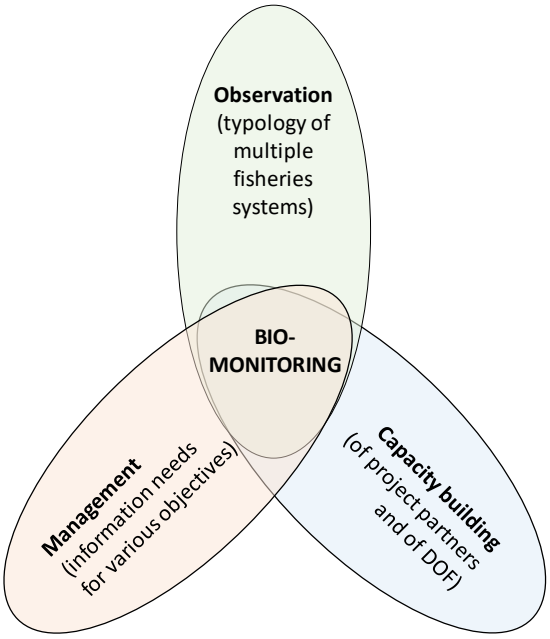


Figure 3: Purposes of biomonitoring in MYFish 2

The proposed biomonitoring must reflect these different purposes, with an emphasis on purpose #1 (observation), while integrating the constraints inherent partnerships with universities, and adapting to the number of sites possible in relation to human, logistical and financial resources.

Several studies have reviewed the parameters required for rapid assessment or long-term monitoring of small scale tropical fisheries, in particular Pido et al. (1996), Bunce and Pomeroy (2003), Halls et al. (2005 a and b), or DoF and SEAFDEC (2010) in the case of Myanmar. The latter reference also provides detailed questionnaires for commercial and small-scale fisheries monitoring, including in Myanmar language. Here, the biomonitoring considered is part of a larger project scheme detailed in Figure 4.

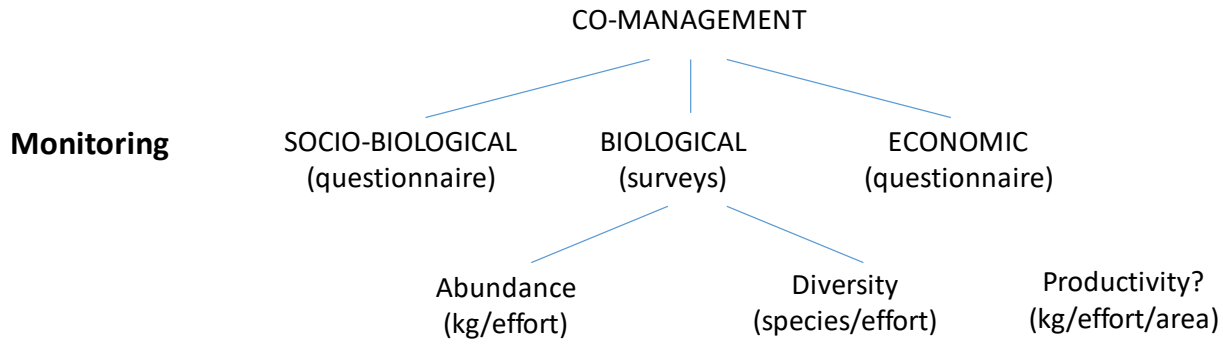


Figure 4: The different fields of M&E application in co-management performance assessment

Relationships between project focus areas, themes of the socioeconomic study using questionnaires and the present biomonitoring survey are illustrated in Table 5.

Table 5: relationships between themes and surveys

Themes of the socioeconomic study

Project focus areas	Social	Economic	Biological
Equity	X	X	-
Sustainability	-	X (benefits of envir. mgt)	+ (trends) X (envir. mgt)
Production	-	X	+ (catch) X (stocking)

\+ : Biomonitoring X : Socioeconomic M&E

We detail below recommendations about the biomonitoring survey.

7.2 Recommended variables

For the present study, and given the observations detailed in the above sections, **we recommend a focus on i) abundance and ii) *Catch Per Unit Effort* by species and by site. This implies measuring i) number of individuals and weight per species, and ii) unit effort,** with subsequent analyses of *CPUE*, *species diversity in catches, dominant species in catches*, and the *relative evolution over time of these three indicators*.

Abundance assessment needs to integrate the fishing effort (Bayley 1988). In a context of small scale tropical fisheries characterized by the diversity of gears used to adapt to fish availability, defining a standard effort is very challenging **We recommend to use as a Unit Effort one day of fishing by an individual professional fisher**, with integration over a long period of time. This is the approach taken, in a similar study, by WorldFish in Bangladesh (WorldFish Center 2007).

Three parameters are often measured in fishery monitoring: *length, weight* and *reproduction stage* of individual fishes of some target species. Such data gathering is essential in the case of long-term monitoring (reduction of average individual sizes and of size at sexual maturity being warning signals of overexploitation). However, it is very unlikely to see a noticeable or significant change in any of these three parameters during the two years of monitoring of the project, so **we do not recommend inclusion of *length, weight* and *reproduction stage* observations in the present monitoring**.

7.3 Recommended approaches

The diversity of situations calls for an **adaptive approach**, to be tailored for each site or cluster of sites. The many objections to the use of a standard fishing method imply a **recommendation for the project team to work with fishers and the gears they use**. Since it is impossible to allocate a survey team to a sufficient number of fishers with a sufficiently tight sampling frequency in each site, **it is recommended to identify and hire in each site a few surveyors who will monitor fishers and their catches each day**, and report to the university teams visiting them once a month. The cost (about USD 20/enumerator/month) is limited and very compatible with budgets available.

We detail in Table 6 the approach recommended in the case of each gear category identified in Section 5. Technical and logistical arrangements need to be discussed on a case-by-case basis with the FRDN partners in charge of monitoring each site.

Note: In a number of sites, in particular in oxbow lakes, a single fishing method dominates. Monitoring such sites implies physical presence for sampling during the few days of harvest at the end of the fishing season. This is a very challenging request to lease operators, and defiance is to be expected when it comes to precisely assessing the yield and therefore the profit from a given lease. In all cases **monitoring of a large gear requires a close collaboration with the CFG committee**, which is unlikely in sites where the CFG is actually a made-up arrangement for a former lease operator or a few powerful families to keep operating the lease at floor price with the backing of a number of villagers (case of sites 1: Ahkae Choung Wa or 13: Kyone Tadun).

Table 6: Summary of monitoring requirements for each fishing system identified

	Agreement	**Scheduling**	**Location**	**Staffing**	**Log book**
Bag nets / stow nets	Requires an agreement with individual fishers	Can be scheduled long in advance	Monitoring at landing site to be determined	One surveyor OK	Log book possible
Bottom drift nets, drift gill nets, set gill nets and trammel nets	Requires an agreement with individual fishers	Need to follow fisher's daily schedule	Monitoring at landing site or sale point to be determined	One fisher at a time per surveyor -> at least one surveyor daily	Log book possible
Cast nets and push nets	Requires an agreement with individual fishers	Need to follow fisher's daily schedule	No monitoring at landing site (need to follow fisher)	One fisher at a time per surveyor -> at least one surveyor daily	Log book possible
Beach seine nets	Requires an agreement with a group of fishers	Need to follow fishers' daily schedule or stay in touch to be present at operation times	Monitoring possible at landing site	At least 2 surveyors per operation (sudden large catch and sub-sampling likely)	Log book unlikely (collective fishing, large catch, sub-sampling required)
Net fences and plain water seine nets	Requires an agreement with a group of fishers *and* with individual fishers	Need to follow fishers' daily schedule or stay in touch to be present at operation times	Monitoring at landing site unlikely (need to embark)	At least 2 surveyors per operation (sudden large catch and sub-sampling likely)	Log book unlikely (collective fishing, large catch, sub-sampling required)
Eel traps, long lines, mud crab traps, fish traps and prawn traps	Requires an agreement with individual fishers	Need to follow fisher's daily schedule	Monitoring at sale point to be determined (self-consumption share?)	One fisher at a time per surveyor -> at least one surveyor daily	Log book possible
"G*yan*" system and water pumping	Requires an agreement with a group of fishers	Need to stay in touch to be present at operation times	Monitoring possible at landing site	At least 2 surveyors per operation (sudden large catch and sub-sampling likely)	Log book unlikely (collective fishing, large catch, sub-sampling required)

7.3.1. Monitoring fishing gears in each site

As mentioned in the introduction, the project covers two perspectives, i) production and ii) equity, which calls for a monitoring of gears i) contributing most to production, be they used by a few people only, ii) most common among all fishers of a given site, be they less productive, and iii) used everywhere (for comparisons between sites).
For these reason, **it is recommended to monitor in each site i) the gear with the largest catch, ii) the gear used by most people, and iii) gill nets**.

The gear catching most and the most common gear should be identified in each site by the survey team.
As for gill nets, **at least three fishers using gill nets should be monitored in each site**, regardless of mesh size used. Given the diversity of gears, variability of practices among fishers and the monitoring through local surveyors, details such as mesh sizes, environment in which the gill nets are set, time at which they are set, angle in relation to banks or moon phase cannot be recorded – although these parameters are known to also influence the catch).

For each gear and for each fishing operation, the surveyor will need about 30 minutes to identify fish species caught and weight the catch for each species. Thus, putting the monitoring in place consists in finding a 30mn time slot between harvesting and sale or processing. Monitoring can usually be done i) in the fishing boat, if the fishing trip is not too long, or ii) at the landing site, before the fish is sold to traders or sent to a market, or iii) at home, when the fisher comes back, if a trader has not collected the fish by boat beforehand.

Therefore the first task for each partner university will be, in each site, to:

- identify the gear with the largest catch and the gear most common
- find 5 partner fishers, identify surveyors, and make agreements with them
- specify the 30mn survey slot for each gear in each site (place, time, etc.). Details in the following section.

Unlike in fishery socioeconomic studies, monitoring cannot be done at the level of traders or at markets because we need a clear assessment of the fishing effort to calculate CPUE –traders cannot provide such information- and also because fish of different origins are often mixed together at markets.

7.3.2. Monitoring a given gear

In each site, in order to put in place the monitoring of a given gear the study team should answer the following questions:

Where is the fishing taking place? → *where should the surveyor go?*
When is it taking place? → *when should the surveyor monitor?*
How long does the fishing take? → *how long may the surveyor have to wait?*
How often is fishing done? → *how often should the surveyor survey?*
What is the cost of monitoring one fishing operation? → *how many operations can we monitor?*

The various options are illustrated in Figure 6 and in the following sheets reflecting field observations for eight common fishing gears. The same principles must be followed in the case of gears not detailed here.

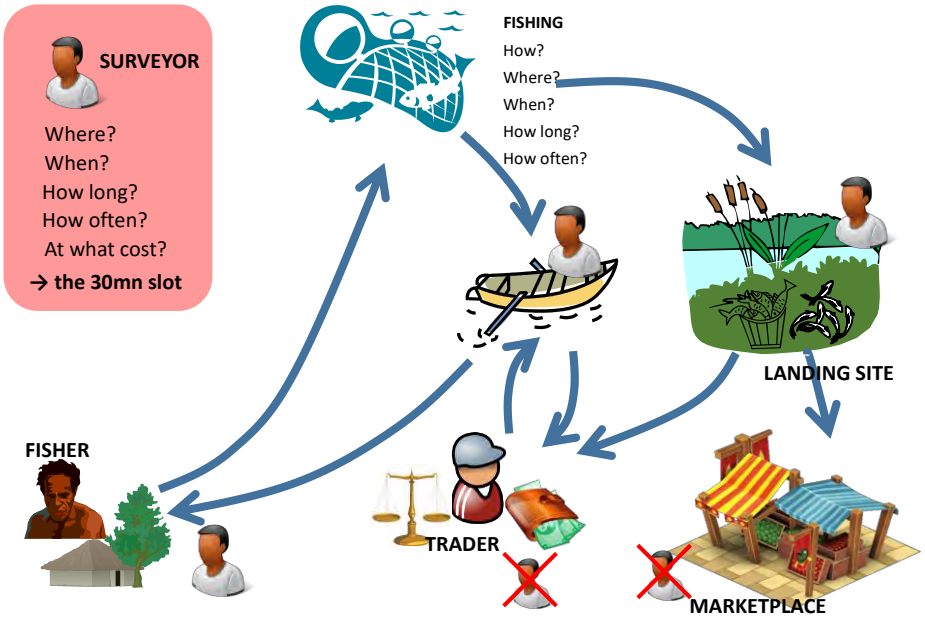
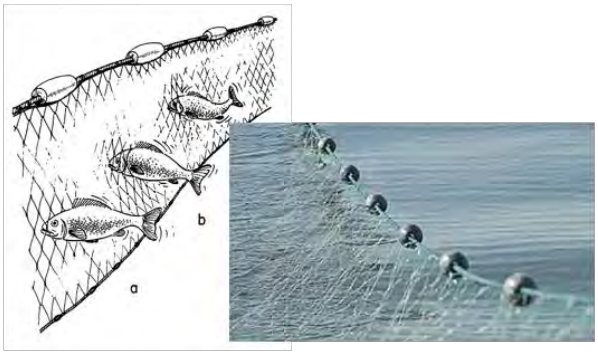


Figure 5: The various times and places when catch can be monitored

Gear: SET GILL NET *(Tar pike)*



How

Set at the surface with floats or at the bottom with anchors

300 x 25 feet; mesh size varies, often 1-3”

Selective gear, catch not high, but cheap and easy -> the most common gear, used everywhere.

Where

Locally along banks for small and medium sp., at special locations across rivers for large commercial sp.

When

Set early morning or in the afternoon for night catch; collected 3-4 times/day

Gear name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Set gill net (*Tar pike*)												

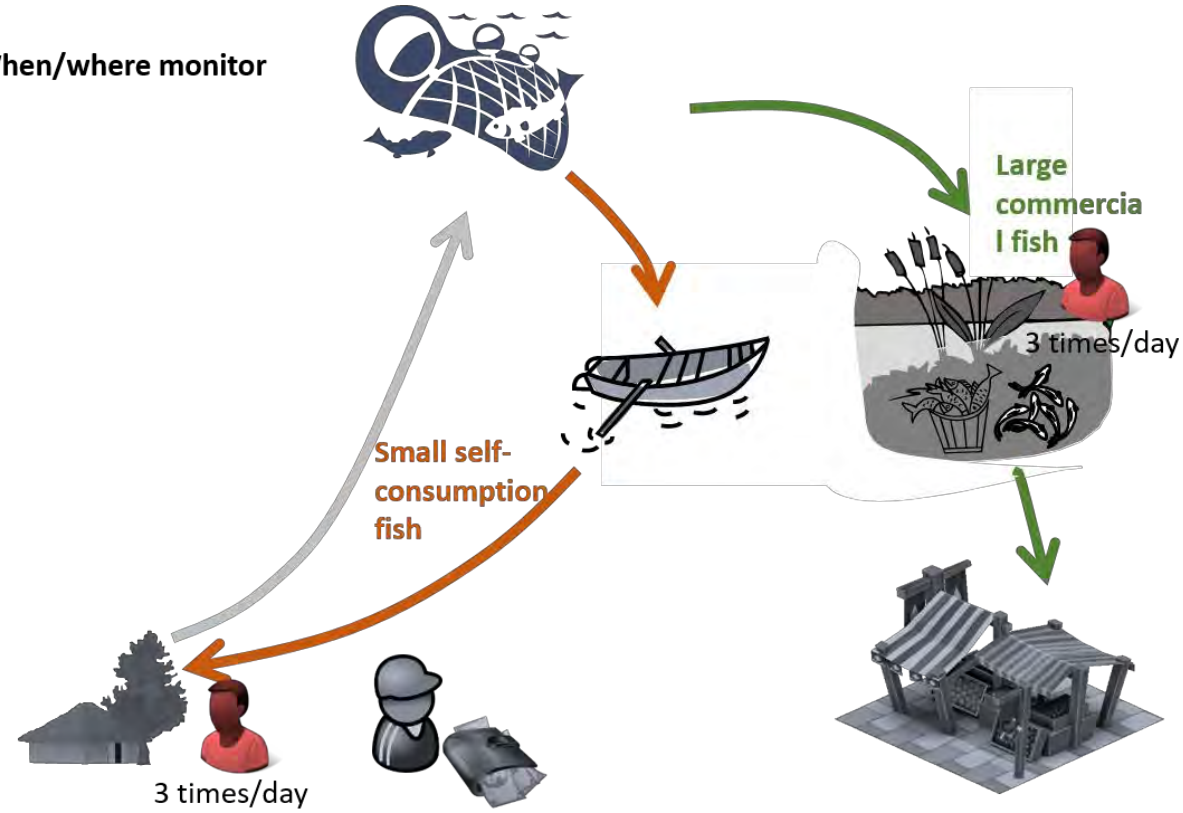
Frequency

± 25 days per month

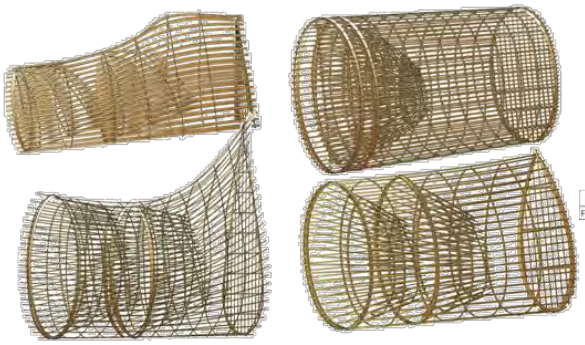
Species

Depends where it is set: large mobile carnivorous species if across streams, smaller omnivorous sp. if along banks

When/where monitor



Gear: FISH TRAPS *(Myone)*



Where
In the floodplain and creeks

When
Collection between 5 and 8 a.m., from Sept. to March, peak in Oct.-Dec.)

Gear name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Fish trap (for fish; *Myone*)												

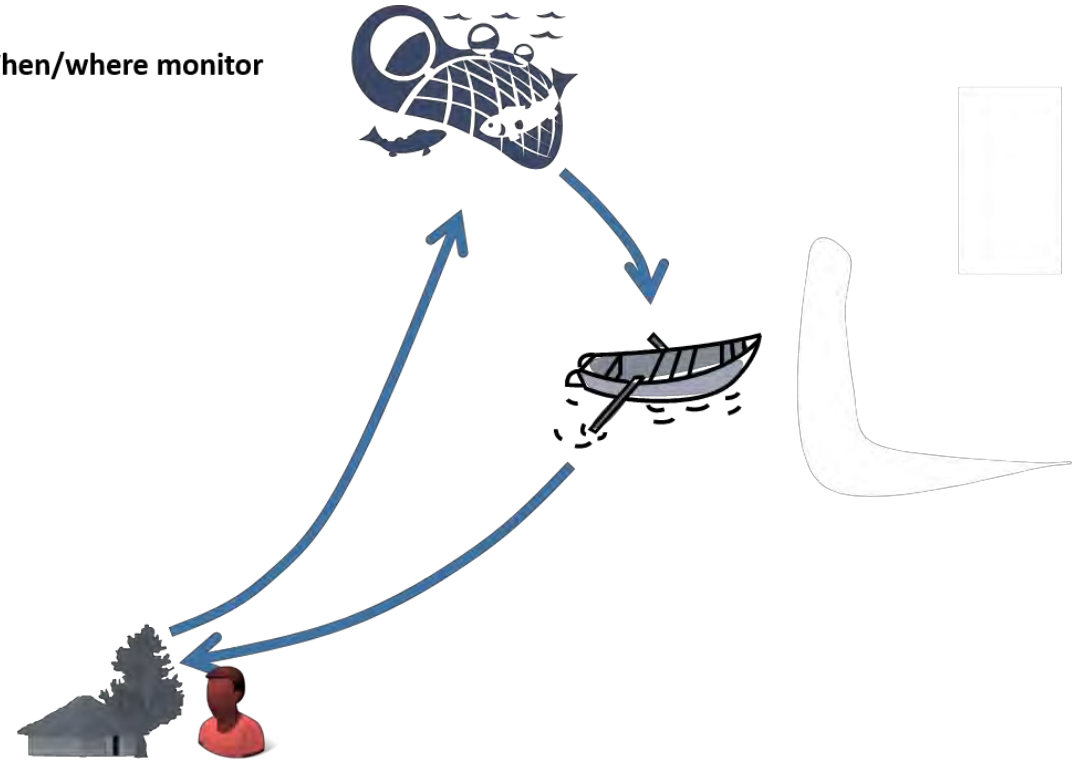
Frequency
Every morning

How
Sets of 30-40 traps per fisher
Fish collection once a day by 1 man in 1 boat
Fish sorted in the boat into 5-6 main categories, then back home
Selective gear → need to ensure a diversity of shapes

Species
Climbing perch, snakehead, gourami, catfish, misc.

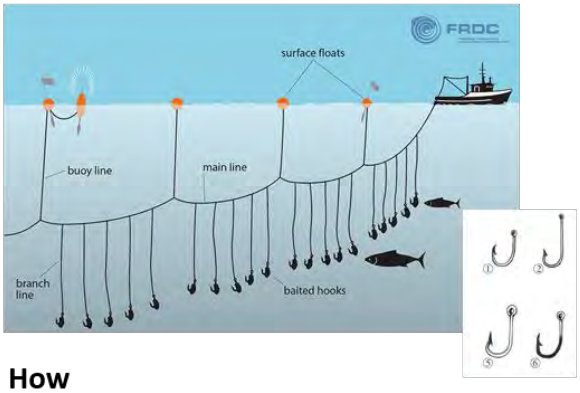
Yield
0 to 8 viss/day

When/where monitor



Around 8 am

Gear: LONG LINE *(Nga hmyar tann)*



How

Length: 1000 feet.
About 1000 hooks per line
Set at 5am and harvested early afternoon, or set in the evening and collected at 4-5am (or combination). Fish brought at home.

Where

In the floodplain, up to 1 hour away from home

When

Small hooks in July-Oct., larger hooks in Sept.-Oct.

Gear name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Long line (*Nga hmyar tann*)												

Frequency

Every day between July and October

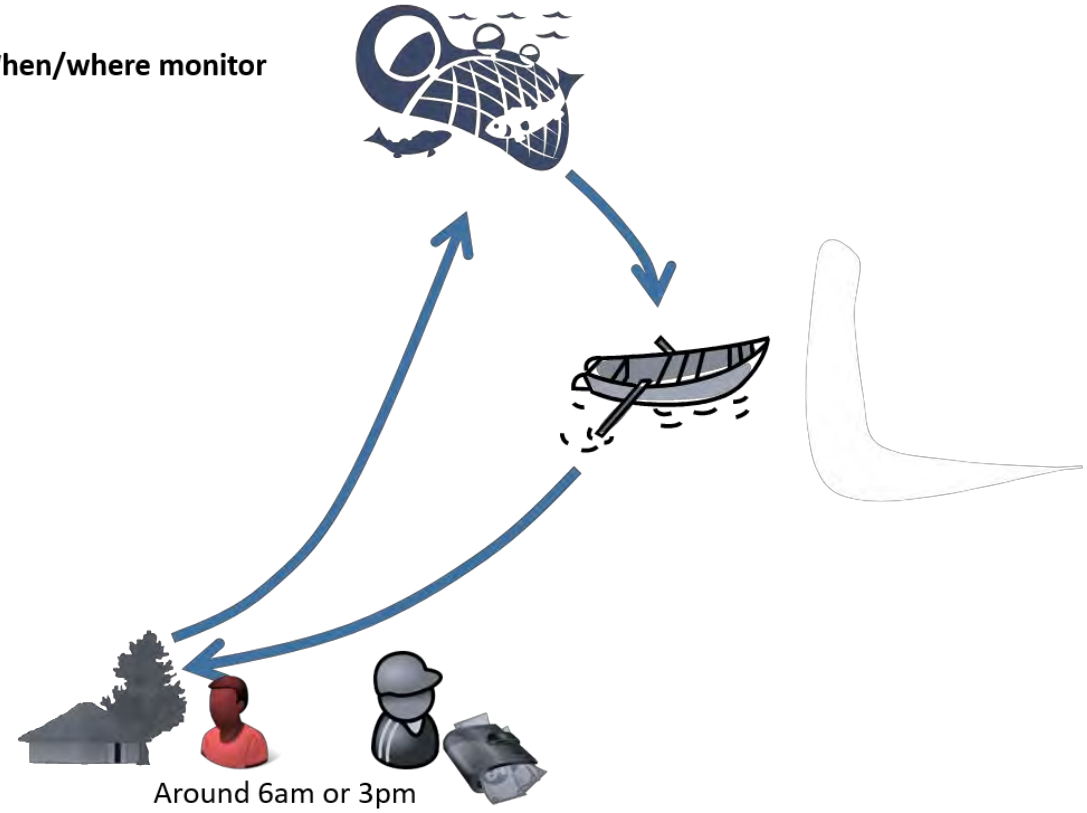
Species

Wallago, Mystus, Clarias

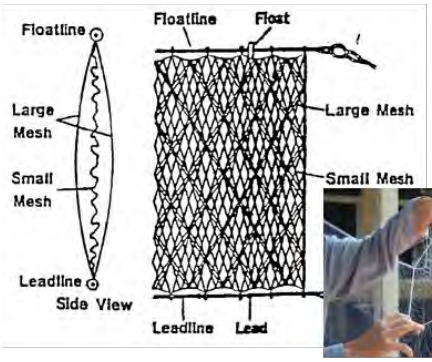
Yield

Minimum 1 viss/operation, usually 3-4

When/where monitor



Gear: TRAMMEL NET *(Nga thalauk pike)*



How

Triple layer of nets entangling fish
Size: 200 x 20 feet; mesh size: 10 and 2”
Net set at a distance from the bank and pulled towards the bank to blanket the fish
High efficiency, very low selectivity.
Fish sorted into 5 main categories and collected twice/day in the boat by a trader

Where

Along creeks and banks

When

From 6am until 5pm and from Oct. to April, with a peak in Dec.– Jan.

Gear name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Trammel net (*Nga thalauk pike*)												

Frequency

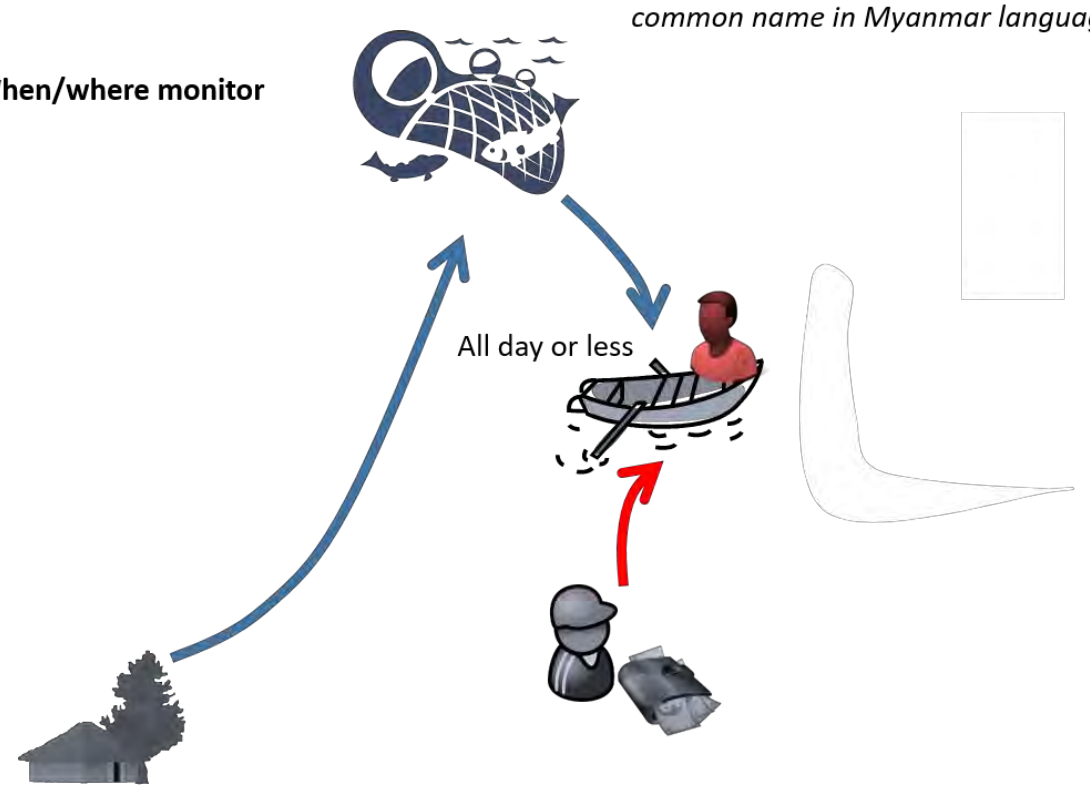
One fishing operation every 30mn

Species

Multiple species, mainly large ones (gourami, snakehead, catfish, featherback), climbing perch

*Note: trammel nets can be used for many species other than hilsa (“*Nga thalauk”*) but “hilsa net” is its common name in Myanmar language*

When/where monitor



Gear: CAST NET *(Le pyit con)*

Where
In floodplains and rivers, wherever water is shallow

When
All year round for subsistence, March-April for commercial fishing

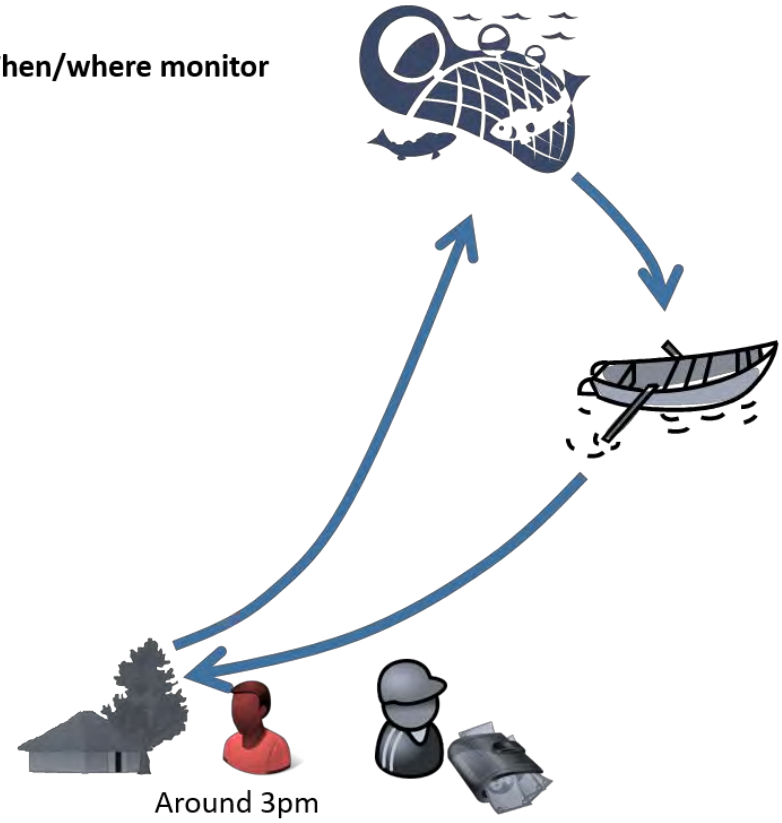
Gear name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Cast net (*Le pyit con*)												

Frequency
Every day

How
Mostly small-scale for subsistence, but a commercial fishing gear sometimes
Last option gear in dry season when water is very shallow (dry season gear)
Mesh size: 2 in. in Jan-Feb, 1 in. in March-April when only small fish remain

Species
Barbodes, Ompok, Mystus, Macrobrachium

When/where monitor



Gear: STOW NET (*Kyar pasat*)

How

Operates by blocking a creek
Two wings and a capture chamber
Fish is landed, sorted, then transported to a trader

Where

In a creek draining a floodplain; the gear works with water recession

When

Day and night during 3 months

Gear name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Stow net (*Kyar Pasat*)												

Frequency

5 to 10 operations per day depending on catch
Day and night at peak season

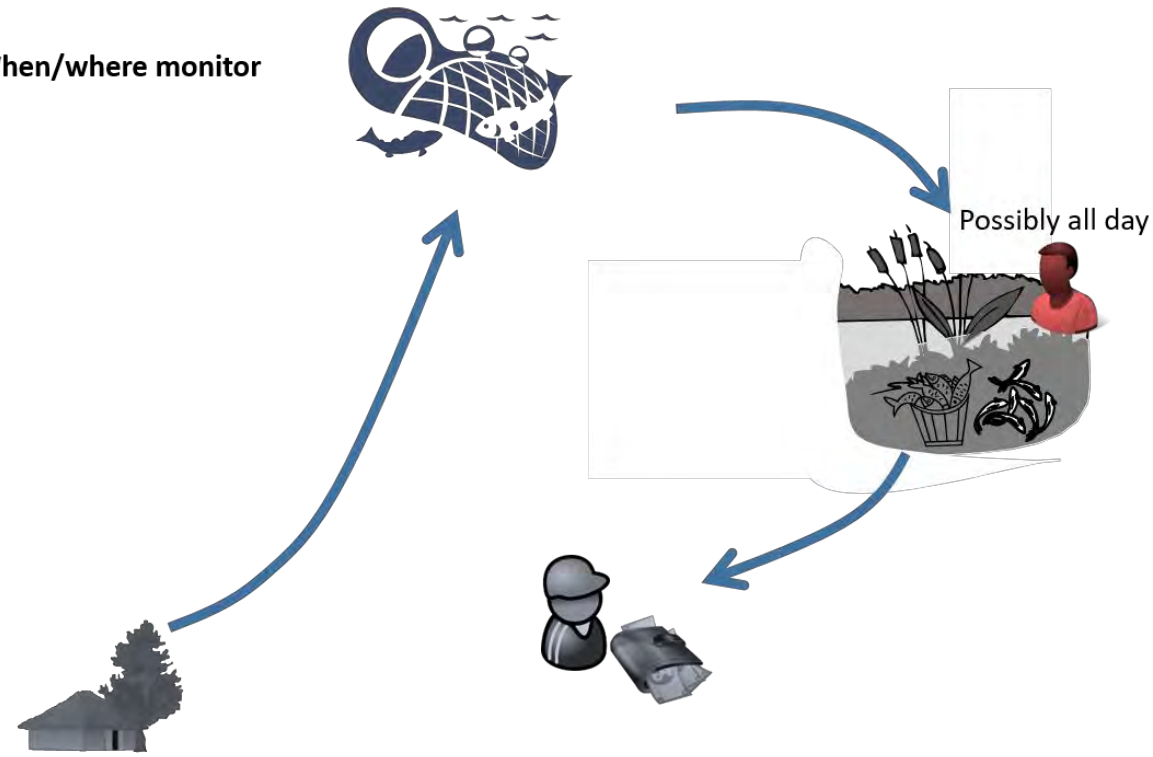
Species

All floodplain species: featherback, snakeheads, multiple others

Yield

Up to 25 viss/day in peak season

When/where monitor



Gear: SEINE NET

Where
15 sites planted with shrubs

When
Harvest in each site 2 month after shrubs planted

Gear name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Seine net (*Chon wai pike*)												

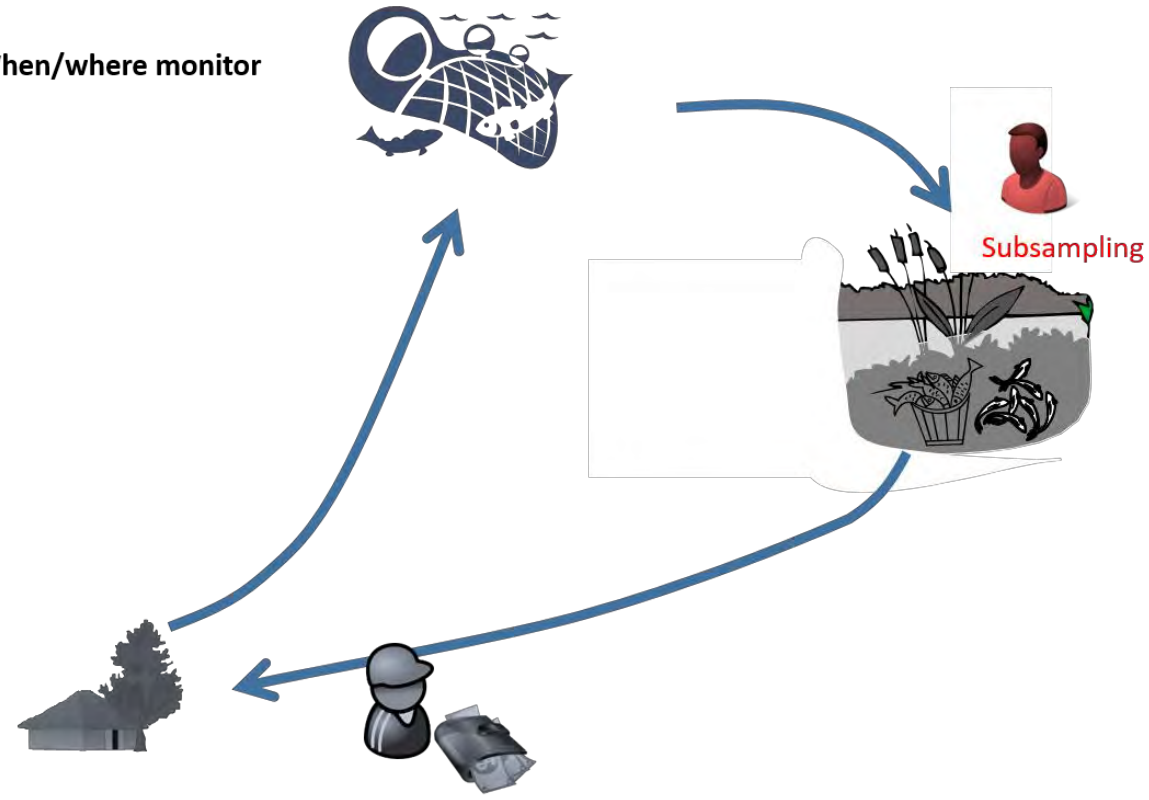
Frequency
15 harvests every 2 month -> 30 harvests per season

How
Sites "planted" with shrubs; gear used to surround them and harvest fish by pulling the net on the bank after removal of shrubs
Size: 400 x 60 feet. Mesh size: 0.5"
1 operation = 1 day, by 8-10 persons
Workers paid in cash and fish brought at home for trader to collect

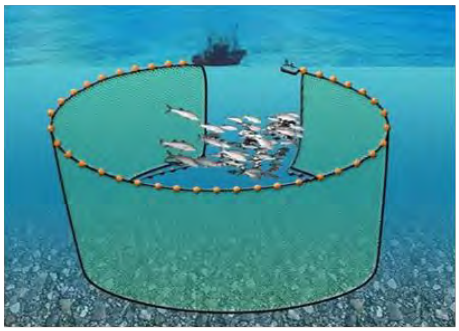
Species
Gourami, snakehead, climbing perch, catfish

Yield
About 50 viss per operation

When/where monitor



Gear: PURSE SEINE



How

Set with 2 boats

Large seine for hatched species: 2000x30 feet, mesh size 4.5 to 1.5 in. Small seine for native species: 900x30 feet, mesh size 0.5 in.;

Set with 2 boats; 1 operation = 1-3 hours

Fish poured into boats and brought to a platform for sorting (5+6 categories)

Subsampling needed; logbook available

Where

In the oxbow lake, within the "gyan" fish concentration area

When

Every day, from December to May

Gear name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Seine net (large & small; *Kolar pike*)												

Frequency

1 to 3 times/day, depending on demand (In Shar Kae, seine = aquaculture harvest gear)

Species

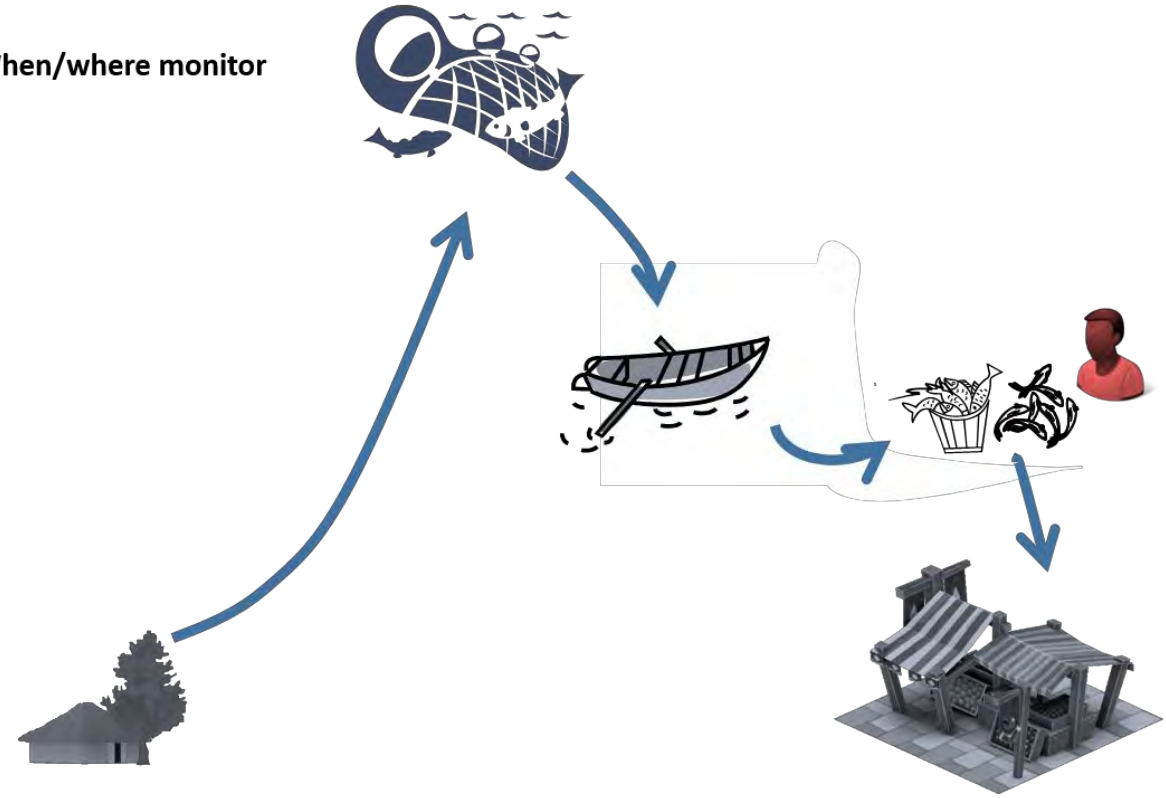
Rohu, mrigal, tilapia, catla, pacu, pangasius ± 15 more native species

Yield

Large: 700 viss/haul

Small: 100-200 viss/operation

When/where monitor



7.3.3. Organizing surveyors

Surveyors can be men or women, fishers, traders or even people not working in the fishery sector but literate, reliable and willing to work part-time. Some fishers can record their catch and effort data themselves, if fishing operations allow; we shall call them “self-surveyors”.

Some surveyors will monitor one fisher, whereas others will monitor several fishers at once (e.g. case of seine nets). All surveyors and self-surveyors will report to a senior surveyor (one in each study site) who will collect and check data sheets. At least once a month, the senior surveyor will hand data over to university researchers.

These researchers will in turn provide training (e.g. species identification) and instructions (survey modalities) to surveyors. They will also supervise the overall data collection, and, importantly, they will **control the accuracy of data gathered** by visiting the site at least once a month.

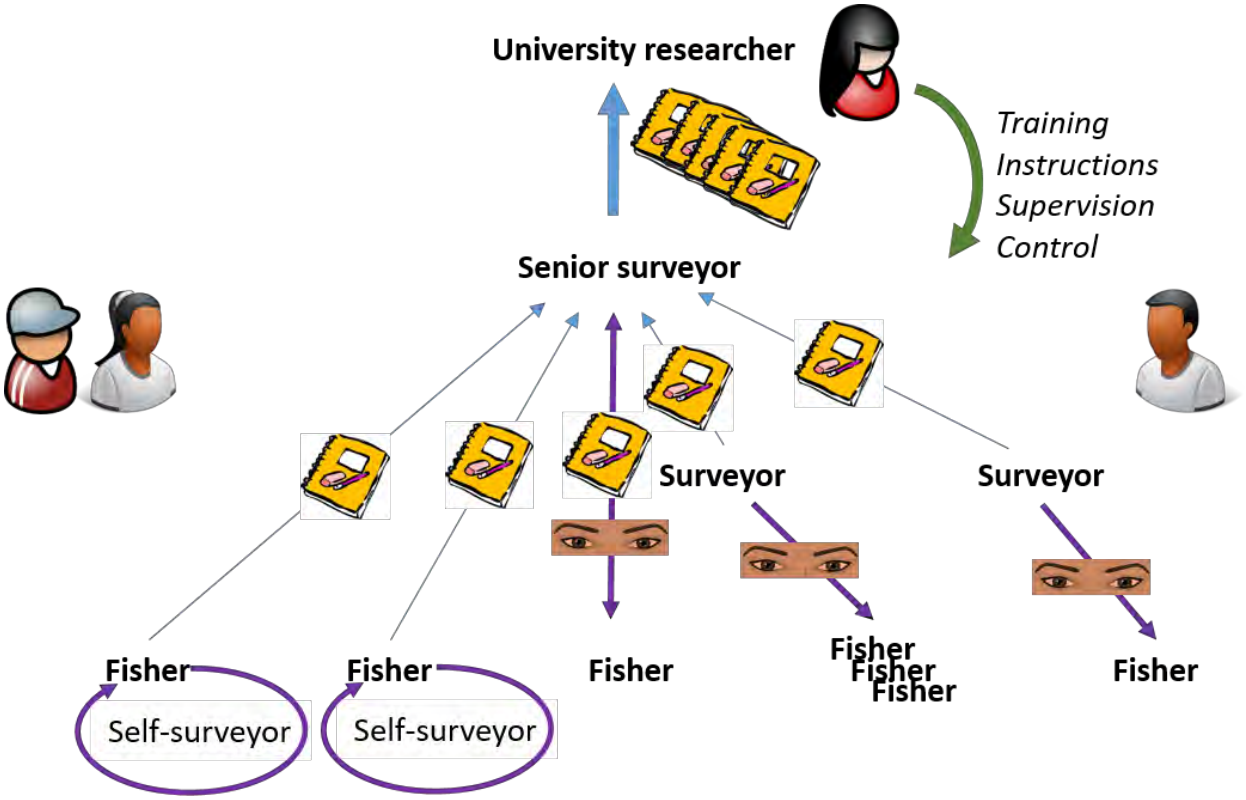


Figure 6: Organizing surveyors

7.3.4. Data sheets

Data sheets for records should include three main sections: identification, fishing effort and catch. As previously mentioned, during analysis the effort units will most likely be aggregated into "days of professional fisher using a given gear", but at this stage the effort of individual gears should be recorded. The combination of effort and catch during data analysis will generate CPUE, while the Catch section will also allow determining species composition and dominant species.
As previously mentioned, individual length, weight or sexual maturity will not be recorded. These parameters can be integrated to monitoring once the latter is firmly established.

A data sheet template is proposed in Figure 8.

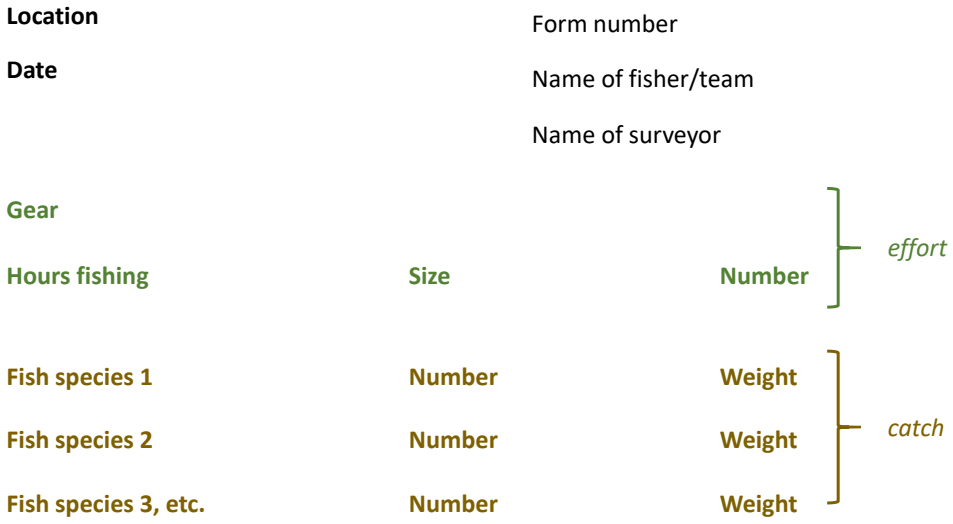


Figure 7: Proposed data sheet template

7.3.5. Taxonomic resolution

Since identifications will be routinely done by local surveyors and fishers, we recommend identifying species using Myanmar common names, after training of surveyors by universities. There will be conflicts between common names and Latin names (usually several species for one common name, or different local names for different sizes or phenotypes of the same species) but they can be addressed during data analysis.

In order to avoid misspellings and given the focus on species relevant to CFG management, **we recommend surveyors to be provided with a pre-established list of dominant or commercially important species**. This list can be established using DoF township catch statistics collected for the SOBA study. **Thirty freshwater species should be identified for inland sites, as well as thirty brackish species for the coastal site**. This number is a compromise between diversity coverage and practical aspects.

7.4 Protocol limitations

Several important caveats inherent to the study must be considered; they are briefly reviewed below.

Several Community Fishing Groups have limited or no resource management system in place –in particular in a context on one-year lease only. Their activity consists in securing a lease or a tender from the DoF and then harvesting with no other restriction than seasonal closed season and ban of destructive methods imposed by the law. Biomonitoring can be put in place in such sites (e.g. sites 7, 13, 14), but it is foreseeable that **no correlation will be found between "co-management" (actually limited to social sharing arrangements) and production or sustainability.** The situation could be turned into a positive perspective, these sites being considered as "no management control sites".

The duration of the project is too short to allow significant conclusions about outcomes of fishery management. Biomonitoring is designed and implemented in 2018 and will produce two years of data – in 2019 and 2020- by the end of the project. Two years of data are not enough to draw reliable conclusions about fishery management outcomes in a highly diverse system (diversity of habitats, of target species, of gears) subject to variable climatic conditions (from season to season, from year to year). Figure 4 below illustrates the possible (mis)interpretations about a hypothetical trend, when data are limited to two years only. Trends in biological indicators are influenced in particular by climatic variability (droughts or high flood years) or follow patterns that are not necessarily linear, which requires more than two years to assess.
The biomonitoring being put in place must then be seen as the beginning of a long-term initiative focused initially on capacity building, before being refined into a full-fledge monitoring system yielding interpretable results after a few years of implementation.

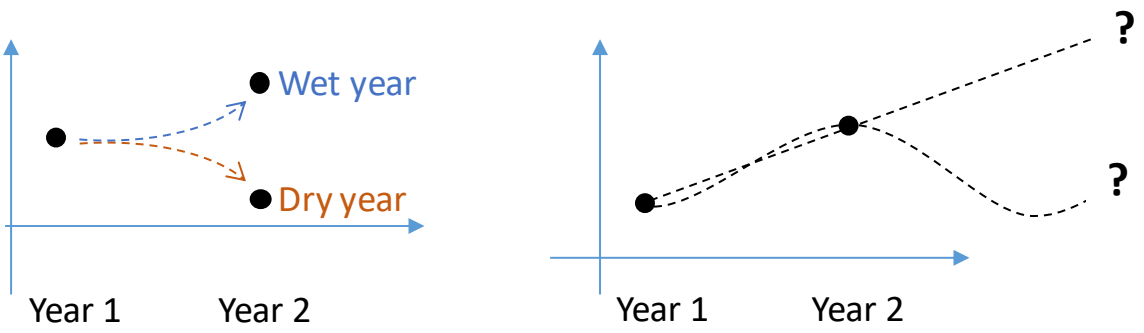


Figure 8: Possible interpretations based on two years of data only

The number of sites studied (8 to 14) is not compatible with the requirements of a formal statistical analysis. The project aims to study the relationship (correlation) between a set of *dependent or explained variables* (fish yield, fish size, species composition, etc., dependent upon or explained by fishery management) and a set of *independent or explanatory variables* (fishing intensity, fishing restrictions, natural habitat maintenance, protected areas, etc.). Parametric statistics usually require a ratio of 30 between samples of one explained variable and one explanatory variable (i.e. it takes 30 measurement to assess whether variable X depends on variable Y or not). In this study, we shall record

multiple explained variables (each CPUE per gear type is one) but we only have 8 to 14 samples[1] (= study sites) to assess the correlation between each explained variable and one explanatory variable. Not to mention the large number of explanatory variables as well.
For these reasons, an analysis of the results based on standard statistical approaches and tools cannot be expected. It can be noted, however, that many studies have been published about the relationship between fishery management variables and outcome variables based on a small number of cases, and on an analytical discourse rather than on a formal statistical analysis. Examples are available in Evans et al. (2011) in which only 2 of the 29 studies reviewed included more than 15 sites, and 5 had dealt with 6 sites or more.

Given the environmental and fishery diversity of sites, the biomonitoring has to focus on two main dimensions of the resource: abundance (biomass) and diversity. Considering the limited sampling effort that can be deployed as part of the project and its focus on yield as an outcome of co-management, ***fish stock* cannot be assessed in each site during the proposed study.**

Fish diversity is to be understood as diversity in the catch, not in the site – acknowledging that sampling using fishing gears imposes a certain selectivity (in particular a bias towards larger size commercial species) and that fish diversity in catches only partly reflects the species diversity a taxonomist would identify using a combination of methods, in particular poisoning.

Last, **monitoring productivity is not feasible** since productivity (i.e. biomass harvested per effort unit *and per surface area unit*) requires knowledge of a reference surface area, which is not available in the vast majority of sites. Livingston (1987) warns in particular about the danger of drawing ecological conclusions at a scale larger than that of the sampling unit. The current project is not intended either to provide data relevant to models predicting maximum yield, as discussed for instance by Halls et al. (2006).

[1] Eight to fourteen depends on the number of sites that can be actually surveyed, based on resources available.

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9. ANNEX A: QUESTIONNAIRE ABOUT DOMINANT GEARS IN EACH SITE

Site name:		Number: ____	Date: ___/___/ 2018
Interviewer:			
Interviewee:			

MEETING WITH THE DoF

- What are the taxed dominant gears in the community.

- By who are the taxed paid.

MAIN GEARS IDENTIFICATION (ON SITE)

<u>Identification of the 3 gears catching the largest quantity of fish</u>

Gear 1, 2, 3: _____

- Picture identification of the gear (SEAFDEC book)
- Who operates the gear (individual, how many persons, etc)

- Possibilities for monitoring

- Willingness of the operators to collaborate

- Timing of operations

Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**

Identification of the three gears used by most people

Gear 1, 2, 3: _____

- Picture identification of the gear (SEAFDEC book)
- Who operates the gear (individual, how many persons, etc)

- Possibilities for monitoring

- Willingness of the operators to collaborate

- Timing of operations

Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**

10. ANNEX B: RESULTS OF THE GEAR SURVEY

Gears with the largest catch

Site Name	#	Gear name	Dimensions	Operation	Details	Operation time	Species
Ayar Taw Tender (Pyin Salu sub-township, Labutta District)	1	**Stow net for krill/Mysis** (local name: Hmyin Kyar Pike/Hmyin hpoung)	Length 13.5m, mouth width 5m, depth 4m, mesh size 0.25-inch price-0.7 lakh	15 stow net for 1 person and 3 helpers. 100-150 fishermen during big catch period.	People prepare fishing net from Aug-Sep and start fishing from Oct to mid-March. There are 3 types of krill such as pelagic krill, mid water krill and demersal krill. It can catch at different months or seasons each year.	Start fishing from Oct to mid-March and fish 20 days/month. For normal water current they use 4 ropes and 2 ropes for strong current because 2 rope can shift the stow net from right side to left in the water.	*Mysid* (Hmyin) Krill. 2000-3000 viss during big catch period from Nov-Jan)
	2	**Stow net for fish and shrimp)** (Kyar Pike)	Length 17-m, mouth width 5m, depth 4m, price 3 lakh	One boat/1 person with 2-3 stow net. Total about 15-20 fishermen including krill stow net fishers.	Shrimp is dried and sold to local market 4 viss /month. Corresponding income is 1 lakh/month. 100 viss of raw shrimp to get 0.2 viss of dried shrimp.	Fish about 15 day/month during peak tide.	Pazun Kyaung- (20000-25000 ks) Dried shrimp/ Thae Khel Pazun/Myet Pazun (Jul-Sep)/ Pel Hna Pyar- (Sep-Nov) Dried shrimp/ *Penaeus Spp: (white shrimp/*Myee Ni) (Feb-Apr)- sell as raw Kyaw War pazun- (Nov-Dec) sell as raw *Penaeus monodon (*tiger prawn) (Apr-Aug) sell as raw *Eleutheronema tetradatylum* (Nga Kyaung Tabet/Zayaw Gyi) *Signaus canaliculatus* (Nga yan shar) *Ophichthus rutidoderma (*Nga Than lone) *Mystus vittatus (*Nga Zin Yine) *Odontamblyopus rubicundus (*Nga Pyat)
	3	**Net fence** (Pike Bawoun)	Length 100-600m, depth 4m, mesh size 0.5-1", price 4 lakh	1 net/1 boat and 2 person. 12 fishermen use net fence; 2 owners have 400-600m net fence and others use only 200m fence net	People fish from Sept. to Feb. 150 viss/15 day. The big catch period is Oct-Dec.	15 days/month from Sept. to Apr. It take about 6 hours for 1 haul. Fishermen who own 400-600m of place according to space. 100m net fence owner set the net in one place.	*Mugil cephalus (*Ka Belu) *Penaeus monodon (*tiger prawn) *Penaeus spp: (white shrimp/*Myee Ni) *Paelemonids (*Pazun Uma Htoke) *Lates calcarifer (*Ka Ka Dit) *Pangasius pangasius (*Nga Dan) *Cynoglossus lingua (*Nga Khwe Shar) *Eleutheronema tetradatylum (*Nga Kyaung Tabet/Zayaw Gyi) *Johnius belangerii (*Nga poke thin) *Signaus canaliculatus* (Nga yan shar) *Platycephalus indicus (*Nga Sin Nin (Nga Yaung Ma)/ Ray (Laik kyauk)

Hlaing Tar Mezali Car Lam Myaung Wel Yar Tender Lease (Maubin District)	1	**Bush park surrounding net** (Chon Wine Pike)	Length 100m, depth 10m, mesh size 1", price 10 lakh	Total 12 person with 3 boats operate for 1 bush park in one segment. Lease area has 9 segments	Fishermen set the brush park into a creek to aggregate fish and feed them from Sep to Nov. Then they start harvesting from Jan. to mid-March. They sell products to local vendor and Yangon fish market.	6 times/month between Jan. and mid-March (operation during slow water current period).	*Trichogaster pectoralis (snake skin gourami,* Salavia, Japan ngar, Be lar)- 1800 kyat/viss (salted & dried) *Channa striata (*Nga yant) *Clarias batrachus (*Nga khu) *Anabas testudineus (*Nga pyay ma) *Channa punctata (*Nga panaw)
	2	**Surrounding net** (Wine pike)	Length 80-100m, depth 9m, mesh size 0.5", price 20 lakh	There are 8 place to operate surrounding nets in the tender area. When fishing they use 4 boat/15 person. About 60 fishermen use this gear in the lease area.	Sell products to Yangon fish market	Fish remain in the fence after brush park is surrounded by the net. Then fishermen use surrounding net with small mesh size.	*Puntius sophore (*Nga khone ma) (40%-50%) *Amblypharyngodon mola* (Nga bel phyu) (14%) *Mystus vitatus* (Nga zin yine) (40%)
	3	**Stow net** (Kyar pike)	Length 10-100m, depth 12.5m, price 15 lakh	3 stow net areas in a lease operated by 2 boats/4 persons.	Sell the products to local vendor and Yangon fish market	Harvest 5-6 times/day in Sept.-Oct., during strong water current period	*Snake skin Gourami* (Salavia, Japan ngar, Be lar)-1800/ (Salted & Dried) *Channa striata* (Nga yant) *Puntius sophore* (Nga khone ma) *Mystus vitatus* (Nga zin yine) *Macrognathus zebrinus* (Nga mwe htoe)
Pathwel Ahtet Ma Kun Lease (Pantanaw Township, Maubin District)	1	**Bush park surrounding net** (Chon Wine Pike)	Length 100-120m, depth 10m, mesh size 1", price 10 lakh	About 4 boat and 15 persons for fishing and 25-30 person to remove bushes	In Sept.-Nov., people set bush park in the water, about 100x120 m long, to aggregate fish and feed them. Sell fish products to local market and Yangon fish market. Catch 40-50 viss for 1 bush park	Harvest about 5-6 brush parks 100 mx120 m / month	*Notopterus notopterus* (Nga fel) 50% *Labeo rohita (*Nga myint chinn) 20% *Ompok bimaculatus* (Nga nu than) *Osteobrama belangeri* (Nga fel aune) *Channa striata* (Nga yant) *Trichogaster pectoralis (*Nga phyin tha let, Snake skin Gourami, Japan ngar, Be lar) *Wallago attu (*Nga bet) *Mystus vitatus* (Nga zin yine) *Puntius sophore* (Nga khone ma) *Clarias batrachus* (Nga khu) *Amblypharyngodon mola (*Nga bel phyu) *Xenentodon cancila (*Nga paung yoe)
	2	**Surrounding net** (Wine pike)	Length 140-150m, depth 5-15m, mesh size 0.5", price 25 lakh	12-13 laborers operate in one segment. Labor fee is 5000 MMK/day	People use surrounding net only about 15 days before harvest in bush area.	Surrounding net used 15 days in December. About 1:30-2:00 hours for 1 haul, depending on catch.	*Mystus vitatus* (Nga zin yine) *Puntius sophore* (Nga khone ma) *Xenentodon cancila (*Nga phaung yoe) *Parambassis ranga (*Nga zin zat) *Ompok bimaculatus* (Nga nu than)
	3	-	-	-	-	-	-

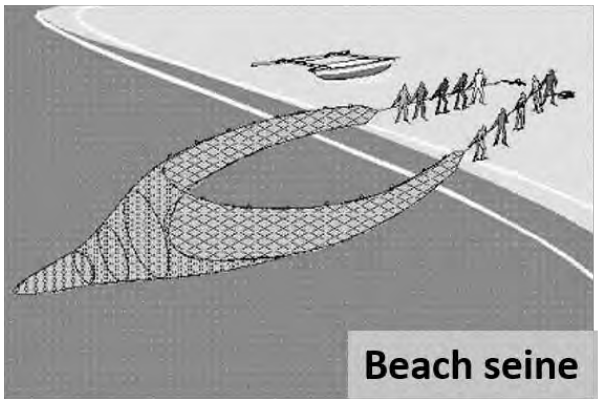
Yinn Sel lease (Thar Paung Township, Pathein District)	1	**Surrounding net** (Wine pike gyi)	Length 320m, depth 5m, mesh size 1"-1.5", price 6-10 lakh	2-3 boats/10 person per fishing	In October they may block outlet of lease area. Start fishing from Nov. to Apr. and big catch in January.	2-3 time/day and about 30 minutes/time.	*Wallago attu* (Nga bet) *Osteobrama belangeri* (Nga fel aune) *Ompok bimaculatus* (Nga nu than) *Hemibagrus microphthalmus* (Nga eik) *Mystus vitatus* (Nga zin yine)
	2	**Seine Net** (Swel pike, chae to pike)	Length 12-15m, depth 5m, mesh size 0.8", price 6-10 lakh	operated by 1boat/4person	Sell to local vendor	2-3 day catch for 1 place in lease area.	*Osteobrama belangeri* (Nga fel aune) *Mystus vitatus* (Nga zin yine)
	3	**Cast net** (Le pyit kon)	Length 4.5m, mouth 9m mesh size-0.5" / price - 50000-6000 MMK	1 boat/2 person. IN total about 50 persons use cast net	People can fish freely in lease area. Owner pays 500 MMK/viss to the fishermen	Depending on the catch 25 days/month fish in lease area from Nov to Feb.	*Wallago attu* (Nga bet) *Osteobrama belangeri* (Nga fel aune)
Khay Nan Lease (Thar Paung Township, Pathein District)	1	**Surrounding net** (Wine pike)	Length 12-15m, depth 7.5m, mesh size 1.5", price 1 lakh	2 boats/20 persons per surrounding net. Workers paid 3000-5000 MMK for daily labor.	Fishing in creeks and canals when water level starts decreasing; local vendors come and wait for fish products.	1 time/day and 3 times/month for one area. From Jan. to Apr.	*Wallago attu* (Nga bet) *Osteobrama belangeri* (Nga fel aune) *Channa striata* (Nga yant) *Ompok bimaculatus* (Nga nu than) *Puntius sophore* (Nga khone ma) *Clarias batrachus* (Nga khu) *Catla catla* (Nga gaung pwa)
	2	**Surrounding net** (Wine pike)	Length 12-15m, depth 5m, mesh size 0.75", price 0.7 lakh	1 boat/2 person in one segment	People use surrounding nets at low water level after evaporation in the block.	2-3 day harvest for one place. Start form Jan-Apr	*Puntius sophore* (Nga khone ma) *Pseudeutropius atherinoides* (Nga than chaik)
	3	**Pumping** (harvesting by pumping dry)	Price 5 lakh pipe+ machine	2 persona to operate the pump and 10 persons to pick fish up. 1 person costs 3500-5000 MMK/day	Local vendors buy fish products and spend 0.6 lakh to pump one block in creek	It take 10 to15 days to harvest one black, depending on place.	*Puntius sophore* (Nga khone ma) *Macrognathus zebrinus* (Nga mwe htoe) *Pseudeutropius atherinoides* (Nga than chaik)

Gears used by most people

Site Name	#	Gear Name	Dimensions	Operation	Details	Operation time	Production	Species
Ayar Taw Tender (Pyin Salu sub-township)	1	**Crab Trap** (local name- Ganan paing)	Length 18", depth 5", mesh size 0.5", price 500 MMK for 1 trap	About 50 persons use crab traps. About 20 person use 100-150 traps with boat and others use 50 traps without boat.	During waning gibbous moon people catch crabs with full of eggs. In Dec-Jan, they get 15000 -20000 MMK income by using 50 traps. Under 80g, value is 1500MMK-2000 MMK/viss. 1 male special size 320g: 1500 MMK	about 20 days/month annually		*Scylla serrata* (mud crab)
	2	**Long line** (Nga dan/ Nga Kyaung Tabet/Zayaw Gyi / Nga Myar Tann)	Length 200m, 100 hooks used, hook size no.6	1 boat/1 person install 1 hook every meter. 20 fishermen use long lines	People sell their products to local market and vendors. Big catch period in Aug.-Nov. and Feb. –Mar.	15 days/month especially in slow water current. Use different type of bait such as salted meat (Feb-Mar) and fruit (Aug-Nov).		*Pangasius pangasius (*Nga Dan)-30000/- (above 3 viss) *Eleutheronema tetradatylum (Nga Kyaung Tabet/Zayaw Gyi)* 5000/viss
	3	-	-	-	-	-	-	-
Hlaing Tar Melzali Car Lam Myaung Wel Yar Tender Lease (Maubin District)	1	**Set gill net** (Tar Pike)	Length 40m, depth 3", mesh size 2"1.5", price 10000 MMK	1 net /person; in total 60 persons	Sell to local vendor	Set the net at the evening and harvest in the morning; 14 days/month		*Mystus vitatus (*Nga zin yine) *Puntius sophore (*Nga khone ma)
	2	**Cast net** (Le pyit kon)	Length 4.5m, mouth 9m, mesh size 0.5", price 50000 MMK	1 cast net/person; in total 16 person	Sell to local vendor	Depending on catch. Fishing from Dec to Apr		*Puntius sophore* (Nga khone ma) *Mystus vitatus* (Nga zin yine) *Amblypharyngodon mola (*Nga bel phyu)
	3	**Trap (*Mystus vitatus* trap)** (Nga zin yine myone)	Length 0.5m, price 1500 MMK	25-40 traps/ person. In total 24 persons	Sell to local vendor	Start from Mar to Apr. Set the traps at the evening and harvest in the morning.	3-10 viss/ day	*Mystus vitatus* (Nga zin yine) -1200-1500 ks/viss

Pathwel Ahtet Ma Kun Lease (Pantanaw Township, Maubin District)	1	**Drift net 1 layer** (Hmyaw pike, hlwer chinn pike)	Length 140-160m, mouth 6-6.5m, mesh size 0.5"-1.5"	About500 fishermen around of lease area use drift net	Sell to local vendor and Pantanaw Township	Depending on catch they fish every day in Sep-Oct		*Osteobrama belangeri (*Nga fel aune) *Notopterus notopterus* (Nga fel)
	2	**Set gill net** (Tar Pike)	Length 40m, depth 3m, mesh size 2"1.5", price 10000 MMK	About 30 fishermen use set gill net	Sell to local vendor	14 days/month. Net set in the evening and harvested in the morning. Fishing from Dec. to April		*Osteobrama belangeri* (Nga fel aune) *Clarias batrachus* (Nga khu) *Puntius sophore* (Nga khone ma) *Macrognathus zebrinus* (Nga mwe htoe) *Xenentodon cancila* (Nga paung yoe)
	3	**Trap for all species (**Balalar myone)	Length 0.5m, mouth 1m	1boat / person use 25-50 traps in total 30 person	Sell to local vendor and Pantanaw township	1 time/day during 20 days/ months. From Aug-Apr.		*Anabas testudineus (*Nga pyay ma) *Channa striata (*Nga yant) *Clarias batrachus* (Nga khu) *Trichogaster pectoralis* (Snake skin gourami ,Be lar, salavia, japan ngar) *Channa punctate* (Nga panaw) *Monopterus albus* (Nga shint)
Yinn Sel lease (Thar Paung Township, Pathein District)	1	**Set net** (Tar Pike)	Length 20m, depth 1.5m, mesh size 2.5", price 3000 MMK	1boat/person per set net. In total 60 person	People make salted fish and sell to local market. Large catch period: 3-5 viss; small catch period 0.5-1 viss	20 days/month during 2 months/year. Net set in the evening and harvested in the morning.		*Osteobrama belangeri* (Nga fel aune) *Hemibagrus microphthalmus (*Nga eik) *Wallago attu (*Nga bet)
	2	**Trap for fish (**Thai myone	Length 0.6m, mouth 1.5m, price-5000-6000 MMK	20 fishermen use this fish trap	Sell to local vendor	20 days/month. Set in the evening and harvested in the morning. From Aug. to Sept.		*Osteobrama belangeri* (Nga fel aune) *Mystus vitatus* (Nga zin yine) *Hemibagrus microphthalmus* (Nga eik) *Ompok bimaculatus (*Nga nu than)
	3	**Long line** (Nga Myar Tann)	Length 250m, price 1500 MMK, hook No 8-9-10	50-100 hooks/person. In total 20-30 persons use long line	Sell to local vendor	Fish in the night time and harvest every 3hr.	0.5-1.5 viss/day	*Hemibagrus microphthalmus* (Nga eik) *Ompok bimaculatus* (Nga nu than)
Khay Nan Lease (Thar Paung Township, Pathein District)	1	**Set Gill net** (Tar Pike)	Length 40m, depth 3m, mesh size 1.5-2", price 10000 MMK	30 fishermen use set gill net	Sell at villages	Fish in the night time in Jan-Feb and stop fishing in May-Jun because no water in field areas		*Catla catla* (Nga gaung pwa) *Wallago attu* (Nga bet) *Osteobrama belangeri* (Nga fel aune) *Puntius sophore* (Nga khone ma)
	2	**Cast net** (Le pyit kon)	Length 4.5m, mouth 9m, mesh size 0.5", price 50000 MMK	20-30 persons use cast net	Sell to local vendor	From 8am to 4pm in Jan-May		*Osteobrama belangeri* (Nga fel aune) *Wallago attu* (Nga bet) *Channa striata* (Nga yant)
	3	**Trap for shrimp (**Pazun hmyone)	Length 0.5m, mouth 0.25m, price 700-800 MMK	1boat/1 person use 30-50 traps. In total 20 persons use these traps	Sell to local vendor	Set in the creek and field and harvest twice/day.		Shrimp

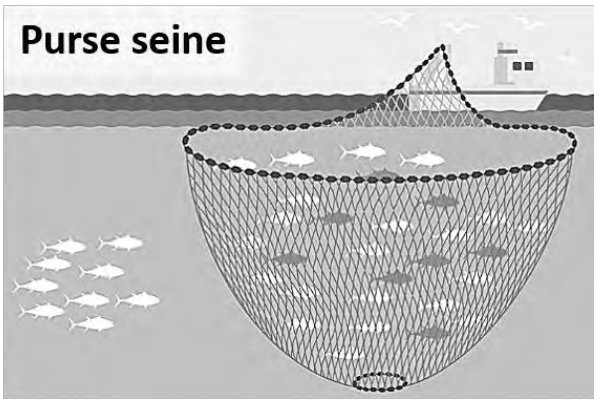
11. ANNEX C: CLARIFICATION ABOUT SEINE NETS



Thaung swae pike / Kalar pike

Pike bawon / Chone cha

Tan pike / Swae pike



Wai choat pike

12. ANNEX D: INFORMATION ABOUT UNIVERSITIES AND NAG

- The Zoology Department at Hinthada University has a large team and can involve experienced and motivated scientists.
- Zoology Department at Pathein University is very motivated but has limited resources to offer. One scientist with experience in hilsa landings monitoring. Limited experience in statistical analyses and reporting. Impossible for them to work in distant sites such as Labutta. **It is recommended that the project also contacts the Department of Marine Science at Pathein University**; the latter is more experienced in biological sampling, coastal environment and data management.
- Yangon University has solid resources, i.e. multiple experienced scientists and PhD candidates. Experience of work with fishers, of statistical analyses and reporting, of taxonomy and of supervision. They can take overall supervision in charge.
- Dagon University has a couple of scientists with the relevant experience. Limited experience in data analysis and reporting though. The staff they can involve with these scientists consists mainly of MSc students. Heavy constraints regarding examination periods (mid-September to end of November)

Discussions with NAG (including U Bobby) covered a range of different points, detailed below:

- An M&E framework is being designed for them and will be available soon. This M&E will include fishing effort, CPUE, as well as ecological information gathering such as breeding zones. The plan is to implement this framework, meant to demonstrate the performance of co-management, in two sites, still to be determined. This M&E works with villagers as surveyors, but frequency and timing are also to be determined. NAG is interested in doing M&E in more sites with WorldFish.
- Overall, NAG has 43 sites in the delta (various management regimes), but this number is changing with the return of leases to private persons. NAG has done a baseline monitoring in about 20 of these sites (baseline being different from M&E). The baseline is considered superficial, but data have been entered in Excel and are available for a number of sites, with data analysis and reporting on-going (details to be determined)

It is recommended for the MyFish project to **keep interacting closely with NAG, but not to rely on their baselines or M&E plans**, as their content and data remain much uncertain at this stage.

MYFish2 - Component 2:
Field test and adapt improved fisheries management approaches for different access arrangements in key fish-production areas of the Ayeyarwady Delta

Protocol for Socio-economic Monitoring of Myanmar Inland Fisheries in Ayeyarwady Delta

Table of content

1. BACKGROUND AND PURPOSE OF THE PROTOCOL

This monitoring protocol is developed as part of the WorldFish/DoF (ACIAR funded) project "Improving fishery management in support of better governance of Myanmar's inland and delta fisheries" (MYFish 2, 2017-2020). Building on the study on "Leasable fisheries in Myanmar: typology and management opportunities" (Khin et al. 2017), the protocol provides guidance to administer the socio-economic baseline and monitoring questionnaire (Baran et al. 2017) developed for the MYFish2 project , while acknowledging the need to corroborate it with the biological monitoring procedure being implemented in parallel.

When a socio-economic survey is conducted as part of a monitoring program, it can be used to identify trends and changes in community and household demographic and economic characteristics, resource use activities, and people's perceptions of the fisheries and community issues (Kronen et al. 2007). As such it can identify threats, problems, solutions and opportunities for better resource management and the information generated becomes the basis for an ongoing monitoring program to support adaptive management.

The purpose of this protocol is to provide Myanmar's Department of Fisheries (DoF) and relevant stakeholders with a tool to monitor the outcomes of community-management practices under different access arrangements. The protocol proposes 1) a methodology: overall approach, sampling method, and survey team formulation; 2) an analytical framework: types of responses/ data, data entry, data processing and analysis; and 3) steps to conducting a survey: planning for a survey, field data collection, processing and analysis and reporting.

2. METHODOLOGY

General methodological approach

The overall monitoring protocol of MYFish2 aims to **monitor the development of Community Fisher Groups (CFGs) and their functioning and performance from a social, economic and biological perspectives.** As such the approach will assess outcome of the management practices on **the social equity, economic productivity and biological sustainability** of the system against a set of both quantitative and qualitative indicators (Baran et al. 2017). The present socio-economic survey methodology focuses on the first two dimensions (social equity and economic productivity) of the monitoring. Some aspects of the third dimension (biological sustainability) are also covered but these lie primarily on data and information generated under the biological monitoring procedure implemented in parallel.

It is recognized that in a complex system like fisheries, self-assessment of the situation and trends by the households (HHs) is more integrative than the statistical analysis of related individual variables (Baran et al 2017). Furthermore, the perceptions of local actors are assumed to be central when determining whether to continue the community-management experience or not. While it is important to gather reliable data and information from fishers and other local stakeholders, a good trade-off should be found between large sample and reasonable costs.

The basic unit for data collection under the proposed monitoring protocol is household (HH). However, the analysis of the data and information will be made at individual selected site level and comparison among and between them for some variables shall be possible. The proposed socio-economic monitoring approach uses questionnaire as a way to generate information. It also takes a non-probability, judgmental, convenience sampling method (United Nations 2005) into consideration to

justify the cost, time availability, and also convenience on the part of the survey team to represent the target population.
The sampling methodology proposed is a random sampling as proposed by Bunce and Pomeroy (2003). Annex 1 provides an overview of the resulting distribution of the samples across the sites. The survey proposes for one-on-one individual administration of questionnaire and also probing undertaken to ensure the respondents comprehend the questions and the responses reflect true experiences and understanding of the respondents. Since the sampling size is relatively small, the analysis will not include robust statistical tests.

Each fishery site shall be considered as a unit, for which a set of population is sampled for interview. For all sites, not only the fishery size and shape differ but the number of villages and populations dependent on each lease are different. Thus, the sampling size for each site will not be the same.

The study sites

The study sites are located across the main agro-ecological system of the Ayeyarwady delta including floodplain and brackish waters in the coastal areas. They encompass a diversity of management and access types i.e. leasable, tender and open, thereby offering a broad range of perspectives on the modalities of community-management approaches in Myanmar AD. The total of 13 pilot sites are distributed across 11 townships (in 5 districts) are selected as presented in Annex 1. Preliminary visits to all the sites show two main types of configuration of the selected fishery site subject to the survey: channel (Mya Sein Kan & Akei, Hlaing Tar Mezali, Alei Met Kun, Nga Wun Taein, Yin Se, Shar Khe, Ka Ka Yo, Ah Yar Taw, Kyone Ta Dun, and Kone Myint Thaung Tan) and polygon (Inn Gyi, La Har Gyi, and Khay Nan).

Defining sampling frame and size

Data on villages for consideration to define sampling frame are received from Department of Fisheries as CFGs submitted their respective application of bidding for a lease with a list their respective CFG villages that are dependent on the lease. As a result 86 villages with 12,465 household population have been identified. With coordinates for all sites and coordinates all the villages from DoF, the data are plotted using ArcView application and then the result overlaid on a Google map. This shows that these villages tend to distribute within 1 km from the boundary of each target fishery site. All villages in the data from DoF were considered included as the sampling frame.

Considering the purpose of the survey (i.e. monitoring the outcomes of different community-management practices) and the resources available - human, financial, and time available – our methodological approach proposes to administer the questionnaire to 6% of the total household population dependent on the fisheries being studied (the population within the sampling frame). For each site, the sampling size (i.e. number of households to be surveyed for each site) will be proportional to respective population of the site, that is to say 6% of the population. Annex 1 also provides information about population sizes and target sampling size in for each site, sampling villages and HH sample size for each sampling village.

Sampling design and techniques – The sampling villages

With 86 villages it will not be practical for survey team to cover, therefore for each site a set of sampling villages is identified and selected. Based on distribution and location of villages in the sampling frame sampling villages are identified using a set of criteria as follows:

- A set of sampling villages for each site shall collectively has household population no less than 50 percent of the population for the site. This is to ensure that no less than 50 percent of households for a site shall have a chance to be selected for sampling.
- The sampling villages for a site shall be geographically fairly distributed across the site so there is no bias for or against villages situated closer or further away from the lease.
- Where more villages for a site are available to choose from to form a set of sampling villages, ones with easy access by road shall be taken. This is to reduce logistic constraint during the data collection.

The result of sampling village identification is provided in annex 1.

How to randomly select households to be surveyed?

One the sampling villages are identified and selected, households for sampling will have to be identified from within each village in the set of sampling villages for each lease site. Sampling size of these households has to be proportionate with the overall household population of the village and the sampling is not done arbitrarily but randomly.

The easiest way to this random selection is when a list of HH names can be obtained for all sampling villages in all lease sites. The list may be available with village or village tract authorities. In this case, sampling HHs can be identified and selected randomly for each sampling village before the survey team is in the field and with the assistance of villager leader appointment for interview with each HH can be made beforehand.

For each site, calculate sample size from 6% of all HHs for the site. Base on the site sample size calculate village sample size for each village in the selected set of sampling villages for that site. Once the list of HH name is secured for sampling villages of the site, enter all the names with their number (i.e. their position in the list) on a separate Excel sheet by village. An Excel function (called RANDBETWEEN) can then be used to generate random numbers for each sampling village. The households corresponding to these numbers will be the ones to be visited for interview. Note that the sampling village is the base unit for picking HH randomly.

Example:

For example: 5 HHs is calculated for a village of 60 HHs. A list of 5 HH names from the village with 60HHs will have to be picked randomly. The Excel function RANDBETWEEN (1,60) in 5 cells is used. The resulting numbers (e.g. 12, 45, 26, 7, and 56) shall be used to pick HHs for interview in the list of HH names for that sampling village, and if any of the selected HHs are not available for interview, the next ones shall be called upon.

Survey team

The survey may be conducted by a number of teams but the size of each team may only be small and that it is also able to perform several key roles in the design, implementation, and analysis of a socioeconomic survey (Kronen et al 2007; and Pinello et al 2017). Each team should include:

- A team leader/ senior team member who will supervise and facilitate overall tasks including verifying that all the needed information and materials are in place prior to the survey and during the survey and ensuring that all the questions are appropriately answered. He or she should be available to administer questionnaire also.
- Two or more assistants/enumerators who will facilitate and engage in the data collection at the field and ensure that the data and information are correctly and completely filled in the questionnaire or in the answer sheet, entered on computer and cleaned as needed.

Where available other team members may also include:

- Members to help with prior collection of relevant background information of the site, communication with the target community to inform of the survey and for appointment and logistical arrangements. Where staff limited the enumerators may share this task.
- Members responsible for data analysis and reporting. Where, specific members for this role is not available, the team leader should be trained to take this task.

Team leader and assistants shall be familiar with the objectives of the survey and their respective role in the survey. They need to be familiar with facilitation in participatory process, how to administer semi-structured questionnaire and understand the flow and relationship of the different sections of the questionnaire and the importance to probe for relevant, reliable, and accurate answers.

Collection of additional information, pilot test and training

Some background information of the participating communities will be needed and may be obtained from various sources including existing national statistics, census or project report. Such information may also be obtained with a preliminary scoping visit when direct communication with local authorities including village and/or village tract chief can be made as part of the planning process. Such information includes on villages involved in using/managing the fisheries, total number of HHs and population, number or percentage of key stakeholder groups, and ethnic groups – all are required for the purpose of planning prior to the field data collection to define respondents, and overall sample size and sample for each stakeholder group (sub-sample).

A pilot test may be done as part of the planning process to ensure that the approach and design of and questions in the questionnaire can be fine-tuned.

Two trainings may be required and can be provided separately in sequence or in one event. A training shall ensure that all survey team members are familiar with all the questions in the questionnaire and how they related to each other, how to administer the questionnaire in a socially acceptable way, how to record and probe for answers that reflect clear understanding by the respondent of the questions, and his/her experiences and the situation he/she is in. Another training may be needed to cover data entry, processing, analysis and also how to present findings.

3. ANALYTICAL FRAMEWORK

Data types

The information generated with the questionnaire is divided into 3 main parts:

a) General information on the background of respondent and his/her HH in relation to fisheries and livelihood;

b) HH information specific to fishing and other fisheries related activities; HH involvement in, production and income from, the activities; observed trend in catch; experiences in fishing with selected gears and in other fisheries related activities as well as access to fish for HH consumption; and

c) Information about CFG members and CFG management committee and specific to initiatives in management of the fisheries, arrangements for management of the CFG as an organization, and outcomes of the management.

As such not all questions may be relevant to all respondents or stakeholder groups so it is not unusual that there will be no answer to some questions for some stakeholder groups (notes provided directly on the questionnaire).

The questionnaire is also designed in a way that some questions are relevant for baseline survey only while others are also for the follow on monitoring surveys. The information from the baseline survey will provide a snapshot of each site's situation which will represents the referential status against which results from the follow on monitoring surveys can be compared. In this way, information from the following on monitoring surveys, to be conducted until 2020, will enable tracking of changes as the fisheries management for the pilot sites goes forward.

Answers to the questions may be in one or other forms as follows:

- Tick for 'Yes' or 'No' or 'Do not Know' answer;
- Tick for one or multiple answers from the list provided for specific question;
- Percentage that are add up and that are not add up to 100%;
- One or more descriptive answers.

Entry, treatment and processing of data and information

For the time the protocol is developed, there is yet a decision on specific software application is used. It is thus proposed that Microsoft Excel be used for data entry and processing. The questionnaire is proposed to be made on hard copy for the purpose of field administration. All answers in the field answer sheet shall be verified at the end of each interview.

Data entry is to be made on a preformatted Excel matrix, based on the questionnaire. The entry of data is recommended to be done at the end of each interview day by respective enumerator. Doing this will ensure that information that may not be written on the answer sheet can also be factored in when there is doubt during the data entry. Leaving it for too long before it is entered may result in the survey team forgetting or misunderstanding some answers that may not be clearly written.

In entering data and information, all answers from an answer sheet have to be transferred into an Excel matrix. This process has to be completed with one answer sheet before moving to the next one.

While answers recorded during the interview may be written as tick, number, percentage or text, all entries in the Excel matrix must be converted to number. For the purpose, a Book of Code is developed, providing code for each individual answer in number, depending on whether 'yes' 'no' answer or absolute number are available in the field answer sheet. For open questions, no coding is possible until all the responses are pooled together for each site, the answers are clustered in accordance with their logical theme, prevalent the themes are taken and coded for analysis. The Book of Code will be provided separately.

The rule for data entry is that all the acronyms used corresponding to each question in the questionnaire are listed in a single column of the data entry sheet in excel format, with all answers from each respondent/interview are written on the next single column, and thereby record for each respondent will appear in one column. A sample of data entry sheet is provided in Annex 2. Once the entry of data and information is complete it shall be checked for errors and correction made accordingly.

Analysis of data and information

Fisheries socioeconomic monitoring typically comprises hard science, but there is increasing consideration for non-expert community involvement. Statistics and numerical information presented in tables, graphs and maps usually form the basis to describe quantitative indicators and serve as key foundation of fisheries and subsequent decision making by relevant stakeholders. Quantitative data are often complemented by qualitative data to capture attributes that cannot be easily measured.

In quantitative research trend analysis is instrumental in understanding how change occurs over time against baselines, and therefore various possibilities exist to present the trends, which can easily lead to different interpretations and conclusions (Namisi and Jiribi 2013). An indicator can be absolute value, percentage, or index (of composite parameters).

Qualitative analysis, on the contrary, is the process of examining qualitative data and information to derive an explanation for a specific phenomenon. It gives an understanding of the research objective by revealing patterns and themes in the data. It involves familiarization with the local context, establish theme, coding and categorization, and interpretation.

For the current survey, the objective is clearly defined, i.e. to assess the outcomes of fisheries different community-management practices in terms of economic productivity, social equity, and biological sustainability. To do so, the analytical framework posits these outcomes as the indexes to be monitored. The latter combines qualitative and quantitative approaches to define specific thematic indicators. This way, each research questions of the survey questionnaire is flagged to a specific indicator and the longitudinal information generated over the course of the monitoring period collectively contributes to evaluate the three main indexes to be monitored. Importantly, the analysis are to be supplemented with the results of the biological monitoring implemented in parallel.

To assist in analysis the generated data, a Book of Questions is developed and provided separately. The Book proposes for 8 indicator classes that collectively will provide information to support answer to the four thematic questions/indexes of sustainability (both resources and functioning of the CFG) and social equity with sub-set of information that would contribute to a lesser extent to answering question on production of the fisheries system, for which information from biological survey will come to play.

In the Table 1 below provides an overview of the logic assumption of thematic index and indicator classes.

No	Indicator class	Thematic questions (Index)			
		Sustainability		Social equity	Economic productivity
		Resources	CFG Function		
1	Fishing, processing, aquaculture and stocking	✓			✓
2	Income			✓	✓
3	Food and nutrition			✓	
4	CFG Performance		✓		

5	Gender		✓	✓	
6	Satisfaction about CFG management			✓	
7	Benefits of CFG management	✓			

4. CONDUCTING SURVEY AND DATA ANALYSIS

Planning for a field survey

a. With information received beforehand on the number of participating villages, total number of HHs in each site the survey team calculates sample size for the survey for each site. The team should not expect that all invitees are available for interview although confirmation on their participation is made. Be prepared to turn to other relevant members of the community following 'How to randomly select households to be surveyed' as provided earlier in this document.

b. Date and specific time to administer questionnaire with each respondent have to be fixed beforehand. In some cases, alternative venue away from home or under a tree may be preferred by the respondents for the interview.

c. Appointment shall be made with follow up confirmation within one week time, giving short explanation of purpose and significance of the survey, who specifically from the HH is targeted, the date and time, expectation from the invitee in terms of what they would do during the questionnaire administration and approximate time required from him/her, the importance to be on time, and how the invitee will be compensated for participation in the survey. It may be necessary to arrange meetings with local opinion leaders to explain the purpose and process of the survey and for them to persuade invitees in their respective areas to participate in the survey (United Nations 2005).

d. Survey questionnaire has to be translated in to local language and sufficient number of hard copies is made available for use as field answer sheet on which direct recording of answer have to be made.

e. Sufficient cash in hand shall be made available to cover transportation of the survey team – where project vehicle is not available, and also for transport and participation fee for respondents in accordance with the rate provided for by the project, plus some amount for unexpected expenses.

Conducting the survey

Survey team shall arrive on time and an interview should start with the team member introducing him/herself, giving a brief background of the survey, its purpose and the time it may take, and the overall process. Inform them that the same process will be done annually and they may be called upon to participate again with all the same arrangement made.

Respondents should be asked to participate for the whole session and provide their answers to the relevant questions. The participants will be then asked if they have any question or suggestion for which quick response should be made accordingly.

As respondent gives answer, try to probe if the respondent understand the question and if the answer correctly represents what he/she means. When the interview is competed, ask if the respondent has something to add or to correct on his/her response.

Data processing and analysis

The book of questions provide for guidance how to analyze data with questions clustered by indicator class each of which would contribute to answering thematic question of the survey.

Synthesis and presentation of findings

Drawing together or synthesizing research findings is required to represent in a faithfully manner the experiences and knowledge shared by the respondents. This is the aim of the final stage of the exercise and it is where the conclusion based on information provided by respondents will be refined, summarized, and described to reflect the intent of the respondents while also meeting the survey objective. The findings can be presented to provide as a narrative, supplemented with an illustration in the form of charts, graphic, tables and with direct quotation if available. A basic content of the report is proposed as bellow:

- Introduction
- Data analysis and interpretation
- Socio-economic characteristics
    - Demography
    - Housing and other assets
- Fisheries related livelihood activities
    - Fishing: selected main gears used, catch, seasonality
    - Fish processing: most common species and type of processing
    - Aquaculture: source of seed, stocked species, feeding practices and feed types
    - Fish trading: species sold fresh, amount sole and seasonality
- Sources of fisheries resources consumed
    - Type of products
    - Amount by product type
    - Seasonality
    - Fish consumption, nutrition and food security concerns
- Access to fishing and fisheries related livelihoods
    - Access to fishing
    - Access to other productive resources and commodities
    - Control of access
- CFG as a fisheries resource management organization
    - The CFG identify
    - Management structure
    - Internal rule and regulation
    - Planning and decision making
    - Gender and woman roles
    - Consultation and engagement of others
- CFG management of fisheries resources

    - Type of fisheries under its management and area
    - Segmentation of the fisheries area and establishment of boundary
    - Designation of non-fishing zones
    - Available management/action plan
    - CFG financing
    - Awareness raising
    - Patrolling
- Conclusions and recommendations

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Annex 1. List of sites, Population and sampling size

Fishery site	Surrounding villages	Total population (people)	Total population (HHs)	HH samples and Sampling villages
Akhae Choung Wa Aukpaing Hma Mya Sein Kan Hti Thaung	Yadanar Thaung Tan	250	65	
	Thar Yar Chaung	225	60	
Hlaing Tar Mel Zali Tender	Let Pan Kone	1,545	309	
	Zee Kone	1,540	308	
	Ah Date	1,504	300	
	Pa Pin	754	105	
	Pa Laung	1,395	279	
	Kha Naung Gyi	1,400	278	
	Ah Lan Oke	1,728	345	
	Kun Dai Lay	1,971	395	
	Phoe Yar Wei	2,380	476	
	Hlaing Tar	2,445	489	
Ma Let To o Alel Met Kun Leasable	Ta Ma Lo	1,104	220	
	Tha Yet Ngu	1,150	230	
	Ma Let To	980	136	
	Ta Put Ta Naung Gyi	1,855	371	
	Pa Yaite	400	70	
	Kwye Khon Ywar Thit	201	40	
Inn Gyi leasable	Inn Gyi	733	180	
	Bamaw Taung Su	646	170	
	Se Inn	274	73	
	Ka Nyin Chaung	220	60	
	Kyaung Kone	350	89	
	Kwet Thit (1)	276	76	
	Kwet Thit (2)	287	68	
Nga Wun Taein Leasable	Pauk Taw	431	137	
	Pauk Kone	389	97	
Yin Se Leasable	Yin Se	2,325	501	
	Yoe Gyi	527	133	
	Ywa Thit	194	44	
	Kayin Su	165	39	
	Auk Su	653	152	
	Hlay Swae			
	Hnan Kone			
	Ai Zauk			
	Kalayoe			
	Ahle Kyun			
Shar Khe Inn	Shar Khe	909	266	
	Kyaung Su	927	220	
	Tha Pyay Ngu	900	200	
	Ywa Thar Aye	650	87	
	Hnae Bo Kyow	550	95	
	Kwan Chan Su	350	50	
	Pa Lin	1,135	277	
	Kwin Pauk	223	52	
	Kwin Ma	430	116	
	Myo Kone	367	103	
	Inn Phyar			
Ka ka Go Tender	Ka Ka Go	478	110	
	Wei Dauk	271	56	
	Sar Check	1,027	200	
Ah Yar Taw Tender	Ayar Taw	1,282	346	
	Kan Chaung	302	52	
	Nyaung Kone	176	48	
	Aung Tha Byay	302	91	
	Nauk Phay Kone	164	48	
	Ye Twin Seik	518	134	
La Har Gyi Leasable	Ye Twin Kone	1,486	296	
	Hlay Seik	513	145	
	Hle Seik	655	159	
	Kinmon Chaung	629	157	
	Yekyi	1,051	247	
	Ahnyar Su	340	105	
	Khin Matut	380	91	
Kyon Ta Dun Leasable	Kyone Ta Dun	555	138	
	Byant Gyi	481	107	
	Htan Ta Bin	517	148	
	Nhga Pyaw Taw Chaung	162	40	
	Thu Bain Da			
Khay Nan Leasable	Khay Nan	1,699	416	
	Shwe Hlay Kwin	232	67	
	Gyogone	414	100	
	Khway Koke	1,114	297	
	Maung Hnama Kone	84	16	
	Wun Lo Gal	377	77	
	Ga Mone Chaw	390	100	
Myin Ka Kone Myint Thaung Tan	Myin La Kone	1,308	225	
	Pan Hmauk Khone	167	26	
	Ein Yar Chaung	242	56	
	Daung Ye Kyaw	700	142	
	Linn Swei Lay	242	33	
	Gon Nyin Tann	690	156	
	Pan Saine Kone	142	20	
	Kyon Lata	193	96	
	Pike Check	96	18	
	Nat Mu	567	141	

	TOTAL	56,684	12,465	

Annex 2. Sample of data entry sheet

Suggested data entry template			
	Individual record	Individual record	Individual record
1. Enumerator name:	John	Marie	Mike
2. Response number:	1	5	3
3. Date of interview **(1.1)**	7.11.2018	10.11.2018	8.11.2018
4.a HHHeadName (1.2)	Myat Noe	Victoria	Sai Hein
4.b HHHeadTel (1.2)	(91) 435-6752	(90) 953-4762	
5. ResName **(1.3)**	Aung Zuy		Oon Keow
6. VillName **(1.4)**	Zee Kone	Lat Pan	Kone Din
7. VillTrackName **(1.5)**	Malato	Zanawa	Tapunaung
8. Township **(1.6)**	Maubin	Pantanaw	Pathein
9. District **(1.7)**	Maubin	Maubin	Patehin
10. State/Region **(1.8)**	Ayeyarwardy	Ayeyarwardy	Ayeyarwardy
11. Yrvill **(2.1)**	4	3	7
12. YrFish **(2.2)**	3	3	5
13. HHsize **(3.1)**	5	4	6
14. HHmale **(3.2)**	2	1	3
15. HHFemale **(3.3)**	3	3	2
16. HHHead **(3.4)**	1	1	2
17. Ethnicity **(3.5)**	1	2	3
18. #Child **(3.6)**	3	3	4
19. #ChildInSchool **(3.7)**	2	1	2
20. Source$ a. ____ **(4.1)**	Fishing	Fishing	Fishing
b. ____	Rice farming		Rice farming
c. ____	Fish trading	Fish trading	
d. ____	Fish processing	Fish processing	Fish processing
e. ____		Selling labour	Selling labour
f. ____			Fish farming
%bySource$ a. %____ **(4.2)**	20	30	35
b. %____	15	0	40
c. %____	30	15	0
d. %____	35	20	10
e. %____	0	35	5
f. %____	0	0	10
22. HouseMat **(5.1)**	1	2	4
23. HhinFishFull **(6.1)**	2	2	3
24. HhinFishPart **(6.2)**	1	2	2

Characterisation of fisheries management systems in AD and CDZ

MYFISH 2

Case Study 1
Report

Table of Contents

Tables and Figures

Abbreviation

AD	Ayeyarwady Delta
CDZ	Central Dry Zone
CSO	Civil Society Organization
DoF	Department of Fisheries
FAD	
FAO	Food and Agriculture Organization
FDA	Fishery Development Association
FG	Fishers' Group
FGD	Focus Group Discussion
HH	Household
KII	Key Informant Interview
LIFT	Livelihood and Food Security Fund
NAG	Network Activities Group
NGO	Non-governmental Organization
PDAM	Participatory Diagnosis Adaptive Management
RAAIS	Rapid Appraisal of Agricultural Innovation System
RDD	
USD	United State Dollar
WF	WorldFish

Note: Exchange rate: 1 USD = 1,346 Myanmar Kyat

1. Objective of the study

The aim of this case study is to generate an "in-depth" understanding of the fishers' group fisheries management system in Maubin, with a focus on identifying major issues and potential entry points for addressing these. Hence the specific objectives are as follows:

- Assess the performance of the fishers' group fisheries management systems based on agro-ecological, social, and institutional environments in Ta Ma Lo, Maubin; and
- Identify key issues and opportunities for interventions to improve the performance of this fisheries management system.

2. Methodology

This case study documented the fishers' group fisheries management systems based on its current performance, strengths/merits, and weaknesses/constraints using both quantitative and qualitative indicators. The final output was the identification of entry points both at the local and higher level for sustainable capture fisheries in the area. The first case study selected was Ta Ma Lo Village, Maubin Township. This site previously was under an individual lease management system, which was converted into a fishers' group management system in 2017, after the fishers organized and lobbied with the government to pay and allow the use and management of the lease. The information and data used in the analysis were from both primary and secondary data sources.

Review of Secondary data

A matrix was developed to compile existing information about the site, fisheries, and type of management in the target area. The information gathered to complete the matrix were sourced from FAO assessment, MYFish 1 fishery survey, MYFish 2 Component 2, and other available information from DoF at District, Township and Region level.

The Analytical Framework

The approach for the case study characterization process was adopted from the tool Rapid Appraisal of Agricultural Innovation Systems (RAAIS). RAAIS is a diagnostic tool originally developed for the agricultural sector that allowed for analysis of issues ranging from broad entry themes to more specific entry points for productivity, natural resource management, social development, and institutional innovation. The RAAIS tools were combined with another theoretical framework tailored to the identification of fisheries management issues-the Participatory Diagnosis Adaptive Management (PDAM). The two frameworks were combined, adopted, and graphed into the radar issues of PDAM as the four analytical dimensions based on RAIIS results. The four dimensions are as follows:

Assessment Dimensions	Indicators
People & livelihoods	Living conditions; diversification/income dependence; assets and income poverty
Natural system	Biodiversity; stock status and trends; fishing practices; aquatic ecosystem conditions
Institutions & governance	Fishing and development policies; organizational and institutional capabilities; access to markets and financial services; collective action abilities; governance performance and rights; legal frameworks
External drivers	Infrastructure development; conflicts with other sectors or users

Definition of the four Dimensions[1]

People & Livelihoods - this is the socio-economic aspect of the fishing communities and it encompasses household well-being, which includes household income, diversification of household livelihoods, household fish consumption, living conditions, norms and culture, and household assets. It also can include conflict with other users and resource use

1 Definition was taken from the MYFish2 - Characterization Component 2

Natural system – a biological classification of yield, biodiversity, and sustainability of the fisheries resources and ecosystem, its stock status and trends (total catch, total catch by species, fishing effort, catch by unit effort, and number of species), fishing practices, and aquatic ecosystem condition, such as connectivity, breeding ground, pollution from upstream, agriculture, industry.

Institutions & governance – the manner in which power is executed in the management of the fisheries sector. It is the enabling environment aspect in governing fisheries management in order to reach maximum sustainability (legitimacy, membership rules, access rights, management controls, representation rules, sanctions, enabling legislation/policies/legal framework, local support, financial management and services, access to market, organizational and institutional capabilities.

External drivers - outside influences that can impact the fisheries resources and its ecosystem. Various external factors can impact the ability of the fisheries to achieve its maximum productivity/biodiversity and sustainability. These external factors include infrastructure development, macroeconomic instability, climate change and environmental uncertainty, migration, market demand changes, price fluctuation, land use changes, migration.

RAAIS as a participatory diagnostic tool combines multiple methods of data collection, building on existing experiences with rapid appraisal approaches and (participatory) innovation systems analysis. The methods for the RAAIS shall generate both qualitative and quantitative data; facilitate 'insider' and 'outsider' analysis; targets different stakeholder groups across different levels with individual, group, and multi-stakeholder perceptions on weaknesses/constraints and solutions; and provide sufficient detail on the main weaknesses/constraints under review, the capacity for innovation in the fisheries management system and the functioning of the fishery management system. On the other hand, the innovated framework will be used also to identify the performance, and strength/ merits (what has worked) of the management systems under review.

Methodological steps

Based on RAAIS tool, the following steps were taken to assess the existing fisheries management systems based on the context of each site: (i) identifying strengths/merits, and weaknesses/constraints; (ii) categorising strengths/merits, and weaknesses/constraints; and (iii) exploring specific and generic entry points for recommendations for the current fisheries management system to achieve equitable and sustainable fisheries. The objectives, sessions and activities of each stage are presented in detail in Annex 1. The steps were conducted in the selected site to gather a broad range of information from relevant stakeholders and articulate a participatory assessment of existing fisheries management systems. These methodological steps are shown below:

Multi-stakeholder workshops focus mainly on insider analyses of the current fisheries management system and conditions of the system. Four groups of stakeholders identified, categorised and analysed strength/merits, weaknesses/constraints, and performance of the existing management system to provide specific and general entry themes for innovation in the fishery management system.

The DoF and WF in Myanmar led the selection and organisation of stakeholders who participated in the multi-stakeholder workshop. A total of 25 participants, including 5 women, attended the multi-stakeholder workshop activity. Figure 1 shows the percentage of participants in the four stakeholder groups. The Fisher Group had the highest rate of participation, at 30% of total participants.

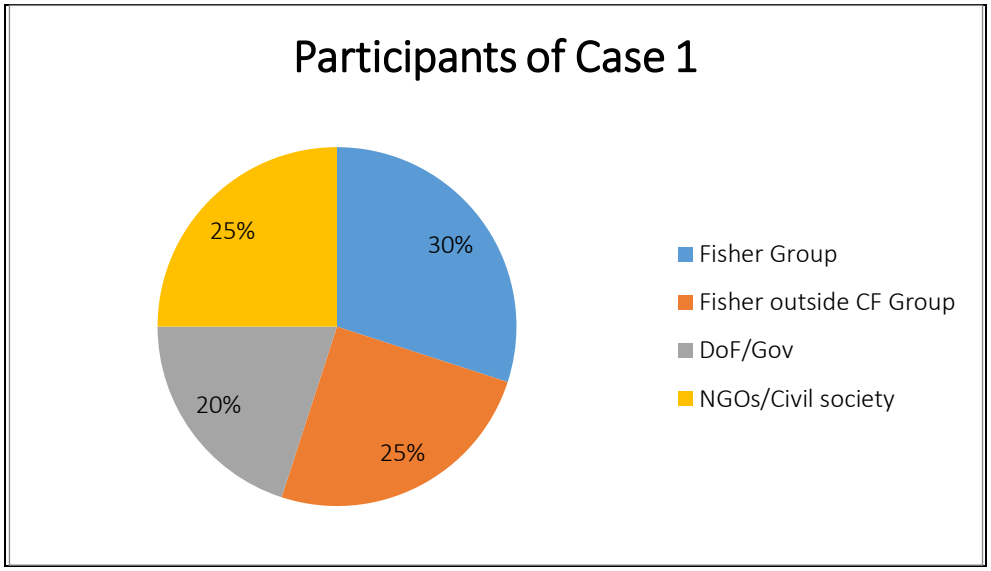


Figure 1. Participants of Multi-stakeholders Workshop in Maubin Township

Key Informant Interviews were facilitated through one-on-one conversation between WF/DoF team members and a key informant. Five key informants were interviewed, including a DoF district-level staff member, the village chief, a woman from a female-headed household, the head of a women's association, and a business holder/nursery operator, who was previously a fisherman. The KII was used to gain extra in-depth information based on what was gathered during the multi-stakeholders workshop, to validate secondary information, and to understand the perspective of relevant individual respondents on the existing fisheries management system in the area.

Focus Group Discussions were facilitated with representatives of the fisher group leaders, non-fisher group members, fisher group members, and the private sector (represented by small scale aquaculture and traders). A total of 16 participants, including 3 women, attended the focus group discussion. The FGDs were used to collect more in-depth information related to what was gathered during the multi-stakeholders workshop and to understand the perspectives of and dynamics between different groups under the existing fisheries management system in the area.

A total of 47 respondents participated in the information/data collection during the three days of field work (15 – 18 May 2018) at Ta Ma Lo Village, Maubin Township. The Fisher Group had the highest number of respondents participating in data collection.

Table 1. Summary of methods and sampling strategies and sample size deployed during the study

Method	Type of analysis		Stakeholders groups targeted – Sample size				
	Stakeholder-led	Researcher-led	Fisher Group	Non-FG	DoF/Government	NGOs/CSO	Private Sector
Multi-stakeholder Worksop	X		7	7	4	7	
Key informant interviews		X	1	1	2		1
Focus Group Discussion		X	12	2			3
Secondary data		X					
Total	47		20	10	6	7	4

3. Study site

3.1. Socio-economic characteristics

The Athet Mek Kun lease area consists of six villages, namely; Kha Naung Gyi- (116 fishers - 100 FG members and 16 non–FG); Alan Oak - (120 fishers - 57 FG members and 63 non-FG); Ta Ma Lo (126 Fishers - all FG members); Pa Yaik (62 Fishers - non-FG); Paya Chaung (no fishers - part-time fishers); Kwye khon Ywar Thit (no-fishers – part-time fishers). The case study was conducted at Ta Ma Lo Village with 278 households including 87 full-time fishers who were all members of the Fisher Group. In terms of livelihoods, Ta Ma Lo has 18 landowner households, 12 of whom are paddy farmers and 6 have converted their land for aquaculture. The local fish farms employ casual labour from 25 households in the village (Table 2). There is also a relatively large number of small businesses (18) operating in the village, some of which may sell inputs, (feed and supplies) for aquaculture. There has been invested heavily in aquaculture in the area around Ta Ma Lo village. Aquaculture started in this area in 1997-1998. Once that the model looked profitable, companies started grabbing land without compensation. Some companies compensated local landowners at a rate of 400,000 Kyats per acre. Other available socio-economic information is presented in the Table below.[2]

Table 2. Socio-economic characteristic of Ta Ma Lo Village

Area (km^2)	
Number of households	278 HH
Full-time Fishers	126 HH
Local aquaculture employment	25 HH
Small Businesses	18 HH
Land owning households	18 HH
Total acres of Paddy land	140
Boats with engine	120
Canoes	150
School	1 primary school

3.2. Fisheries System

3.2.1. Natural system and fishing techniques

The Athet Mek Kun Lease is located in an area with fresh water year-round. The fisheries system or lease area is a creek with a length of 2.7 miles. The lease expands into the floodplains during the wet season from July to October. There are around 308 full-time fishers in the six villages around the lease area. The closed season for fishing is during the months of May, June and July. The peak fishing season is during the months of August and September. Fishing is expanded into the floodplain during the start of the open season. Fishers are allowed to fish in the rice farms during the open season but only for two months. The most commonly used gears and corresponding license fee are; Long hook (10,000 Kyat/year); Gill net (30,000 to 40,000 Kyat/year); Traps (40,000 – 50,000 Kyat/year) and Eel trap (2,000 – 3,000 Kyat/year). In this lease, the most commonly caught fish species are; snakeskin gourami, featherback gourami, snakehead, rohu, tilapia, catla, and walking catfish. The current average catch range is around 100 – 240 viss/year/fisher (around 160 – 384 kg/year/fisher).

3.2.2. Changes in fisheries management

Before 2008, the lease was awarded to a leaseholder who would manage the area for 20 years. According to the fishers, the lease is fully controlled by the leaseholders. Fishers that are not

2 Aung Kyaw Thein, et.al., 2018, PRA – Vulnerability Study of Ayeyarwaddy Delta Fishing Communities and social protection opportunities

connected to the leaseholders or sub-leaseholders cannot fish in the area. However, in 2008 the government changed the system into an annual bidding system. After the political changes in Myanmar pushed for by the National League for Democracy (NLD) in 2012, a process of decentralisation was started. Sub-national governments were created at the State/Region level (Table 3). In 2013, the fishers got an idea to organise and collect contributions from the fisher group members to place a bid to get the lease. In 2015, an election was held and a new parliament was established. The parliament promised to change the system of bidding for the fisheries lease, giving priority to fisher organisations to bid and manage the lease. In 2016, the fishers' group finally organised and they established a committee with 11 members representing 11 villages (1 member per village). The fishers group started with 42 members and grew to more than 700 members at present. The Fishers Group asked the assistance of NGOs and DOF (Bangou/RDD/FAD/NAG/LIFT/DoF) to conduct a workshop and develop a proposal to lobby the plan of managing the lease area. In 2017, the 42 members of the fishers' group met the local authorities (village and township level DoF) and submitted their proposal. The fisher's group proposal was approved and they paid the floor price of 2,635,380 Kyat, which was then used as revenue of the DoF in 2017. The members agreed to divide the lease based on the boundary of the village and pay their share for the lease price according to its size and productivity.

Table 3. Key changes in past fisheries management systems

Year	Main event
2012	Change of political system – National League for Democracy
2013	Lease still under individual management. Fishers' got an idea to organise and join the auction
2014	National Census – Population – 51,486,253
2015	Decentralisation to Sub-national (State/Region) Government - Election of State parliament - promised to transfer management of the lease to the fisher organisations
2016	Draft of the New Fisheries Law under the State governance Community fishers organized and lobby for the management of the lease
2017	Lease was awarded to the fishers' group
2018	2nd year of fishers' group management of the lease

Since the reform of the fisheries sector in 2008, the lease was put up for auction every year. Figure 2 shows the trend of the lease price. After three years the auction price started to increase by on average 10% each year. The price of the lease in 2008 was only 1,310,000 Kyat (973 USD) but it increased to 2,899,000 Kyat (2,154 USD) in 2017 or 121% increase compared to 2008. The issue here is that while the price of the lease is increasing, resources are decreasing due to a deterioration of fish habitats in this township.

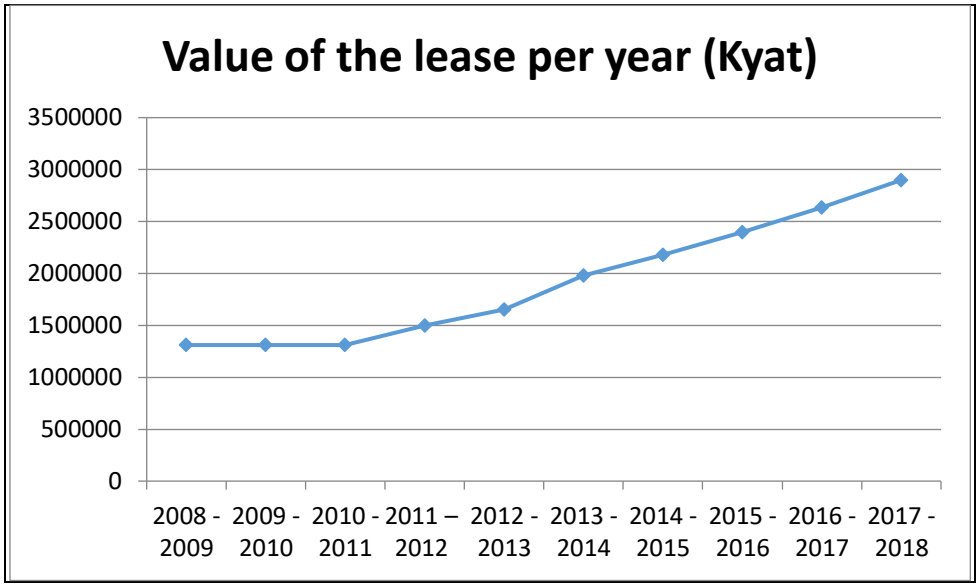


Figure 2. Evolution of the auction price of the Lease in Athet Met Kun[3]

3.2.3. Current organisation and management

After the recognition of the Fishers' Group in the Township Level, the Fishery Development Association's (FDA) Rules and Regulations was developed. The Association's Vision is "the improvement of job opportunities for small-scale workers and ensure sufficient livelihoods through sustainable economic development in Ayeyarwady Delta". The association has three objectives; (i) develop regional laws and policies around access rights and conservation of water resources of the small-scale fish workers; (ii) create job opportunities for the small-scale fishers; and (iii) improve the productivity of fishing grounds and by applying water conservation measures. The FDA has 11 committee members representing 11 villages in the Township. The village representative in the committee is the elected leader of the fishers' group at the village level. The fishers' group committee nominates and elects their chairman, vice chairman, secretary, vice secretary, and finance officer. The fishers' group has 714 members. Each member has to pay a membership fee of 2,000 Kyats (1.5 USD). Eligibility for membership is based on five criteria, namely; interest in fisheries; applicant must be at least 18 years old; application to be sent in by candidate member; endorsement from two FDA village members; and have enough money for annual and membership fees. The duties of the members are as follows; the members need to do their tasks individually or work together with the team to which they will be assigned by the committee; report on the working situation in a timely manner; and report any unusual incidents related to fishing to the committee in a timely manner. The members have the following rights; the right to attend any local and international training, workshop, and excursion trips related to fisheries; the right to obtain loans and get suggestions for their skills and business; the right to resign out of their own volition if the member no longer wishes to be involved in any activities; and equal opportunity in discussion, voting in FDA cluster meeting.

The fishers' group in each village has full control over their agreed territories. The control and monitoring of fishers and gears are very strict because every village leader has taken out a loan with high interest rates from money lenders. The group leaders need to be strict in collecting the money in order to repay their loan. Based on their experience in 2017, the fishers' group was able to generate a surplus after paying their loan to the money lender and the lease to DoF. The Fisher Group managed to control/limit illegal fishing due to the cooperation of the fishers to protect and conserve their investment and resources as their assets. If they observed fisherfolk fishing illegally, they have to report this to the DoF to take action because the fishers' group does not have the authority to

3 Source: Department of Fisheries Township

catch/chase illegal fishermen. All villagers decide on the use and management of their resources because all of them have contributed equally to the lease. All collected revenue of the Fishers' Group for the lease payment and gear fees is kept at the bank. If there is profit after a year, the fishers' group donates this money to the village to further its development (e.g. infrastructure works). The fishers' group is also planning to provide loans to their members who need support, because previously the individual leaseholder is providing loans to fishers to ensure their loyalty and to make sure they sell their catch to the leaseholder.

4. Results

4.1. Performance of the management system

4.1.1. Current performance

The overall performance of both the current and future of the fishers' group management system is presented according to the four dimensions of development affecting the fisheries system. Figure 3 shows that all stakeholders agreed that institution and governance have the best performance under the current management system in terms of average of all the factors contributing to this dimension. According to the fishers' group, the following factors, i.e. access to market, access to resources & resource sharing, enforcement of regulations, and policy and regulation development have improved after the lease was awarded to them in 2017. Under the current management system, access to financial services is the weakest point in this dimension, according to the fishers from and outside of the community, and the NGOs/CSOs. The DoF/government disagrees. They think that the CFG has enough funds available to use and provide financial support to their members, although their reach may be limited.

Figure 3. Measuring performance of the existing fisheries management system

The livelihood dimension has improved under the current fishers' group management system. The stakeholders mentioned that fishers can now sell their catch to any trader in the village at a better price compared to the previous individual management system, where fishers were forced to sell their catch to the lease or sub-lease owner. Tenure and ownership are also ensured for the fishers in each village. Communities outside the village boundary could not easily fish in areas without permission from the villagers, and thus catch has improved for the fishers within the village, resulting in increased income and food security. On the other hand, the fishers outside the fisher group disagree that food security and income have improved, because they felt that they have to pay more on their license to fish and their catch is less than before. They also mentioned that they have to pay the same amount as CFG members to pay the lease area, if they will not contribute, they will not be allowed to fish in the fishing area. Although the government agrees that income of fishers has improved because of a

free market, they still believed that food security in the village didn't improve because fish catches have declined over the past few years.

The natural system or the ecosystem has been assessed through three factors namely biodiversity, stock status, and habitat. The results of all stakeholder workshops show that, even under the current fishers' group management system, all of the factors affecting productivity and biodiversity are still in decline due to external drivers, caused by human actions and natural degradation. According to the three stakeholders groups, one of the main reasons of the ecosystem decline is due to expansion of agriculture and aquaculture in the area, resulting in the loss of fish habitat. They also mentioned pollution from agrochemicals (e.g. fertilisers and pesticides) kill fish and other aquatic animals. The river/creek water level is decreasing due to sedimentation, and the use of water for aquaculture and irrigation. The fishers outside the fisher group and the government think that the decline of biodiversity and stocks is due to overfishing and other illegal activities. The government mentioned that implementation of the law is still weak among the CFG members. According to the fishers' group, the productivity and biodiversity are still declining because they only got the lease last year (2017) and just recently established the conservation areas and managed to control illegal fishing.

The external drivers dimension had a great negative impact to the fisheries system. Illegal fishing, infrastructure development affecting the fisheries system, pollution and other activities outside the fisheries are increasing. However, according to all stakeholders, after the fisher group took over, they were able to control illegal fishing because the lease areas were divided and awarded to each village and were effectively monitored, surveilled, and controlled.

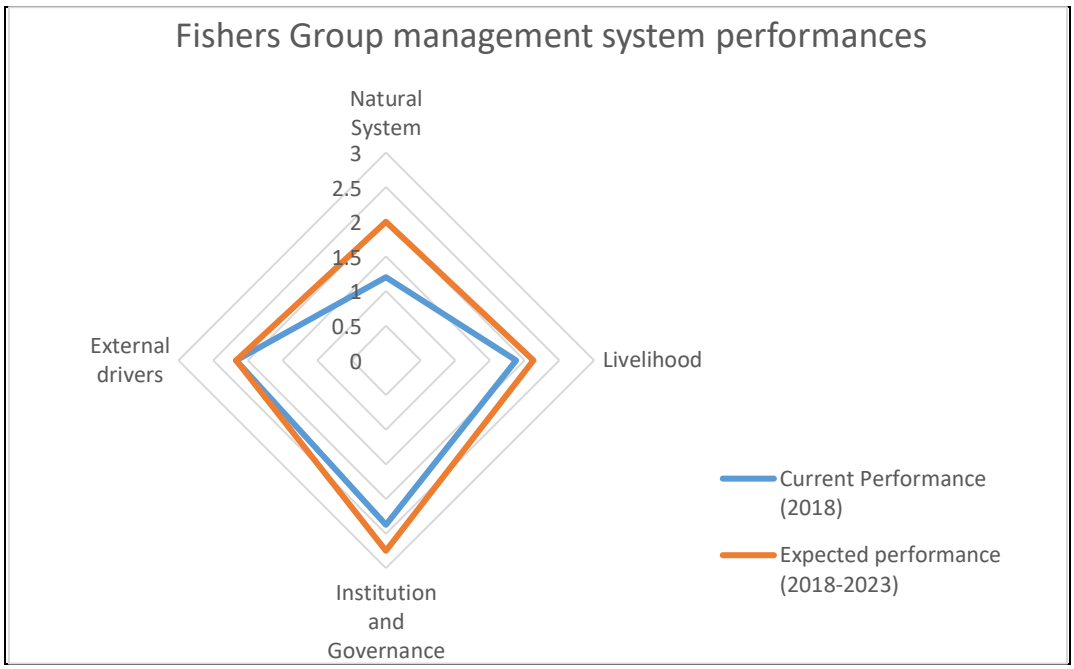


Figure 4. Past and expected performance of the fisheries management system

4.1.2. Expected performance in the next 5 years

Result of the analysis in Figure 3 shows an optimistic evolution in the performance for all four dimensions if the existing fishers' group management system will continue. Institution and governance will have the best performance, reaching a near-perfect score, according to the different stakeholders. The other three dimensions are expected to be at the medium level because of many factors that may affect and hinder achieving of a better performance in the next five years. The natural system, in particular, because of external factors such as pollution, sedimentation, encroachment, expansion of aquaculture and agriculture, and other development in the area.

4.1.3. Productivity and income

According to the fishers, their catch in the lease areas decreased compared to five years ago. Based on their experience, a fisher can currently catch 100 – 125 viss/year (160 – 200kg/year), which is around 100 kg lower than before, where one fisher could catch between 150 – 200 viss/year/fisher (240 – 320 kg/year/fisher). The current catch could be lower for fishers using traditional fishing methods or gears. According to one widow respondent, her son can only catch 2 – 7 viss/day (3.2 – 11.2 kg/day) using traditional fishing gears. One of the fishers mentioned that he could previously only earn 1,500 – 7,000 Kyat/day (around 1 – 5 USD/day) from fishing, so he had to change his source of livelihood to a convenience store, with which he can earn much more than fishing (from 8,000 to 10,000 Kyat/day or around 6 – 7.5 USD/day). The decrease in catch has been attributed to overfishing during the previous management of the lease, where there was no conservation in place and no sustainable resource management system. External factors such as a decrease in water level, diversification of water use, loss of fish habitats, and pollution were mentioned affecting the decrease in fish stocks. One of the concerns of the fishers is that the lease price will not be lower than the floor price and it may even be higher as per the declaration of the government for the next bidding period.

4.1.4. Benefit sharing and equity

The Fishers' Group felt that benefit sharing under the current management system is fair. They mentioned that under the previous lease management there were a lot of conflicts between fishermen and the owner, now conflicts have been reduced. However, some respondents mentioned that benefit sharing and equity is not yet really applied. Although they pay the same fee of 5,000 Kyat/fisher (around 4 USD/fisher) for the lease fee, their catch in the lease differs between the different gears used. According to some respondents if you have more sophisticated fishing gear then you can catch more. In terms of trading, the fishers mentioned that it improves; now they can have a better market price in the village because there are more traders to whom they can sell their catch (at least one village has 15 traders). However, the traders sometime complain that prices in the township and the region are not increasing and they may make a loss giving higher prices to the fishers. In terms of gender, benefit sharing and equity are not equal according to the women respondents. They said that only men's names are allowed in the membership lists of the Fisher Group because only men are considered fishers in the village. Women can list the name of their son to be a member of the Fisher Group. However, the female heads of household are also invited to join the meeting when there are important decisions to be made. Another important point to note in this current system is the distribution or sub-division of the lease according to the boundaries of each village. The Fisher Group agreed that only the fishers of a particular village can have access to the assigned fishing area of that village. This might have had some implications in the catch volume of each village, especially for migrating species. The villages in the mouth of the river may have higher catch compared with those in the middle and upper parts of the river.

4.1.5. Access rights

The lease area is now accessible to all fishers who pay their contribution of 5,000 Kyat (around 4 USD). According to the respondents before if the fisher wanted to have access to the fishing area, he had to pay 40,000 Kyat/year (around 30 USD). Now the current management is also flexible to the poor, they can fish and then pay their contribution later. The current issue for the fishers is accessing the floodplain during the open season when fish are in the rice fields or habitats to spawn. According to the fishers a big size of the lease area has been converted to either agriculture or aquaculture areas. The fishers complain that they cannot fish near the aquaculture ponds as they were apprehended by the guards. During the open season, fishers are only allowed to fish in the rice fields in August and September, after these months they are not allowed anymore because the area is planted with rice already. Fishers also mentioned that high dikes and fences were built to exclude fishers to fish in the farms that were previously part of the lease area.

4.1.6. Conservation

According to respondents, in the previous individual management of the lease, the main objective of the leaseholder is to get profit without thinking of the sustainability of the fisheries resources. They said that as much as possible the leaseholder wants to harvest all fish in the lease to get back his investment and high returns. He never thinks of conservation or any management system to sustain the fisheries resources. In the Fishers' Group current management system each of the six villages has established their conservation areas in cooperation with the DoF and local authorities. This conservation has minimum area of 300 sq.ft. covered with bush as fish shelter. The conservation area is a no-take zone for all fishers. Its purpose is to serve as fish habitat and spawning areas for the fish especially during the open season. Aside from the conservation area, the fishers' Group, in cooperation with the DoF, are also restocking/reseeding the lease area with fingerlings. The Fisher Group also follows the closed season regulations of the DoF. Illegal fishing activities were also effectively controlled because of the stake of the fishers in the fishing area in their village. The fishing area in the village is properly protected since the villagers don't want to lose their investment, source of food and income. However, regulations should be developed to control overfishing in the area through control of fishing efforts and type of gears restrictions.

4.1.7. Gender dimension

According to one of the female respondents, there are no women registered as members of the Fishers' Group in Kha Naung Gyi Village. The reason is they are not considered as fishers, only men are considered to be fishermen. This is also out of respect to the men as they are considered the head of the family. However, one widow, in a female-headed household, said that her name was not registered but her son's name was registered as a member of the FG in their village. The lady mentioned that women are not involved in developing the rules, because usually it is the husband who attends the meeting and participates in developing and agreeing on the rules. Women rarely attend meetings, only when the loan is taken out for the household as both the husband and the wife need to sign. In terms of benefit to women, according to the women, although they are not registered as members of the fishers' group, they still felt that they are getting benefits because they are the ones selling or processing their husband's catch. According to a married woman, she discussed with her husband what amount of their catch to sell, what quantity to process for sale or for household consumption. In practice, women are the ones who manage the household income related the family expenditure. For example, the household headed by the widow sells all the fish caught by her son and she is in control of the money. She only gives pocket money to her son, who is registered as a member of the FCG. One of the women said that as compared to the previous management system she is getting a higher income now, as she sells her fish at a fair price to any collector. She further explained that previously, they were obliged to sell to the leaseholder at a very low price. The women felt that the current management is far better than the previous management in terms of productivity, sustainability of the fisheries, and equity for everyone in the village. It is important to note here that women are involved in the whole fishing process -especially post-harvest processing and marketing of the fish.

4.2. Dimensions of Strengths/merits of the management system

Strength and merits of the current system have been gathered and analysed based on the perception of different stakeholders.

Fisher Group

The fishers' group considers the support of the government, especially from the DoF, as the main strength of their current management system. According to them, without the support of the government they will not have the chance to acquire registration of the lease because of the power

and wealth of the previous lease holders. They further explained that without the support of the government they cannot fully manage the lease, in particular controlling illegal fishing and encroachment in their respective areas. The other strengths mentioned of the fisher group are as follows;

Figure 5. Fishers' Group identifying weaknesses/constraints in their management

- Good governance in the group and lease - the rules and regulations of the group are created before acquiring the lease, indicating clear responsibilities of the members;
- Household income has increased after taking over the lease - access and exclusivity of the fishing areas for members has increased their catch and the price of fish in the village level. The fishers group mentioned that previously the price was controlled by the lease holder, now they can sell to any trader according to their own preference;
- Conservation practices to support the fisheries - each of the villages has established a conservation area in their respective fishing areas and protects the spawning grounds. They also follow the fisheries law on closed and open seasons;
- Better control of illegal fishing – illegal fishing activities have been controlled because all members of the fishers' group are involved in protecting the fishing grounds. The fishers are protecting their investment -they are making sure their source of food and income is also protected.

DoF/government authorities

The Dof/government authorities think that the strength of the current system is the potential for conservation of the fisheries resources. They said that previously the lease owner wants to harvest everything to recoup their investment and make a profit. According to them, the lease owner thinks only about what he can gain in the current season, he doesn't have a sustainable or long-term vision on the resources. The other strengths mentioned by this stakeholder were the following;

- Better control of illegal fishing – according to the government there is a sense of ownership among the fishers because of their investment for the lease. The fishers protect and guard their area and report any illegal activities to DoF and relevant authorities.
- More equity and access for fishermen – the government believes that equity and access in the respective fishing areas is working in the current management system, because the contribution for acquiring the lease is equal amongst all fishers.
- Higher income for fishermen – fisherfolk income will eventually increase because of the increased access and control of the resource and a better price in the village.
- Unity between fisher groups –the government observed that previously there were a lot of conflicts and fights among fishermen. The current system has united the fishermen and each member pays an equal contribution to get access to the lease area.

NGOs/Civil society

The NGOs/CSO perceived that the strength of the current FG management system has brought access rights and equity among the fishers, because they equally contribute for the fee of the lease. Therefore, fishers have equal fishing opportunities within their respective areas. The other strengths mentioned are the following;

- Market access has improved – increase of fish price for fishermen, because they can sell their catch to traders at a better price.
- Good conservation system with protected areas – each village has established their own conservation areas, including protected areas for fishing.
- Increase awareness and knowledge amongst the fishers - this includes the impact/damages resulting from illegal fishing activities and what the benefits of the conservation measures are;
- The fisher groups are developing their plan for community development and fisheries resources management - this includes the introduction of micro-credit to support fishermen. The fishers' group perceived that since the government recognised them as a group they can take this as an opportunity to lobby the government about their needs.

All stakeholders agreed that the main strength of the current management system is the (i) improvement of conservation because of the establishment of conservation zones in each village. The investment or contribution of the fishers in getting the lease encourages them to protect their resources. The current management has also controlled illegal fishing through increased tenure and ownership; the fishers do not want that their resources are destroyed by illegal fishers. (ii) In the new management system, all stakeholders agreed that fishers are enjoying a higher income when they manage and use the lease. (iii) The government and NGOs/CSO think that there is more equity and equal access to the resource under the current management system because of the fishers' investment in the lease (Table 4).

Table 4. Merits and strengths that are common to more than 1 stakeholder groups

Merits /Strengths	Mentioned/supported by	Description
Conservation has been improved	Fisher group, DoF/Govt, NGOs/CSOs	Conservation areas habe been established in each village and lease areas have been protected
Illegal fishing has been controlled	Fisher group, DoF/Govt, NGOs/CSOs	Almost all fishers are involved in fishing in their village. Almost all fishers contributed for the lease fee
Higher income for fishers	Fisher group, DoF/Govt, NGOs/CSOs	Fishermen can sell their products to more traders at a competitive price
There is more equity in the use and access of the fishing areas	DoF/Govt, NGOs/CSOs	The government and NGOs/CSOs think that access and utilisation are more equal at the current management system

4.3. Dimension of weaknesses/constraints of management system

Figure 6. Participants categorizing constraints in the 4 dimensions

The dimension of constraints has been determined through a consultation with four stakeholders. Each stakeholder was asked about their perceived top-five weaknesses of the current management system. The lease was awarded to the fisher group in 2017, therefore, the management of external factors affecting the lease could not be addressed under the current system. The following were the responses the fishers group gave during the consultation workshop.

Fishers' Group

The fisher groups are optimistic that the current management system is the best to manage and utilise the fisheries resources equally and to achieve maximum sustainability. The gaps or weakness in the current management system the FG mentioned are more about the external factors affecting the lease and their members. The top constraint that they are currently facing is the decreasing water level of the lease (creek). According to them high sedimentation, irrigation, waste in agriculture and aquaculture, and volume of water hyacinths are causing the decrease in water level in the creek. Other threats identified by the stakeholders are the following;

- Fish catch is decreasing in the lease area – the fishers' catch is not the same as before because fish habitats are becoming narrower due to the encroachment of aquaculture ponds and agriculture in the flooded areas;
- Pollution from agriculture – overuse of pesticides and fertilisers is polluting the water, causing a decrease in fish stocks in the lease area;
- Fish market price is low – although gate prices at the village have increased, the market price for fish is low for traders at the township and region level;
- Livelihood issues for the fisher group members – a lot of fishers are very poor and there is no support from external organizations or the government to diversify their income source compared to agriculture, which receives support from the government, NGOs, and financial institutions.

Fisher outside FG

The main constraints the fishers outside the FGs identified are the limited access to the lease area, because rice farmers are fencing off their agriculture areas. The fishers could not access the fishing grounds -by crossing the rice fields- during open season. The other constraints identified by this group are as follows.

- Limited access to financial services to purchase fishing gears and boats – The FG doesn't have access to loans they can invest in fishing gears and INGOs/NGOs cannot support fishermen to buy fishing gears because of the high price, e.g. 50,000 kyat per gear

- They do not have enough financial support to purchase a fishing license – fishers need to purchase their license for the gear they use in the lease. To have a better gear, you need to pay a higher price e.g. 100,000 Kyat for a gear license;
- Low price for fish – because the margins for traders are small, the tendency is to buy the fishers' catch at a limited price to compensate the limited potential to make a profit.
- Limited price and benefit of fisheries in markets outside the township – price is limited at the township and regional market.

Figure 7. Top five weakness/constraints categorized in the four dimensions

DoF/Government

The DoF/Government thinks that the main weakness of the current management system is the limited investment and technical capacity of the fishers' group – according to them the FG does not have the access to financial services e.g. to do small-scale aquaculture that may ease/lessen the burden on capture fisheries. The other constraints the DoF/Government observed in the current system are as follows;

- Weak law enforcement under the current management system – the government thinks that illegal fishing is still happening and the community fisheries cannot control it. They do not have the power; it depends on the DoF (which is not doing it). They said that the DoF has limited human resources to cover the entire area where illegal fishing activities take place;
- Water pollution in the lease area – factories upstream (rice mill and alcohol industry) are discharging their waste in the canals and rivers affecting fish and fish habitats;
- Limited are to establish ponds for small-scale aquaculture in the area – Lack of land and technical knowledge to expand small-scale aquaculture and to diversify their livelihoods;
- Low market price for fish and other fish products – Cannot get a high price because they sell directly to traders in the village and not higher up in the value chain. It needs to be controlled at national level to export at a better price.

NGOs/CSO

NGOs/CSO consider low access to loans/funds the main constraints of the current management system/group – based on their observation, there are no government or NGOs supporting fishers with sufficient funds to allow them to buy fishing materials to improve their catch. They further explained that there is no proper assessment of the needs of the fishers, which is why there is no appropriate financial support for them. The other constraints observed are the following;

- Access to the resources of the local community/fishers is low – some non-fishermen/non-locals were able to be part of the lease and it hinders the access to the resource for local fishers in the

area. These outsiders have more money than the local community/fishers and were usually given priority;

- Loss of leasable land – It was observed that some investors (private sector) are illegally expanding and taking land from the leasable fishing areas to convert into aquaculture or agriculture farms;
- Pollution – the external activities are increasing the pollution in the lease areas affecting both fish stocks and the habitat;
- Illegal fishing by some fishers (non-FG) and other outsiders.

The overall result of weakness/constraint of the current management system has been categorised according to the four dimensions of the Participatory Diagnosis Adaptive Management (PDAM) Framework. Figure 4 shows that the people and livelihood dimensions had the highest score amongst all dimensions of the PDAM framework. According to stakeholders the current management system is weak in its internal technical capacity and financial support because the new management system was only started a year ago. Stakeholders mentioned the lack or limited external support, both from the government and NGOs/CSOs, to the fishers group managing the system. The fishers could not diversify their livelihood or improve their fishing system because of a lack of funds. The government could not control the price of fish, which affects the income of the fishers and traders.

"Institution and governance" is the next dimension with the highest score in the PDAM framework. Stakeholders perceived that weaknesses, such as limited enforcement of policy to control or stop external drivers that affect fisheries need to be strengthened in collaboration with the fishers' group and partners. According to the fishers' group support by the DoF and other relevant government is needed to control pollution, illegal fishing, and encroachment in habitats for fish and other aquatic animals. Financial support and financial capacity are another weakness, which the stakeholders mentioned under "institution and governance". Financial institutions and government are continuously supporting the development of agriculture rather than fisheries and aquaculture. According to the stakeholders, fisheries and aquaculture don't get the same support.

External drivers, such as pollution and encroachment, have a great impact on the lease areas and especially on the sustainability of the fisheries resources. According to the stakeholders these external weaknesses such as pollution, encroachment, and expansion of aquaculture in the lease areas could not be easily controlled without a clear policy and strong enforcement from the regional government. The stakeholders mentioned that the current management does not have the mandate to confront illegal factories or agricultural operations diverting their waste or pollution to the creek or rivers. It is important to have strict regulations and policies regarding proper waste management and disposal for these sectors.

Figure 8 . Group of NGOs/CSOs mapping the constraints into the four dimensions

Less weaknesses/constraints were categorised under the dimension of natural system. Water level and declining stocks/catches have been identified as weakness of the current management by the fishers' group. It could not be the top five constraints for the other stakeholders since the assessment was more focused on the current management of the FG in the fisheries area. During the FGD and KII more issues on the natural system were shared, including sedimentation caused by agriculture and deforestation, decreasing fish catch due to overfishing and illegal fishing, losing fish habitats because of land conversions and infrastructure development.

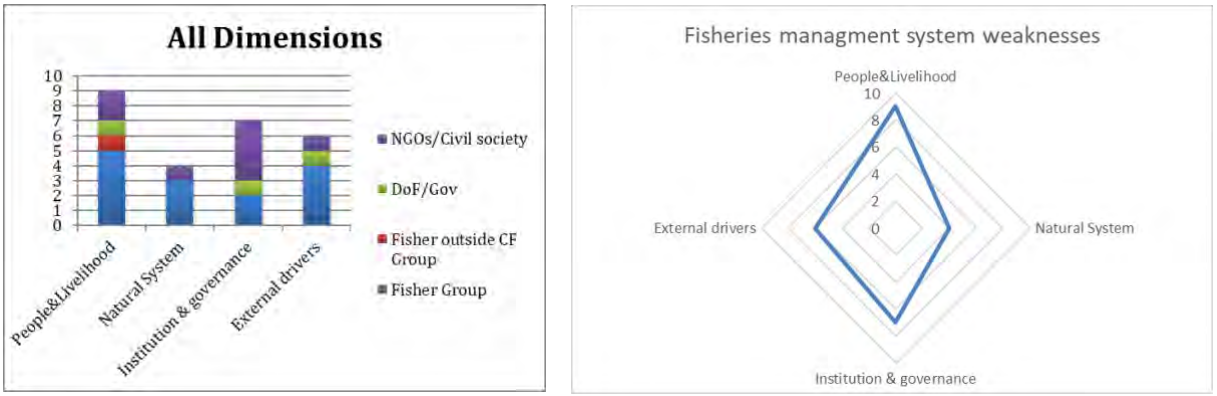


Figure 9. Weaknesses and constraints of the fisheries management system identified by stakeholder group (left) and all groups (right)

All stakeholders agreed to some common external constraints affecting the successful utilisation and management of the lease to reach maximum sustainability. They are concerned about the pollution caused agriculture and industries, affecting fish stocks. Apart from pollution, these sectors also expanding their area into leasable fishing areas, which affects the loss of the fish habitats used for spawning during the flooded season. They said that development and enforcement of policy from the state government is needed to control waste being dumped in the river and encroachment into leasable areas intended as fish habitats. Although the fishers have access to the fishing areas and fish traders can provide a higher price for their catch, the stakeholders mentioned that the price of fish is still a constraint because of the low price for fish at the township and regional level. This affects the price of fish at the village level. Finally, the stakeholders agreed that financial and technical capacity of the fishers' group needs to improve through external support, in the same way the agricultural sector is being supported by financial institutions and the government (Table 5).

Table 5. Constraints that are common to more than 1 stakeholder groups

Constraints and weaknesses	Common to Groups	Description
Impact of agriculture and industries to the lease area (e.g. pollution and conversion of lease areas)	Fishers' groups, Fishers outside FGs, DoF/Government	The excessive use of pesticides and fertilisers is affecting fish stocks. Conversion of the lease areas into agriculture and aquaculture purposes
Issue on price and market of fish	Fishers' groups, Fishers outside FGs, DoF/Government	The market price of fish in the township and region is low. This affect the fish price at the village level.
Access to financial and technical support from external institutions or government	Fishers' groups, Fishers outside FGs, DoF/Government	The current management system of the lease is new to the fishers' group, government, and NGOs/CSOs. There are no policies or regulations in place yet on how this system will be supported sustainably.

4.4. Interaction between constraints

The development and change of priority livelihood of the population, for example intensifying rice production and aquaculture will negatively affect the capture fisheries. Stakeholders mentioned

decreasing size of the lease areas, especially the flooded areas serving as habitat and spawning area for migrating fish. One of the stakeholders mentioned that he stopped fishing already for more than 7 years because of decreasing catch caused by developments such as irrigation and aquaculture. He changed his livelihood to a small-scale fish nursery business and a small convenience store with which he can earn more than what he earned when fishing. Although people prefer eating wild-caught fish over aquaculture fish, trends are changing because of limited catches and population increase. An increase in aquaculture production also affects the price of fish. The price of wild-caught fish has remained the same over time or decreased. Stakeholders mentioned the issue of price as one of the constraints they face under the current management system. The fishers are looking for external support from the government and development partners. They suppose that these institutions could help them improve their gears and catch more fish in the lease area. They expect the government to assist them through development or strengthening of policies to control external issues affecting the capture fisheries, such as agricultural and industrial waste management and limitations to encroachment by of agriculture and aquaculture in the lease areas. People mentioned that after the owners expanded their land to the lease areas, they build high dikes and fences that the fishers could fish anymore in the flooded areas during the open season for fishing. The fishers' group could not control these external factors as their mandate is limited.

Add a graph that shows the interaction/linkages between constraints. It will help to identify key patterns and interaction between constraints that jeopardize this type of management
See example below:

Figure 7. Causal loop diagram of connections among underlying causes of systemic problems hindering effective functioning of the New Zealand Agricultural Innovation System. + or – on the arrow shows if the influence from one variable to the next is in the same (+) or opposite (-) direction, e.g. when the share of firms that are SMEs increases then firm's resourcing of functions decreases (-) and when firm's resourcing of functions decreases the number of firms undertaking the functions decreases (+).

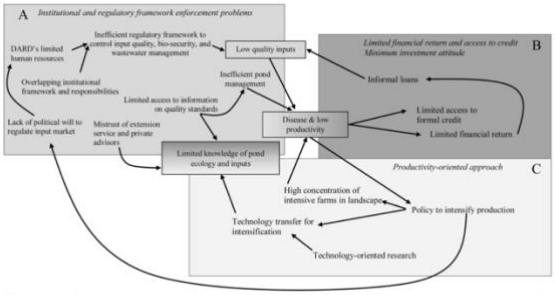


Fig. 3 Connections among constraints that hinder sustainable intensification in shrimp farming in the Mekong Delta, Vietnam. **a**, **b**, and **c** Represent the three blocking mechanisms that hinder sustainable intensification. Arrows represent connections between constraints within the blocking mechanisms and connections between the three blocking mechanisms

4.5. Entry points for improvement of the management system

Figure 10. Constraints at different administrative levels

Most of the stakeholders thought that the identified constraints can only be solved in collaboration with other stakeholder groups (Figure 5). (i) The fishers group mentioned that they can help to increase fish stocks through conservation activities. However, regarding the decreasing water level, pollution from agriculture, low market prices and livelihood diversification; they would need support from other stakeholders, especially the government and development partners. (ii) The fishers outside FGs thought that they can help solve the market price issues by investing in better gears to catch higher quality fish, which has a higher market price. They acknowledged that fencing off rice farms and access to financial services could be solved through support from other stakeholders such as the DoF and NGOs/INGOs. (iii) The DoF/Government group believed that almost all the constraints they mentioned can be solved through collaboration efforts with all stakeholders including the fishers. Except for law enforcement because of mandates and more resources needed to enforce it. (iv) NGOs/CSOs believed that most of the constraints they mentioned (e.g. access to loan, decreasing leasable area, pollution) can only be solved with the support of other stakeholders. Access to the resources and illegal fishing can be solved at the local level as under the current management system it was observed that illegal fishing is decreasing and resources are becoming more accessible to fishers.

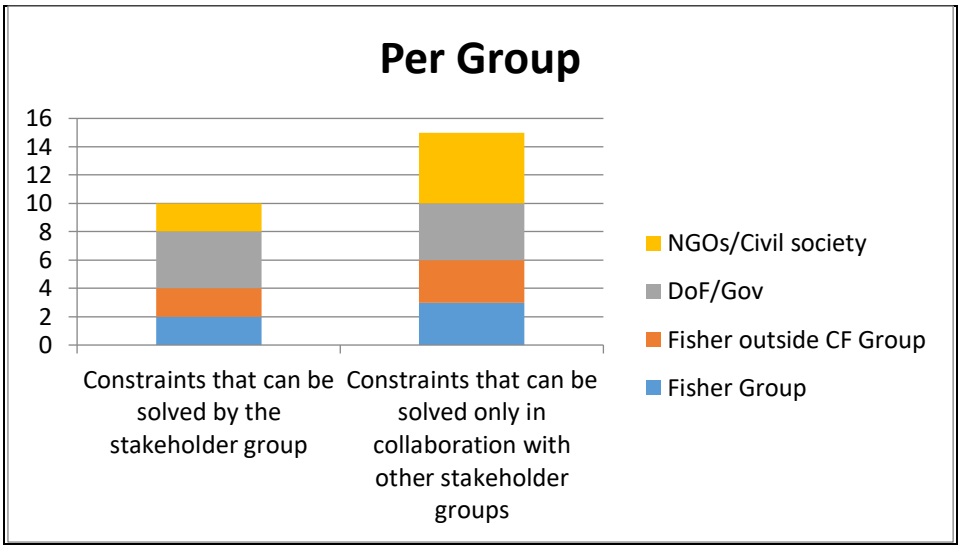


Figure 11. Constraints that can be solved by the stakeholder group by themselves and constraints that require multi-stakeholder interactions

4.5.1. Constraints to solve at local level

Results of the workshop, FGDs and KII identified the following constraints that can be solved at the local level; (i) decreasing fish catch can be solved through conservation of fishing areas. This has already been set up in each of the six villages. The size of the area is usually around 300 sq. feet, covered with bush that serves as fish shelter. This is an initiative of the fishers' group and they informed the local government and DoF when they established it. The fishers and DoF are also reseeding/re-stocking the lease area every year; however, a concern was raised during the interview that non-endemic species are being stocked (aquaculture species); (ii) illegal fishing activities – the investment of the fishers to manage the lease has brought out to ownership and protection of the lease from illegal activities. The fishers in each village control illegal fishing, if there is illegal fishing they report to the FG committee and the FGC report to DoF; (iii) equity of or access to the resource for all– after the change of management all fishers were asked to contribute to the lease fee in order to have access to the village fishing area. Now all fishers have access to the resource at the most productive time of the year. Even when the poorest fishers cannot pay the entire fee, the fisher group allows them access to the village area. The poor fishers can pay later – the system is now more flexible. The fishers can now access everywhere, but the aquaculture owner allows only a few fishermen to access areas close to their farm. In the farming areas, fishers can fish but they need to negotiate with the land owners to be able to fish in August and September. After this periods they are not allowed to fish in the rice farms included in the lease anymore. On the other hand, there are still issues that need to be resolved in the fishers' level on equity of catch, according to some women and fishers outside fisher group, although the fishers agree to use the lease, catch of individual will differ depending on the gear used. If the fisher has a sophisticated or an improved gear he can catch more fish. The solution proposed is to provide a loan to the fishers to improve their gears. Gender is another issue. Benefit sharing is not equally distributed amongst genders as most fishermen are male and can benefit more than women at the household level. Women can benefit if they invest in set fishing nets. For example, a lady (Thin Thin) has bought a long fishing net with the loan she got from FG.

4.5.2. Constraints that need to be solved at higher level

Stakeholders thought that around 75% of the identified weakness/constraints of the current management system can be solved at the township, regional, and national level (Figure 6). The following weakness/constraints that can be solved at the higher level includes; (i) factors affecting the water level, such as sedimentation, infrastructure construction upstream of the lease area, diversion of water for irrigation, and enclosure of large farms for aquaculture; (ii) issues on fish market price at the township and regional level; (iii) encroachment and expansion of agriculture and aquaculture into lease areas intended as fish habitat and spawning ground, and fishing; (iv) limited access to financial and technical services to support vulnerable communities in order for them to compete with better-off fishers; and (v) water pollution from agriculture and other industries dumping waste in the river. The state or national government needs to develop or enforce policies on proper waste management especially in upstream river areas.

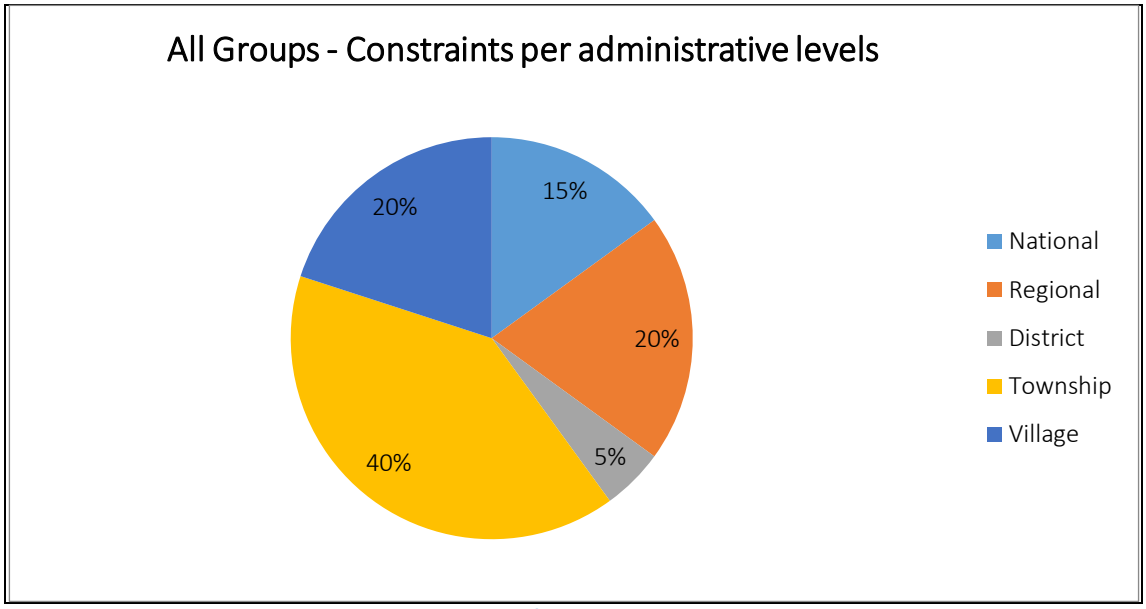


Figure 12. Weakness/constraints per administrative level

5. Discussion

5.1.1. Specific entry point at the Fishery management level

At the local level, the main entry point will be on the internal support as follows; (i) strengthening of the Fisher Group on their unified action in investing their own resources to obtain the lease and take these as their own property to use, protect and conserve; (ii) the DoF/Government observed that the Fisher Group is still weak on their organisational management and activity implementation in terms of technical and financial capacity. The FG needs to have more power to protect their resources from illegal activities and destruction, thus the DoF/government needs to develop and support a policy that will empower the villagers to protect their resources; (iii) it was observed that resources are not equally distributed to the community members, especially to the poor and women. Funds to support these vulnerable communities are limited or lacking at the village level. The stakeholders suggest that the DoF/government and NGOs/CSOs provide financial support to the Fishers Group to assist women and poor fishers to be able to improve gears and derive equal benefits from the lease; (iv) it is important that the government develops a policy that will guide the community to conserve and sustain fishery resources through control of fishing efforts (overfishing), an open and closed season for fishing, gear restrictions, conservation, reseeding and other activities.

5.1.2. Generic entry point at the higher level

The fisher group management system in the region was started a year ago and although it was mentioned in the new Fisheries Laws that an fishers organisation can obtain the lease, it is not clear in the law how the fishers will sustain their tenure to the lease area in the next auction. It is therefore important to develop a clear policy that will support the provision of tenure to the fishers' group in consideration of the current context of the lease, especially the external factors that constrain productivity and sustainability of the lease. External support, both from the government and development partners, is seen to be crucial for the sustainability of the fisheries resources and the development of the fishers' group. Results of the workshop and interviews shows that the lease is not as productive anymore compared 20 years ago because of the external factors affecting the ecosystem, such as sedimentation, pollution, diversion of water for irrigation and aquaculture, encroachment and expansion of farm areas resulting to the loss of fish habitats and spawning areas. These external factors are negatively affecting the fisheries, which can only be controlled or stopped through a clear government policy. However, for the government to develop policy, they need a strong basis that will support their justification or rationale for the development of the new laws or policies. The development partners can assist with the research and assessment of these different factors and

provide a policy brief for the government to use in the policy development. It is also recommended that the government should develop a plan of actions to enforce said policy and a strategy that will support the development of the fishers' group, both technically and financially to achieve sustainable management of the fisheries resources.

6. Conclusion

This case study assessed the performance of fishers' group fisheries management systems, agro-ecological, social, and institutional environments. The dimension that improved most was 'institution and governance', especially on the aspect of market access, access to resources & resource sharing, enforcement of regulation, and policy and regulation development. The indicators for the agro-ecological and social dimensions had improved less, citing a deteriorating eco-system and reduce in fish catches. Therefore, these factors contributed less to the improvement of the income and living standards of fishing households.

The main strengths of the current management system are improved conservation by fishers, the adoption of regulated fishing practices, protection of lease areas against illegal fishing, thereby guaranteeing an income from the lease. There is a more equal access to the resource and higher equity in the benefits derived thereof because fishers had invested in and managed their own lease.

The main constraints of the current management system were the low internal technical capacity and financial support because the system was started recently. Fishers have limited funding and limited external support from government and NGOs/CSO. Other issues affecting fishers' earnings are lower fish catches due to the deterioration of the eco-system and controlled pricing of fish.

The key element to improving the strengths and resolving the constraints is a more effective system of collaboration between government, fishers and supporting stakeholders. At government level, policies and regulations should be upgraded to sustain and ensure the tenure of fisher-leasers with proven conservation practices, to reduce the deterioration of the inland water system by promoting environment-friendly practices among farmers and communities around the system, to improve fish stocks through delineating community fishery refuges, and improving support services to fishers. It is also important to strengthen the government's fiscal resources, human resources, and management systems to improve the delivery of extension services.

Among the lessees, there is a need to improve their income and investment capacity into the resources. This entails a systematic program of services that will improve them as cooperatives towards activities for savings, fish processing enterprises, bulk trading to assured markets, resource-area management planning, community fish refuge and young stock management and investment management. Among CSO/NGO stakeholders, technical and financial assistance is much needed, along the lines of micro-finance schemes, extension services regarding sustainable fishery management, co-partnership in conservation and fishery enterprises; and technical assistance to government institutions for various aspects of institutional management and fishery research as evidence-and-practice-based methods that informs strategies and policies. A program to improve gender outcomes should be promoted, such as women-led savings, fish-processing enterprises, and community fish refuges.

Characterization of Fisheries Management Systems in AD and CDZ

MYFISH 2

Case Study 2

Report

(Individual Lease)

Table of Contents

Abbreviation

AD	Ayeyarwady Delta
CDZ	Central Dry Zone
CSO	Civil Society Organization
DoF	Department of Fisheries
FAO	Food and Agriculture Organization
FDA	Fishery Development Association
FG	Fishers' Group
FGD	Focus Group Discussion
HH	Household
KII	Key Informant Interview
NGO	Non-government Organization
PDAM	Participatory Diagnosis Adaptive Management
RAAIS	Rapid Appraisal of Agricultural Innovation System
TA	Technical Assistance
USD	United State Dollar
WF	WorldFish

Note:

Currency Exchange rate: 1 USD =1,346 Burmese Kyat

Weight Conversion: 1 Viss = 1.6 kilogram

1. Objective of the study

The aim of this case study is to generate an "in-depth" understanding of the Individual Lease fisheries management system in Maubin, with a focus on identifying major issues and potential entry points for addressing these. Hence the specific objectives are as follows:

- Assess performance of the Individual Lease fisheries management systems based on agro-ecological, social, and institutional environments in Pantanaw, Maubin; and
- Identify key issues and opportunities for interventions to improve the performance of this fisheries management system at the area.

2. Methodology

This case study documented the Individual Lease fisheries management systems based on its current performance, strengths/merits, and weaknesses/constraints using both quantitative and qualitative indicators. The final output was the identification of entry points both at the local and higher level for a sustainable capture fishery in the area. This case study selected was located in Pantanaw Village, Maubin Township. The site was an individual lease management system for many years until to date. The information and data used in the analysis were both from primary and secondary data sources.

Review of Secondary data

A matrix was developed to compile existing information about the site, fisheries and type of management in the target area. The information gathered to complete the matrix were sourced from census, FAO assessment, MYFish 1 fishery survey, MYFish 2 Component 2 and other available information from DoF at the District, Township and Region level.

The Analytical Framework

The approach for the case study characterization process was adopted from the tool Rapid Appraisal of Agricultural Innovation Systems (RAAIS). RAAIS is a diagnostic tool originally developed for the agricultural sector that allowed for analysis of issues ranging from broad entry themes to more specific entry points for productivity, natural resource management, social development, and institutional innovation. The RAAIS tools were combined with another theoretical framework tailored to the identification of fisheries management issues--the Participatory Diagnosis Adaptive Management (PDAM) (Table 1). The two frameworks were combined, adopted, and graphed into the radar issues of PDAM as the four analytical dimensions based on RAIIS results. The four dimensions are elaborated, as follows:

Table 1. List of Dimension Indicators

Assessment Dimensions	Indicators
People & livelihoods	Living conditions; diversification/income dependence; assets and income poverty
Natural system	Biodiversity; stock status and trends; fishing practices; aquatic ecosystem condition
Institutions & governance	Fishing and development policies; organizational and institutional capabilities; access to markets and financial services; collective action abilities; governance performance and rights; legal frameworks
External drivers	Infrastructure development; conflicts with other sectors or users

Definition of the four Dimensions[1]

[1] Definition was taken from the MYFish2 - Characterization Component 2

People & Livelihoods - this is the socio-economic aspect of the fishing communities and it encompasses household well-being, which includes household income, household diversification of livelihoods, household fish consumption, living conditions, norms, culture and household assets. It also can include conflict with other users and resource use

Natural system – a biological classification of yield, biodiversity and sustainability of the fisheries resources and ecosystem, its stock status and trends (total catch, total catch by species, fishing effort, catch by unit effort, and number of species), fishing practices, and aquatic ecosystem condition, such as connectivity, breeding ground, pollution from upstream, agriculture, industry.

Institutions & governance – the manner in which power is executed in the management of the fisheries sector. It is the enabling environment aspect in governing the fisheries management in order to reach maximum sustainability (legitimacy, membership rules, access rights, management controls, representation rules, sanctions, enabling legislation/policies/legal framework, local support, financial management and services, access to market, organizational and institutional capabilities.

External drivers - outside influences that can impact the fisheries resources and its ecosystem. Various external factors can impact the ability of the fisheries to achieve its maximum productivity/biodiversity and sustainability. These external factors might include infrastructure development, macroeconomic instability, climate change and environmental uncertainty, migration, market demand changes, price fluctuation, land use changes, migration.

RAAIS as a participatory diagnostic tool combines multiple methods of data collection, building on existing experiences with rapid appraisal approaches and (participatory) innovation systems analysis. The methods for the RAAIS shall generate both qualitative and quantitative data; facilitate 'insider' and 'outsider' analysis; targets different stakeholder groups across different levels with individual, group, and multi-stakeholder perceptions on weaknesses/constraints and solutions; and provide sufficient detail on the main weaknesses/constraints under review, the capacity for innovation in the fisheries management system and the functioning of the fishery management system. On the other hand, the innovated framework will be used also to identify the performance, and strength/ merits (what has worked) from the management system under review.

Methodological steps

Based on RAAIS tool, the following steps were taken to assess the existing fisheries management systems based on the context of each site: (i) identifying strengths/merits, and weaknesses/constraints; (ii) categorising strengths/merits, and weaknesses/constraints; and (iii) exploring specific and generic entry points for recommendations for the current fisheries management system to achieve equitable and sustainable fisheries. The objectives, sessions and activities of each stage are presented in detail in Annex 1. The steps were conducted in the selected site to gather a broad range of information from relevant stakeholders and articulate a participatory assessment of existing fisheries management systems. These methodological steps are shown below:

Multi-stakeholder workshops focus mainly on insider analyses of the current fisheries management system and conditions of the system. Four groups of stakeholders identified, categorized and analysed strength/merits, weaknesses/constraints, and performance of the existing management system to provide specific and general entry themes for innovation in the fishery management system.

The DoF and WorldFish in Myanmar led the selection and organisation of stakeholders who participated in the multi-stakeholder workshop. A total of 16 including 1 female participant attended the multi-stakeholder workshop activity. Figure 1 shows the percentage of participants of the four stakeholder groups. The Fisher Group had the highest rate of participation, standing at 40% of total participants.

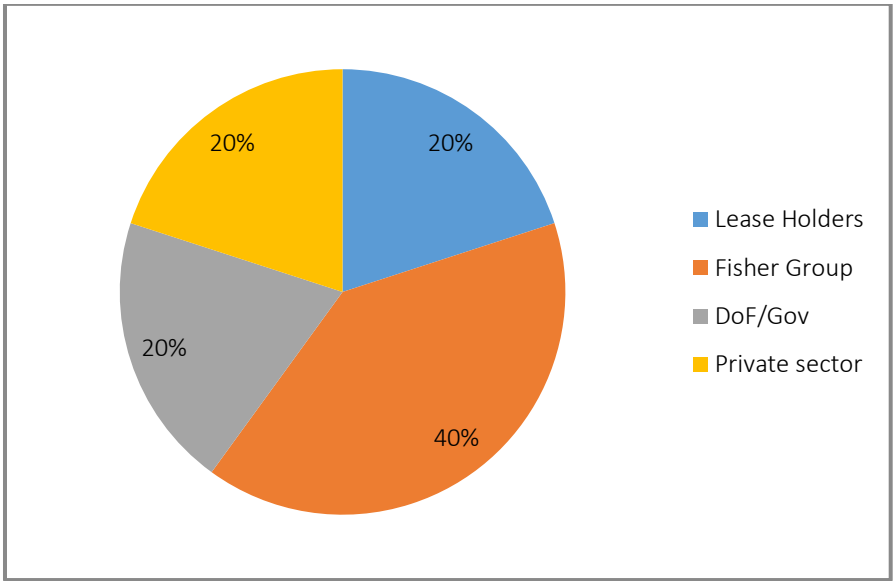


Figure 1. Participants of multi- stakeholder groups' workshop in Maubin Township

Key Informant Interviews were facilitated through one-on-one conversation between WF/DoF team members and a key informant. Three key informants were interviewed, including the village head, a leader at the district level, and a lease owner. The KII was used to gain extra in-depth information based on what was gathered during the multi-stakeholders workshop, validate some secondary information, and understand the perspective of relevant individual respondents on the existing fisheries management system in the area.

Focus Group Discussions was facilitated with the representatives of the sub-lease owner, Fisher Group, outside fishers, and the private sector (retailers and SMEs). A total of 16 participants, including 3 women, attended the focus group discussion. The FGD was used to collect more in-depth information related to what was gathered during the multi-stakeholders workshop, and to understand the perspectives of and dynamics between different groups under the existing fisheries management system in the area.

A total of 35 respondents participated in the information/data collection during three days of field work (13 – 15 June 2018) in Pantanaw Village, Maubin Township. The Fisher Group and the private sector had the highest number of respondents participating in data collection (Table 1).

Table 2. Summary of methods and sampling strategies and sample size deployed during the study

Method	**Type of analysis**			**Stakeholders groups targeted – Sample size**				
	Stakeholder led	Researcher led	Sub-leaseholders Group	Fisher Group	Outside Fisher	DoF/Government	NGOs/CSO	Private Sector
Multi-stakeholder Worksop	X		3	6		3		4

Key informant interviews		X	1			2		
Focus Group Discussion		X	2	4	4			6
Secondary data		X	1			2		
Total	35		4	10	4	7		10

3. Fisheries System

3.1.1. Natural system and fishing techniques

The Maletto Auk Met Kun lease area is a freshwater area the whole year round with a creek that floods and expands its area during the rainy season. The area was auctioned for lease for many years until the reform for a yearly auction for the last ten years. The auction starts in April, is awarded in May and the closed season runs from May to July. The lease owner and fishers prepare their fishing gears and equipment in August. They start fishing in September and continue until April, with the peak season between September and November. From December to February the water is more stable and the fishing activity normalises. The water level is lowest in March and April; during this time the lease owner will ask the fishermen to enclose the areas where all fish aggregate and collect all stock—no matter the size or species.

According to the fishers and lease/sublease owner, the current productivity was on a fast decline over the previous years. They recalled that five years ago they caught 10 -20 viss (16 – 32 kg)/fisher/day during the peak season; compared to last year, they caught around 6 - 7 viss (9.6 – 11.2 kg)/fisher/day during the same season. At low season, the fishers caught around 3 – 5 viss (5 – 8 kg)/fisher/day five years ago, compared with their current catch at around 1 to 2 viss (<1.6 – 3.2kg)/fisher/day.

The issue of declining fish stock affected not just fishers but other actors in the supply chain. According to the processors, they processed 300 – 400 viss (480 – 640 kg)/day five years ago; compared to 200 viss (320kg)/day at present. Traders said that based on their daily trading pattern with the fishers, they verified that fishers sold around 10viss (16kg)/day in 2013 but currently each fisher only sells 1 – 2 viss (3.2kg)/day.

Fishers use a number of gears such as hook and line, fish nets, traps, brush pack and others. The fish collected in the lease area are snake skin gourami, local gourami, featherback, snakehead, rohu, catla, walking catfish, barb, etc. The lease/sublease owners are investing in an artificial fish aggregating brush pack to attract the fish to inhabit the lease during the closed season. During the fishing season the lease/sublease owners ask their fishers to enclose the artificial fish habitat and collect all the fish that inhabit this bush. At the time of harvesting, fishers help the lease/sublease owner for free.

3.1.2. Changes in fisheries management

The auction system of the lease area was introduced during the early days of the British rule (1900). An annual lease was imposed to reduce the effect of the auction system and increase the bids. In 1999, some of the leasable fisheries were converted to agriculture.[2] There had been no change in the lease

[2] FAO&NACA, 2003, Myanmar Aquaculture and Inland Fisheries (http://www.fao.org/docrep/004/ad497e/ad497e00.htm#Contents)

management system in the last 20 years apart from the reform implemented in the last ten years to allow for an annual auction of the lease.

The price of the lease increased consistently at 10% from 2013 to 2017. However, during the auction for the 2017 – 2018 season, the price increased by 242% at 1,250,000 Kyat (933 USD) compared to 366,025 Kyat (273 USD) for the of 2015 – 2016 season (Figure 2).

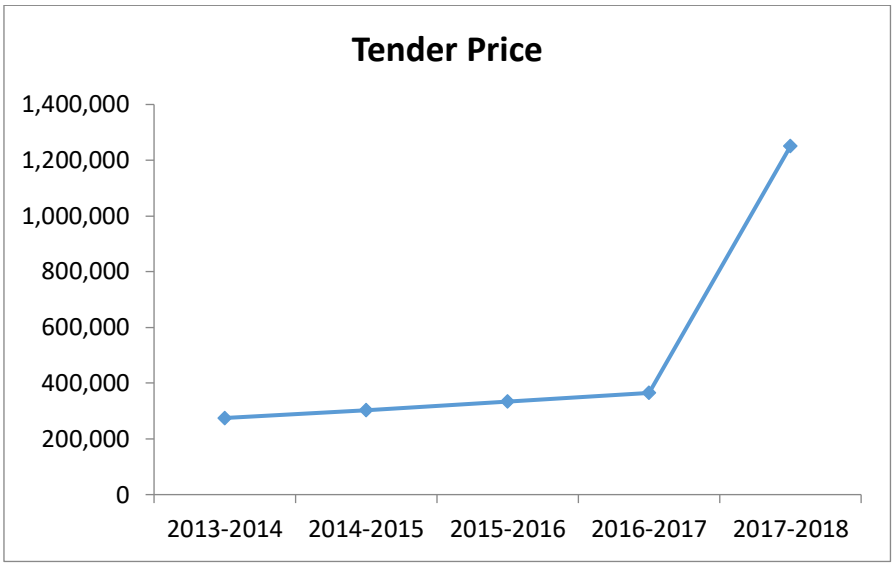


Figure 2. Trend value of the Lease in Maletto Auk Met Kun

3.1.3. Current organisation and management

The lease owner used to control and manage the lease for decades. This changed with the annual auction of the lease. Previously, it was a common practice that the lease owner subleases the area to others. He divides the lease into four segments; he manages one segment while the three sub-leasees manage the other segments. The main lease and sublease owners select their own fishers to fish in their respective lease areas. They provide all equipment, including boats and gears to their fishers on loan with interest, which was be paid every time the fisher sold his catch to the owner. No fisher can sell his catch to anyone else unless it was allowed by the lease/sublease owner (collector paying to the sublease owner). The price of fish was fully under control of the lease/sublease/collector. If other fishers want to fish in the lease area, they had to pay for access to the lease area and they had to sell their catch to the lease/sublease owners at an agreed price (usually 10 -30% lower than other wholesale traders). Eligible fishermen followed all the lease/sublease owners' rules and regulations. They chased and caught any illegal fishers they encountered and asked them to sign a waiver as warning (or) an agreement letter, with the village administrator acting as a witness, while at the same time keeping the confiscated illegal gears. Although some fishermen did not like some of the lease/sublease owners' rules and regulations, (such as pricing and final harvest without incentives), they had to obey them because they didn't have the opportunity to fish in the lease area the next season.

All agreements between the lease, sublease owners, collectors, and the fishermen were informal and verbal. There were no written agreements or contracts signed by the different parties. The usual practice was to award a segment to their relatives. The same was done by the sublease owner who provided access in the leased area to their relatives and friends first. The lease owner also asked the sublease owner to pay the lease in cash and at one time. The price of each segment differed from

auction price: the minimum price was 1,000,000 Kyat (750 USD and the maximum at 4,000,000 Kyat (3,000 USD)/year. According to the lease owner, the price of the lease increased tremendously over the last ten years. Ten years ago the price was 3,000,000 Kyat (2,240 USD) but last year the price he paid was 12,000,000 Kyat (9,000 USD). The minimum catch over the last ten years was around 5,000 viss (8 tons)/year and the maximum was 10,000 viss (16tons)/year.

Aside from the rules and regulations agreed between the government and lease owners, the lease owner had agreements with the sublease owners that they cannot construct any structures that will block the creek or channel. The lease owner also prohibited the pumping of water from the creek during harvest.

4. Results

4.1. Performance of the system

4.1.1. Overall performance

The overall performance of the current fisheries management system was determined based on the perceptions of four types of stakeholders that participated in the multi-workshop activity. The PDAM framework was used to assess the performance based on the four dimensions: natural system, people and livelihood, governance/institutions, and external drivers. The performance score of each indicator had three level with 3 being the highest score. Stakeholders' responses showed that institution/governance (market access) has the highest score as shown in Figure 3 & 4. High responses came from the fishers of the sublease and the retailers/collectors, especially on the indicators for access to the lease/resources and market access. This differs with the response of the government and the lease owners who understood that there was no equity in the lease because the main purpose of the investors (lease/sublease owners) was to gain profit. Almost all respondents agreed that the natural system had deteriorated due to external reasons: illegal fishing, habitat degradation and environmental impact of developments in other sectors such as agriculture, industry, and infrastructures. Livelihood did not score high since the fisheries resources were continuously declining, therefore, affecting income.

In terms of expected performance in the next five years, stakeholders have a common perception on the different indicators. They were not certain of any improvement in the three dimensions of natural, livelihoods, and external drivers; if there won't be a change in management system. According to fishers, retailers, and the government, the lease owner will continue to control the fishing areas for the purpose of profit rather than for conservation and sustainability.

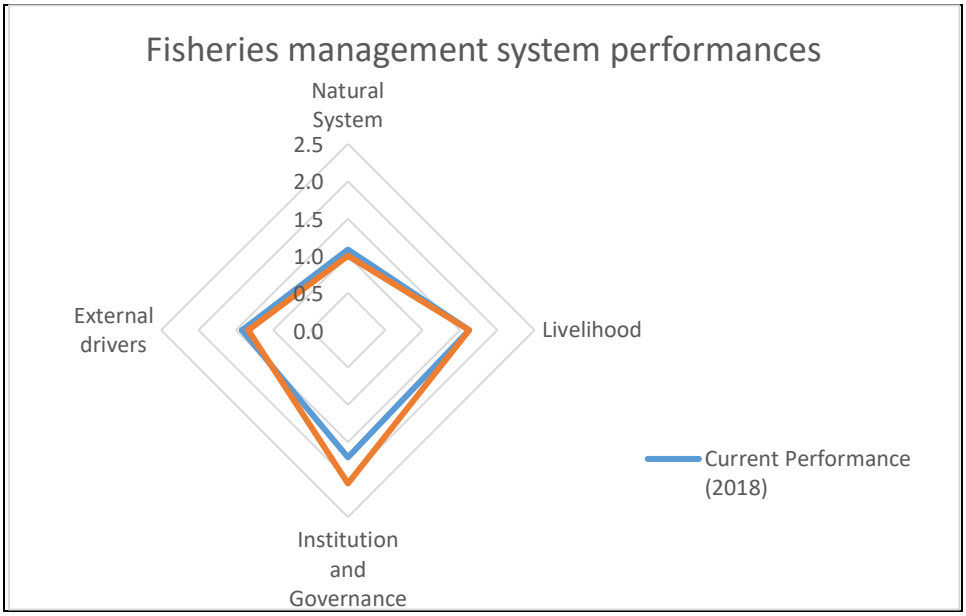


Figure 3. Current and expected performance of the fisheries management system

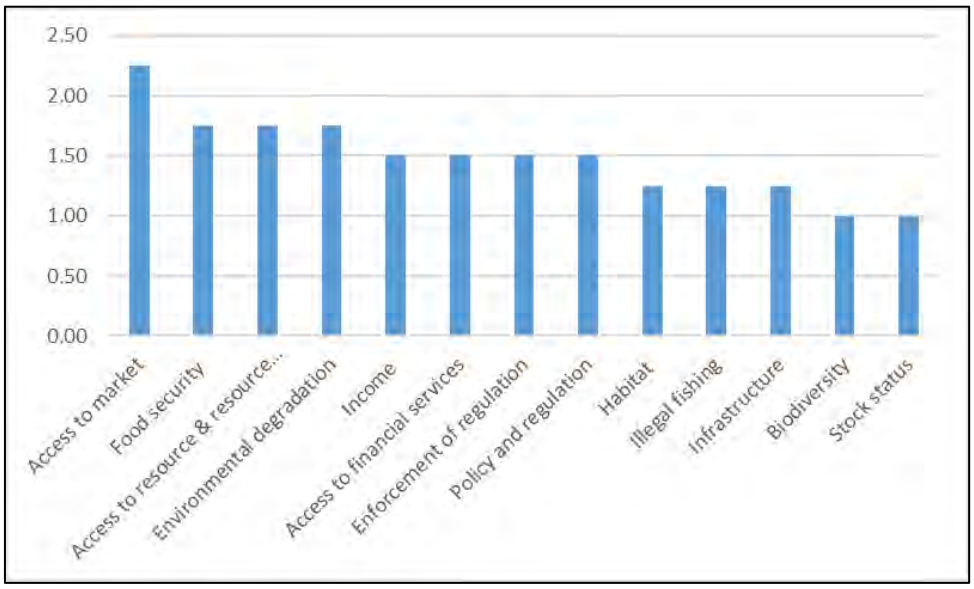


Figure 4. Current Management Performance Indicators

Natural system

The respondents assessed the natural system performance based on biodiversity, stock status, and habitat. Almost all respondents mentioned that the biodiversity in the lease area was degrading because of the impact of the government priorities in agriculture such as irrigation. They mentioned that after the construction of the irrigation gate in the lease area, the natural migration of fish was blocked. The change of ecosystem from a natural flooded area to aquaculture also affected the habitat and spawning of many aquatic species. Illegal fishing methods such as electro fishing and poisoning have affected larvae and juveniles of many fish species. Some stakeholders also mentioned the change in weather conditions affected the abundance of some local species. In terms of the status of fish stocks, the respondents said that it is five times lower than their catch five years ago. Previously, during the peak season they caught up to 30 viss (48kg)/day but now they catch 6 viss (10kg) per day. They attributed decreasing fish stock to illegal fishing and environmental changes and changes in

ecology due to the government's development priorities. Degradation of fish habitats in the flood plain was because of an increase in the number of aquaculture ponds and expansion of agriculture around the lease areas. Habitats in the creeks and rivers are in a bad condition due to sedimentation and pollution. The restocking/reseeding of the lease areas was not working because of illegal fishing activities.

Livelihood

Performance of the current fisheries management system regarding people's food security and income was assessed with 47 respondents. Most respondents said fish consumption among the population was stable because they could catch in the wild and buy fish from aquaculture. However, some stakeholders were concerned about the decline of fish from the wild, which affected the poor who are food-dependent on capture fisheries. The sub-lease owner mentioned that their income was decreasing because the number of fishermen was increasing and increasing aquaculture and diversion of water for irrigation made the fishing area narrower. On the other hand, the fishers under the sub-lease owner and collector said that their income was stable because they were allowed to fish in the lease area and to sell their catch to the sub-lease owner and collectors. This contradicts the response of the DoF/government who mentioned that fishermen now have a lower income because of the declining fish catch and decreasing fishing areas. Collectors and traders seconded the decline in fish catch from the fishermen; hence their income is also lower than it was before.

Institution and Governance

Performance of institution and governance was assessed based on access, enforcement, and policy and regulations. The sublease owners mentioned that although the volume of fish from the wild was decreasing, its price was stable and fishers had access to a market. The fishers said that they do not have problems with marketing their catch because the sub-lease owner and collectors buy all their catch. The fish collectors/traders mentioned that the market demand for wild fish was increasing compared to fish from aquaculture. All the stakeholders mentioned that they have limited access to loans or financial services. According to the sublease fishers, the only loan providers were the sublease owner or collectors. The DoF confirmed that financial institutions and the government give inadequate financial support to fishermen. Regarding access to resources and resource sharing, since the lease was managed individually, only fishermen allowed by the lease and sublease owners can fish or have access to the fishing areas within the lease, besides the sublessee. The DoF/Government group cited nothing to share regarding equity because of the current status of declining fisheries resources. According to the traders/collectors' group, the individual lease system was not fair for the small fishermen because they lacked equipment and the lease and sublease owner don't trust them.

All the stakeholders said that law enforcement in the lease area was weak. The sublease owners said that they cannot enforce the policy during the closed season, as agreed with the government, because they need to recoup their investment and want to make a profit. The fisher group mentioned that they were not aware of any regulations being imposed by the government through the lease owner, because they were not informed. The government confirmed that the communities and fishermen in the lease area were not following rules and regulations, which were agreed with the lease owner. The traders/collectors group mentioned that previously the lease owner and fishers followed the law from Department of Fisheries, especially before the reform to an annual auction system. The policy and regulations were inexistent in the lease area, according to the sub-lease owner, sometimes they could not control illegal fishers in their respective area because it was easily accessible. The fishers group mentioned that they only follow the instructions from the sub-lease owner who allowed them to fish in the lease area. The DoF/Government group mentioned that because of increasing population and

decreasing fisheries resources, the people are not thinking about policy and regulations to sustain their resources. The traders/collectors said that the lease and sublease owners are thinking only about their present benefits.

External drivers

Performance of external drivers was assessed based on the issues of illegal fishing, environmental degradation, and infrastructure affecting the environment. All stakeholders mentioned that illegal fishing activities in the lease area are increasing. They cited the following reasons: lack of law enforcement; poverty; and, the limited capacity of the lease and sub-lease owner to monitor the area the whole time. The stakeholders also mentioned that the ecosystem was degrading because of aquaculture, agriculture, and the construction of new infrastructure. The sublease owner group raised irrigation as an issue affecting the ecosystem, especially fish migration for breeding and spawning. Expansion of aquaculture and agriculture, and pollution from waste discharge directly into creeks and rivers also contributed to the degradation of water quality and fish habitats (Table 3).

Table 3. Summary of Performance of the current management system

Dimensions	Rank	Key point/highlight
Natural system	4	Biodiversity, fish stocks and habitats are degrading because government prioritises agriculture and aquaculture; illegal activities; and environmental degradation such as sedimentation and pollution.
Livelihood	2	Fish consumption is stable because fish is also available from aquaculture; however, the poor are affected the most because they are food-dependent on capture fisheries. Income of fishers and leaseholders are decreasing due to the deteriorating fish stocks and development priorities.
Governance	1	The lease area is fully controlled by the lease and sublease owner. The lease and sublease owners get the highest benefits. Selected fishers get benefits because the lease/sublease owner provides loans and fishing equipment.
External drivers	3	Building of irrigation gates affects fish migration; illegal fishing and poaching are increasing due to poverty; environmental degradation due to agriculture, aquaculture, and pollution.

4.1.2. Productivity and income

All respondents mentioned that productivity of the lease area decreased compared to five years ago. According to the fishers, they previously caught 7 - 10 viss (16kg) per day during the peak season. Now, they catch around 6 viss (9.6kg) per day during the peak season. At low season in the past, the fishers caught at 3 -4 viss (6kg) per day, compared to one or less than one viss (1.6kg) per day todar. The processors group confirmed the catch decreased compared to five years ago. They used to buy 300 – 400 viss (480 – 640 kg) per day during peak season; at present, they process 200 viss (320kg) per day. Catch corresponds to the total production of the lease owner at around 10,000 viss (16 tons) per month during the peak season. They attributed the declining volume of the fish to the establishment of irrigation gates and channels that blocked fish migration. The expansion of agriculture and aquaculture in the lease area also caused fish habitat degradation.

According to the lease owner, revenue from the lease was lower than ten years ago. The price of the lease 10 years ago was only 3,500,000 Kyat (2,600 USD) per year, now the price of the lease is around 12,000,000 Kyat (9,000 USD), an increase of more than 3 times. The lease owner divided the lease area into four sections and rented it out to sublessees to manage. The sub-lessee pays the lease owner according to the size and productivity of the area they are provided with. According to sub-lessees, the payment ranged between 1,000,000 Kyat (746 USD) and 4,000,000 Kyat (3,000 USD). The sublease owner will manage the assigned area and the usual fee the sublessee collects from fishers was 5,000 Kyat (4 USD)/year for specific gears (gill net and traps). The sublessee provides loans in the form of materials and gears to fishermen and obliges the fishers to sell all their catch to him/her at an agreed price (usually 10% lower than the traders' price) as repayment of the loan. At least 6 fishers were allowed in one section of the lease and they have an agreement that the sub-lease holder can purchase their whole catch at 10% below market price. The sub-lessee provides loans at a minimum of 10,000 Kyat (7 USD) to a maximum of 1,500,000 Kyat (1120 USD). If the fishers couldn't follow the agreement between them and the lease and sublease owner, the lease owner confiscated all the materials, gears, and boats provided to the fishers.

According to the fishers' group around 50% – 100% of their income came from fishing. Around 25% of fishers do so full-time. The part-time fishers represent around 70% of fishers in the area, fishing mainly during peak season. The fishers mentioned that their income declined compared to five years ago. Their current daily income from fishing ranged between 3000 – 5000 Kyat (2 – 4 USD)/ day. Some said that although their catch volume has decreased their income hasn't decreased over time, as the price of fish has increased. For example, the price of catfish before was 1,500 Kyat (1 USD) per viss, the current price is 3,500 kyat (2.6 USD) per viss. The most commonly caught fish species were snakehead, stinging catfish, climbing perch, and catfish.

4.1.3. Benefit sharing and equity

The performance of the individual management of the lease does not provide equal benefits to all small-scale fishermen. According to fishers outside the lease area, only fishers selected by the lease/sublease owner can fish in the lease. However, the sublease owner said that they allow fishermen to fish freely in the lease area for household consumption during the closed season. They asked these fishers to work with them during the start of fishing in the lease area. The DoF/government thought that the current management system was fair because the lease owner divides the lease into four segments and sub-lessees then manage and support the fishers in their segment. The fishers under the sublease owner agreed that they are benefitting from the system because the sublease owner provided gears and materials which enable them to fish and which they paid back through selling their catch to the sub-lessee.

In terms of equity, the lease owner got the most benefits from the lease. He can easily recoup his investment from the payment by the sub-lease owners, while he directly manages his own section of the lease. The sublease owner and collectors come second in terms of the most benefits derived from the lease. However, they need to invest more in materials/gears for their fishermen and artificial fish refuges that attract fish which is collected during the open season. The lease owner, sublessee and their collectors get additional benefits through the grading and processing of fish they bought wholesale from fishers. The fishermen of the lease and sublease owners also benefited from the lease because they are the only ones allowed to fish in the area. However, decreasing catches often hinder their ability to pay back their loan from the lease/sublease owner. Often the only way out was to

borrow loan from outsiders at a high interest rate. There is very little equity under the current system as only a few selected fishers allowed to fish in the lease area, while many fishers are not.

4.1.4. Access rights

The current lease management saw the sublessee paying the lease owner for the privilege to access and manage the lease area. The lease price depends on the size of the fishing ground area; the larger it is, the more expensive. Only the lease or sublease owners hold decision-making power on who is allowed to fish in the lease area. If the fisher won't pay the fee to the lease owner or sub-lessee, then he won't have access to the fishing area. The current access fee in the lease area ranged from 5,000 to 30,000 Kyat (4 – 22.5 USD)/fisher per year. The fishers are also obliged to sell their catch to the sub-lessee or collector from whom they got the loan for a boat, gears, and materials. Sometimes the fishermen who paid access fees could not pay back their loan because their catch was limited, so they have to pay the lease/sublease owner by cash. Some sub-lessees further subleasing their areas to fish collectors/retailers, if they cannot manage all. The fish collectors/retailers pay 50,000 Kyats (37 USD)/ year for their fish truck and pay another 30,000 Kyats (22 USD)/year for the fish net gear in one area. If they changed their fishing area, they have to pay the same amount again. The village head thinks that the right of access is not fair because the fees for fishers and collectors are expensive. Another story that was shared was that the lease/sublease owner overfishes in their segment of the lease area.

4.1.5. Conservation

One of the rules of DoF put in place when awarding the lease was to re-stock fingerlings to the lease area for conservation purposes. According to the lease owner they followed this rule by restocking fingerlings amounting to 1% of the total annual lease fee. The species they re-stocked were rohu, carp, silver carp and tarpian (Thai silver barb). However, there is no established conservation area that can protect and ensure fish breeding.

The lease and sublease owners, and their fishermen follow the closed season regulation being implemented from May to July. They installed their artificial fish refuge (brush) along the creek during this period to keep fish from migrating. During the open season these fish refuges were enclosed with nets and the fishermen and sub-lease owner collected all the fish trapped there. Based on the experience of the lease owners and the fishers, the catch volume and biodiversity of caught fish were decreasing. The species that were abundant before, such as snakehead, catfish, climbing perch, and some species of catfish are now slowly declining. They observed that some species are now rarely found in the lease areas, such as the freshwater prawn, stinging catfish, catfish, wallago, spotted snakehead, mola carplet, and climbing perch. Only gourami and barb species are still abundant. The fishers confirmed that overfishing takes place in the lease area. At the end of the lease operation (February and March), all fishermen are asked to gather the remaining fish in the creek and hand it over all to lease/sublease owner without incentive or payment.

In summary, the stakeholders who benefitted most are the lease and sublease owners, and their selected fishers. Benefits sharing, equity, and access rights are not considered in this type of management because the main objective is profit for the lease and sublease owners. Although, some conservation practices are being implemented such as reseeding and implementing a closed season, it is not working because at the end of the lease period all fish are collected by the lease and sublease owner (Table 4).

Table 4. Summary of performance of each indicator

Indicator	Rank	Key point/highlight
Productivity and income	1	Although fish stocks are decreasing the price of wild fish is increasing. It provides good income for the lease and sublease owner. The fishers of the lease/sublease owner have direct market access and access to loans.
Benefit sharing & equity	4	The lease and sublease owners are getting most of the benefits from the lease area.
Access right	3	Only a few selected fishers are allowed to fish in the area. Collectors or fishers need to pay high price for the access to the lease area
Conservation	2	Reseeding of the lease is included in the contract and lease fee. A closed season is observed for three months. However, at the end of the lease period the lease/sublease owners collect all fish in the area.

4.1.6. Gender dimension

The lease and sublease owners are all men. Similarly, the fishers working with the lease and sublease owners are all men. The fishers outside the lease said most of them are men and no women were involved in fishing activities. The women are involved only in preparing gears, materials, and food for the men who fish. On the other hand, all retailers and processors interviewed were women. They said few men are involved in this activity because their main activity was the fishing itself. According to the women processors, around 70% of the household income came from selling dried fish and fish paste they had processed. The women retailers mentioned that 100% of their household income came from selling fish. Women involved in fish processing or retailing mentioned that they have a higher income than the fishers because their products add value to raw fish and this increases the prices threefold. The fishers have a lower income because the sublease owner or collector buys their fish at 10%below market price.

4.2. Dimensions of Strength and merits of the system

The strengths/merits of the current fisheries management system were assessed using the four dimensions of the PDAM framework. The assessment shows (Figure 5) that almost all of the strengths and merits identified fell under the 'people and livelihood' dimension, in particular to fishers of the lease/sublease and retailers. The provision of equipment and gears to the fishers through loans, and assured market access were cited as the main strengths of the current management system. Only the government and lease/sublessees mentioned the strength of institutions and governance regarding control of fishers and of the lease. The dimensions for 'natural system' and 'external system' have the lowest number of strengths and merits. Only the DoF/government and sublessee know about the agreement on reseeding/restocking of the lease. The fishers and retailers don't know any conservation efforts being conducted or practiced in the lease. There is no initiative to conserve resources since the operator changes every year. As evidence, they mentioned the end-of-operation harvest of all entrapped fish—all sizes and kinds-- by the lease and sublease owner since they are not assured whether they will still be the operator next season.

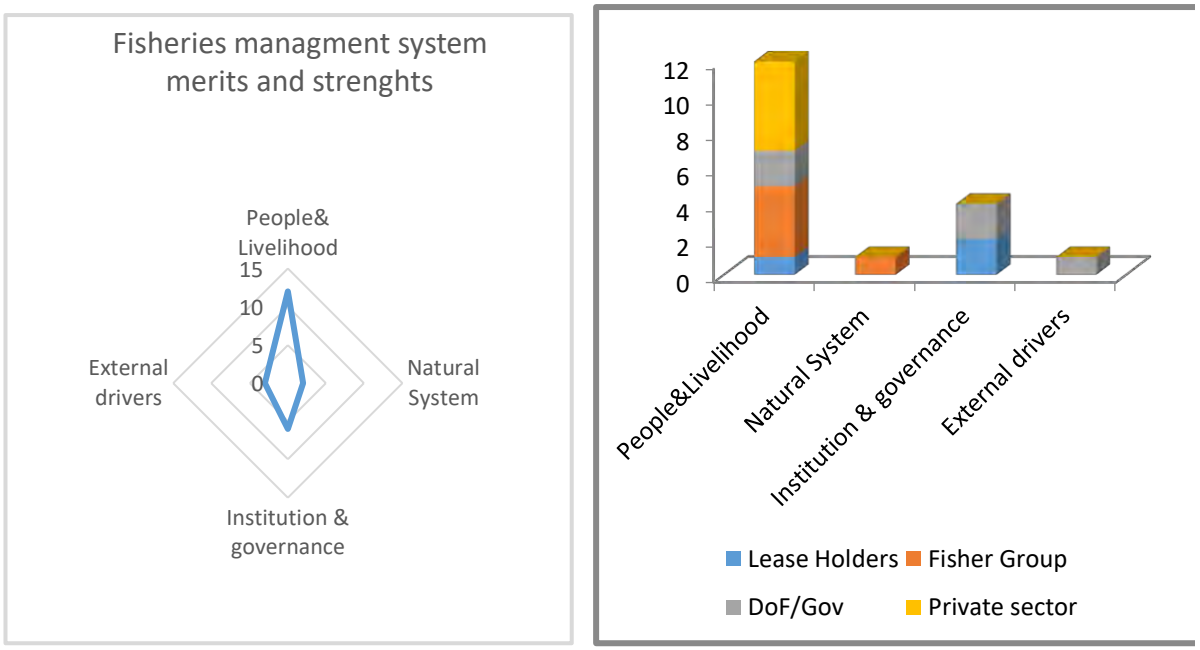


Figure 5. Strength and merits of the current management system

Leaseholders

The sublease owners thought that the main strength of an individual lease was the uncomplicated operation and management of the lease area. They decide by themselves how to operate the lease and their fishers have to follow the agreed management system. The system does not confuse the fishers what to do and where to sell their catch. Because there is only one investor (lease owner), there is no need for consensus on the operations and benefits. The lease holder provides boats and gears to fishermen and then they sell the catch to the lease/sublease owner. The lease/sublease can limit and control fishing activities in the lease areas to their fishers.

Fisher Group

The fishers of the lease/sublease considered the fact they don't have to invest as a strength, because they are poor and do not have enough money to invest in fishing. They saw an advantage in taking out a loan for a boat, gears, and materials from the lease/sublease owner. The other strengths they mentioned were:

- They do not need to bid for the lease: no need to invest or get a loan to bid in the auction. They said that they only need to develop a good relationship with the lease/sub-lease owner.
- No problem where to sell their catch: they are obliged to sell their catch to the lease/sublease owner and there is no need to find a buyer because the lease/sublease owners are automatically their buyers.
- Having access to wider area of the lease: the selected fishers have a wider area for fishing because the lease/sublease owners limits the access so only the selected fishers they manage and trust can fish there. These fishers can catch more to sell to the lease/sublease owner.

- The DoF closed season regulation is followed: the fishers follow the law on closed season and assist in re-seeding the lease to ensure a higher catch during the fishing season. Previously, a lot of fish are left over after the end of the fishing season.

DoF/Government

The government group said the main strength of the individual lease is the strong investment of the lease owner. The lease owner has the money to invest and can even afford an increase in the floor price. The government earns more money from the auction. Other strengths mentioned were as follows:

- Powerful management of fishers –the lease/sublease owner has full power to control the fishers to improve his business. This reduces competition by other fishers because only the selected fishers are allowed to fish in the lease area.
- The lease/sublease has market control. The lease/sublease owner controls the market price because they have an agreement with their fishers they will buy fish at a set price. The repayment of loans by the fishers is also done through this set price agreement. Lease owners can sell fish products where they want and at a price they choose.
- The lease/sublease owners control their fishers. Through fisher selection, provision of loans to fishers, and their position as sole purchaser, the owner/sublease can impose regulations on their fishers.
- The re-stocking of fish in the lease area was based on DoF rules and aptly followed by the lease owner during the lease period.

Private Sector (retailers/processors)

The retailers/processors said that the lease/sublease owner is powerful and could expand their fishing ground in the floodplains or beyond the agreed area. However, this was before the development of aquaculture ponds. The other strengths/merits of the current management they saw were:

- The fish retailers can collect a good amount of fish from fisherman - because the sublease owner controls the lease and provide rights/access to retailers to buy more fish from the fishers.
- Collector can sell fish at a big market (Yangon) – The retailers have a good amount of fish to transport and sell outside of the township to get a better price.
- Job opportunities in the fisheries sector – there are less competitors and retailers can buy a good amount of fish from these fishing grounds to transport and sell at markets in Yangon.
- Consumers can buy fish at a lower price – because the sublease owner/retailers are buying a lower price from the fishers, thus, they can sell the fish at a lower price.

The common strengths and merits of the individual lease management among stakeholders are the full control of the lease and market providing more benefits to lease and sublease owners; investment of lease/sublease owner to fishers, providing benefits for the selected fishers; control of the fishers, providing more rights to lease/sublease to control both benefits and resources; restocking, although this is being practiced both by the lease owners and DoF, there is no basis that this is contributing to conservation because the lease/sublease owners harvest all the fish before the end of annual lease (Table 5).

Table 5. Merits and strengths common to more than 1 stakeholder groups

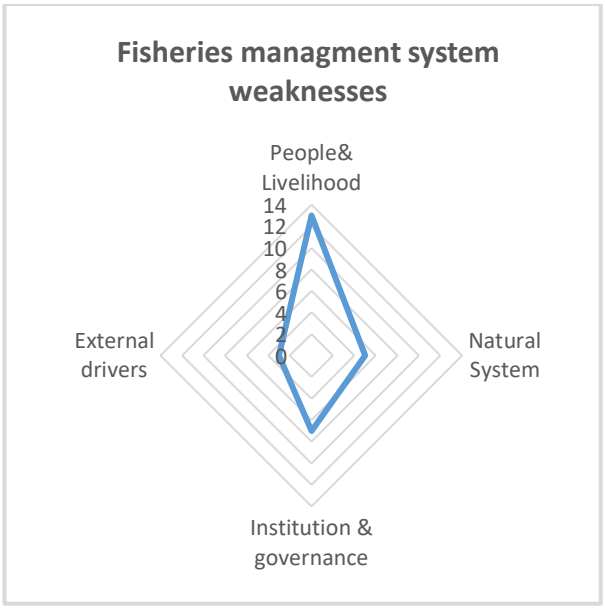
Merits/Strengths	Common to Groups	Description

Control of the lease and market	Sublease owners, Fishers group, DoF/Government, retailers/processors	The lease/sublease owners have the control over the whole lease and market for the fishers.
Investment of the lease/sublease owner to the fishers	Sublease owners, DoF/Government	The lease/sublease owners invest including loan to the fishers.
Control of the fishers	Sublease owners, DoF/Government, retailers/processors	The lease/sublease owners determine who will be involved in the lease, both in terms of fishing and retailing.
Restocking/conservation	Fisher groups, DoF/Government	The lease owner agreed with DoF to reseed the lease and follow the closed season, as per the contract.

4.3. Dimension of issues - weaknesses and constraints

Most of the identified constraints and weaknesses of the current fisheries management fall under the livelihood dimension of the framework. Decreasing catches and a fixed fish price were the main constraints cited that have significant impacts on the livelihood of the fishers (Figure 6). The sublease owner mentioned that their income has decreased compared five years ago. The increasing cost of the annual auction against declining catch meant that the lease/sub-lease could not get back their investment. They don't get any support from the government and financial institutions to purchase or manage the lease.

On the governance dimension, the government mentioned the conflicts between other fishers and lease owner as a constraint, due to the latter's control of the access to the fishing areas. Interviews with fishers outside the lease mentioned that they have to fish far away from their village because they are not allowed to fish in the lease area. Illegal fishing and poaching were mentioned as constraints under the external drivers dimension by the lease/sublease owners. However, this was never mentioned by the fishers, retailers, and government who thought the lease is fully controlled by the lease owners. For the natural system dimension, the government mentioned overfishing and deteriorating breeding habitats, development in the area blocks fish migration routes.



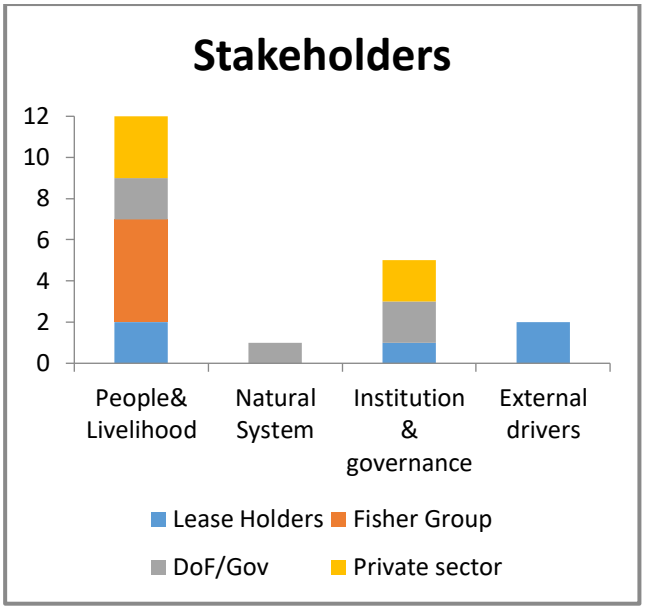


Figure 6. Constraints and weaknesses of the current fisheries management system

Lease holders

The sublease owner on the current management cited their investment as the main constraint. The individual lease management imposes a system that the lease/sublease owners invest by equipping their fishers with boats, gears and materials. With the decreasing catch, the lease/sublease owner sometimes cannot recoup their investment in the limited lease tenure of one year. Other constraints mentioned were:

- Lack of support from financial institutions for the management of the lease. The lease/sublease owner mentioned that they have plans for their fishers and the lease area, including conservation management, but lacked support from any financial institutions.
- Illegal fishing (electrofishing and poisoning) – Although the lease is divided into four segments, illegal fishing activities could not easily be eliminated because the difficulties of poorer people regarding their livelihood, which forced them to fish illegally.
- Decreasing fish catch in the lease – according to the sublease owner fish stocks are continuously decreasing because of over-harvesting and changes to the natural flood cycle. They also attributed this on the establishment of a water gate for irrigation which blocks fish migration during the flood season.
- Lack of control of outside fishers. The lease area is wide and the sublease owners cannot monitor and prevent outside fishers throughout. Poaching occurs and sometimes the sublease owner allows the community to catch fish for consumption.

Fisher group under the lease/sublease owners

The main constraint mentioned by fishers of the lease/sublease is the fixed fish price. The fishers said the lease/sublease owner buys their fish at a very low price, around 30% lower than other collectors in the village. The fishers mentioned other collectors buy at a price of 1,000 Kyat/viss but the lease/sublease owners only pays them 700kyat/viss. They said that they cannot sell their catch to other collectors because the sublease owners provide them their loan and materials. Other constraints cited were as follows:

- Fishing without incentive during the final harvest before the lease ends. The usual practice of the lease/sublease owner was to harvest all the fish in their lease areas before the end of

the lease contract (April). The fishers were asked to enclose the fish in an impounding area, where all trapped fishes are gathered. The fishers have to do this without incentives; if they do not help in this, they will not be allowed to fish next season.

- Lease/sublease decides on the fishing areas for the fishers. According to the fishers, they do not have the liberty to select good fishing areas because the sub-lease owner took good fishing areas for himself.
- The lease/sublease owner decides on what fish to catch and buy. Lease owner determines what fish the fishers will catch based on current market demand and the period in which certain fish species have a higher price. The fishers follow the lease/sublease owner or their catch will be cheaper or it will be kept for making raw fish paste.
- Compulsory payment of fisher's loan before the end of the lease – the fishers agreed to pay back his loan through selling fish to the lease owner at a lower price. If the full amount of the loan was not repaid before the end of the lease by selling fish, the fishers have to pay cash through loans from private money lenders with high interest rates. If the fishers don't pay, the lease/sublease owner will report to the authorities for legal action. The fishers who don't pay their debts will not have a chance to be part of the lease fishers in the next season.

DoF/ Government

The main constraint of the current management is the decreasing fish resources because of overfishing – according to the government officers. The lease/sublease owners are equipping their fishers to catch more fish resulting to overfishing in their corresponding areas. The use of illegal fishing methods (electrofishing and poisoning) in the lease areas was another factor. Other constraints cited by government respondents were:

- Aquaculture is decreasing the fish breeding and spawning grounds. The current management does not have the mandate to stop the expansion nor does the owner of the lease.
- Less opportunities for more fishers. The lease/sublease owners fully control all fishing area of the lease. They only allow few selected fishers who work for them, therefore, excluding access to the area for other fishers.
- Conflicts between lease owner and fishers outside the lease. Because only fishers who work for the lease/sublease owners are allowed, other fishers tend to poach and fish illegally. These conflicts are usually brought to the local authorities to solve and settle. Another conflict is the control of the lease/sublease owner over fish price and market access.
- The individual lease management does not contribute to the environment and socio-economic dimension of the community in the area. Government officers saw individual ownership as a selfish private business with profit as prime motive. The lease/sublease owners do not consider how to conserve and sustain the fisheries resources for the next generation.

Private Sector (retailers/processors)

The practice of the lease/sublease owner of selling access to the lease at a very high price was the main constraint seen by retailers/collectors. This is also true for fishers allowed to fish in the lease area. In certain areas the fee to fish is higher than the gear license fees paid to the government. Other constraints cited by the retailers are as follows:

- The current management does not provide equal access to the fishing areas. The lease/sub-leases was very selective on fishers allowed to fish in the lease area and those allowed are not given access to areas with more fish.
- Some collectors have to pay a license fee for collecting fish. This results in high expenses for retailers/collectors.

- Decreasing worker/fishers for the lease owner. Since the fishers get low benefits from the lease owner, they tend to look for alternative jobs.
- Only few can be a sublease owner. Most of the time the only one who can sublease and fish in the lease area are the lease owner's relatives.

The constraints that is common among stakeholders presented in Table 6 are; decreasing fish catch affecting income and livelihood of both lease owner and fishers; the limited access to the lease area, lease owner controls the selection of a few fishers to his benefit; and increasing lease price, a lease owner is hesitant to continue bidding in the lease because the auction price increases while catches are decreasing.

Table 6. Constraints common to more than 1 stakeholder groups

Constraints and weaknesses	Common to Groups	Description
Decreasing fish catch	Sublease owners, DoF/Government	The fish stock is decreasing because of overfishing and habitats degradation
Limited access to the lease area	Fisher group, DoF/Government, Private sector	The lease owner identified the area allowed to fish, there is limited opportunity for fisher, lease allowed fishing to their relatives and friends
Increasing price of the lease	Lease owners, Fisher group, retailers/processors	The lease price is yearly increasing, the fishers could not pay loan, retailers pay high to lease owner.

4.4. Interaction between constraints

Constraints have been categorized under the four dimensions of the PDAM framework; (i) Livelihood; (ii) institutional/Governance; (iii) External Driver; and (iv) Natural system (Figure 7). Results of the workshop indicate that more issues on livelihood and institutional and governance are apparent. In (i) livelihood dimension the increasing lease fee constrains the capacity of stakeholders to pay the fee, which is linked with the restriction of fishing activities; less fishers benefitted; and it causes loan default and complaints. These issues are linked with the (ii) institutional/governance issue - in relation to conflict between lease/sublease owners and fishers both inside and outside the lease. Once there is dissatisfaction among the fishers, this results in poaching and illegal fishing activities in the lease area, categorized as (iii) external drivers. Finally, these external drivers will affect the (iv) natural system in several ways such as, decrease of fish catch and breeding areas, and decline of fish biodiversity, which is affecting the livelihood of the people, especially small-scale fishers.

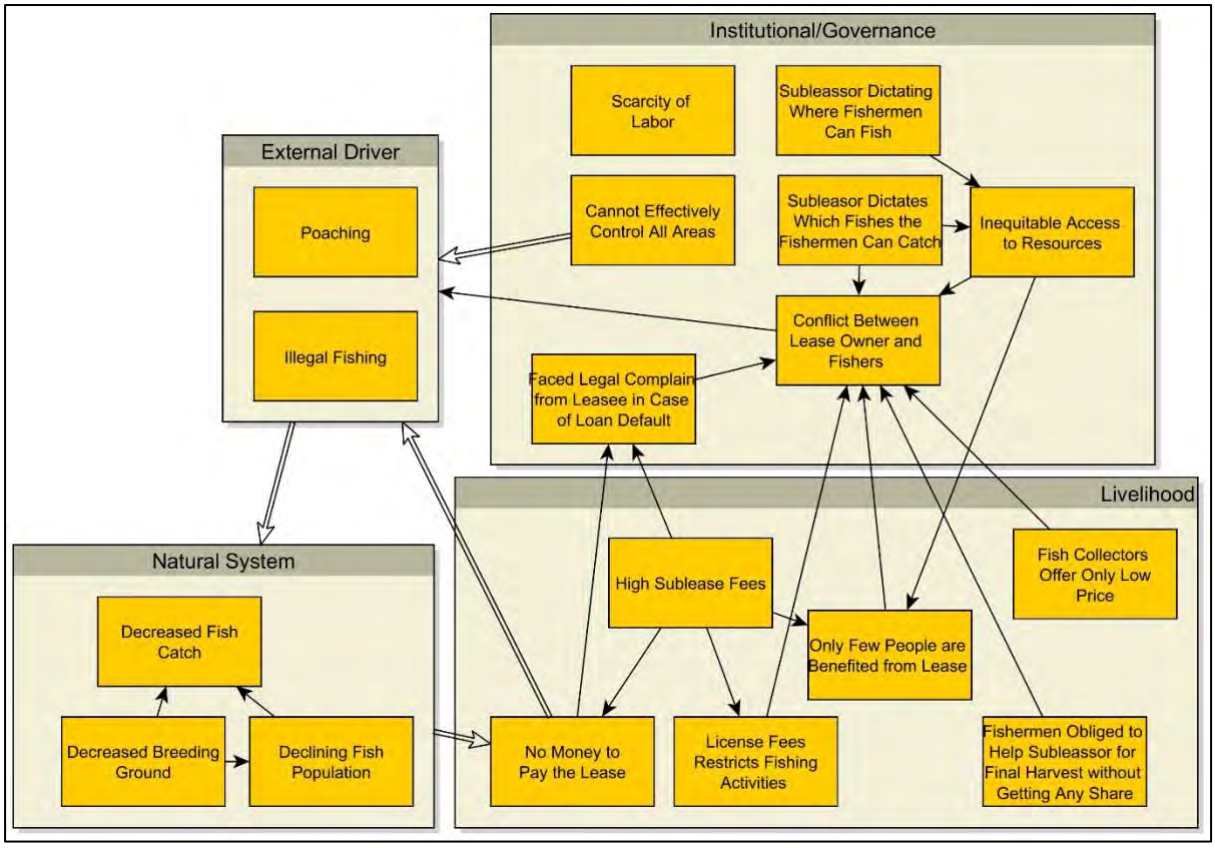


Figure 7. Framework of interaction between constraints

4.5. Entry points for improvement of the management system

Based on the interaction of constraints, the main entry points for improvement should be policy support of the institutional/ governance, in particular around conflicts between stakeholders on how they can be united/organised to address the issues they currently face. An initiative to open up fishing access in the lease area can possibly reduce conflict and address the issue of poaching and illegal fishing activities. This initiative will also assist in the promotion of conservation in the area resulting in more sustainable fisheries. Higher catch volumes will result in a higher income for fishers, which they can use to bid for the next auction and have full control of and benefit from their fisheries resources.

4.5.1. Constraints to can be solved at local and higher level

The respondents think that around 60% of the constraints they identified can be solved at the village or township level (Figure 8). These includes: illegal fishing activities (electrofishing and poisoning); poaching; decreasing catch; access to the fishing areas; better fish prices; conflicts between lease owner and fishers; and equal treatment of all fishers. For higher level interventions, the constraints mentioned are: policy support for conservation practices; encroachment and conversion of lease areas into aquaculture or agriculture; technical support for livelihood diversification from the government; and support from financial institutions.

Results of workshop showed the different perspectives of the stakeholders on how an issue or constraints can be solved. The lease owner and the fishers group perceived that constraints can be solved at the local level without any policy support for their recommended solutions. While the DoF/government and the private sector believe that most of the constraints mentioned may be solved with policy support. They believed that constraints can be easily solved if there are corresponding

policies to support the intervention, in particular regarding technical and financial needs of the stakeholders.

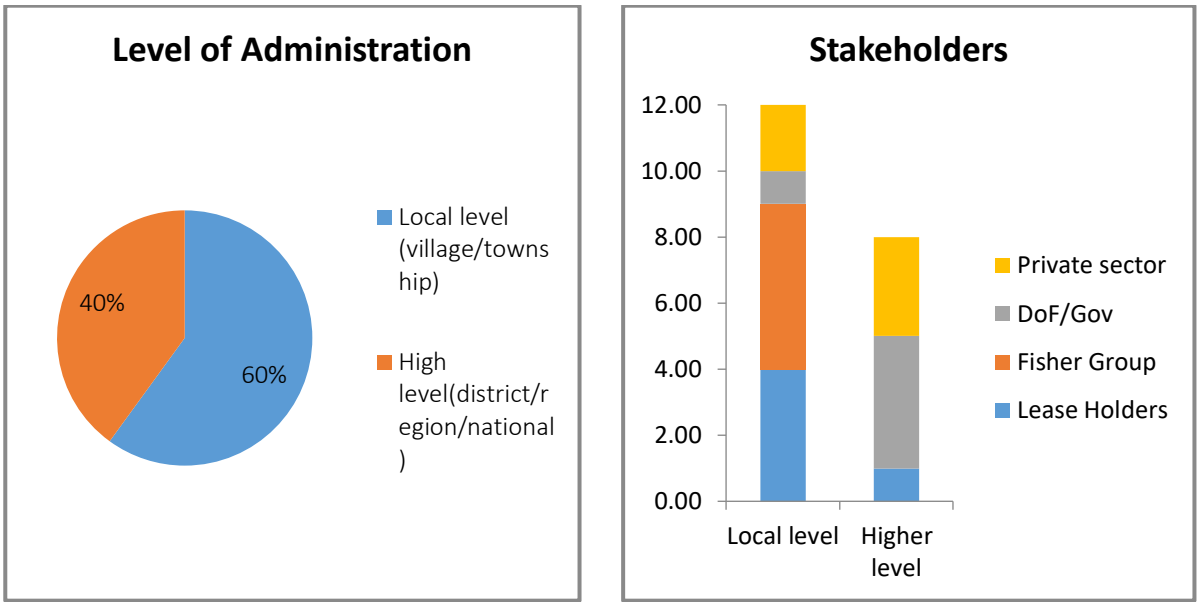


Figure 8. Administrative level where constraints can be solved

4.5.2. Constraints that can be solved by stakeholders

The respondents determined who can solve the weakness/constraint they identified during the discussion. Around 57% of all weaknesses/constraints were perceived to be solved with other stakeholders rather than their group (Figure 9).

- Lease holders think that illegal activities, poaching and limited control of the lease area can be solved within their group. However, they need external financial support and they need to address the decreasing fish stocks in the lease area.
- The fishers' group thinks that all their identified weaknesses/constraints can be solved within their group, but they need to negotiate and cooperate with other stakeholders. For example, the low price provided by the lease/sublease/collector for their catch, this can be solved by discussing with the lease/sublease/collector to increase the fish price, as they know the current market price. They have done this previously and the lease owner agreed with them the increase the fixed price. On the issue of free service for the final harvest, the fishers said that the lease owner may consider providing incentives if he can see the effort done by fishers for this final harvest. Issues on the access to productive areas, selection of which fish to catch, and the capacity to pay the loan needs to be negotiated with the lease owner with the support of the local authorities.
- The perspective of the DoF/government differs from the local communities. They believe that issues regarding management in the lease area needs support from external stakeholders, especially for the government. According to them, the declining fisheries resources, degrading habitats, socio-economic issues, and conflicts between the lease owner and the fishers, can be solved through the assistance of the government, NGOs, and the private sector.
- The retailers and collectors think the issues they mentioned can be solved either within their group or through collaboration with other stakeholders. The constraints that can be addressed within the group are: equal access to fishing for all fishers, through negotiation with

the lease owner; and, the limited number of workers or fishers that can operate within the lease, negotiation with the lease owner to allow more fishers in his lease area.

Results of the workshop reflected the knowledge, attitudes, and decisions of each stakeholder group. It was observed that fishers have limited knowledge about their rights and access to communal resources. Their knowledge on policies that can support them was also limited and they are dependent on decisions by the lease/sublease owners. They have limited awareness of any government assistance they can get, even from stakeholders outside their communities. This is clearly illustrated through the fishers thinking they are the only ones who can address their identified constraints. The complete opposite can be said about the government and the private sector, who knew and understood the policies. As for the lease/sublease owners, they tried to conceal these rights to the fishers as this has implications for their power and potential benefits from the lease area. The retailers/collectors (private sector) group understood the fishers' challenges and capacity. They believed that the issues raised could not be solved by their group alone but through collaboration with the government and other stakeholders.

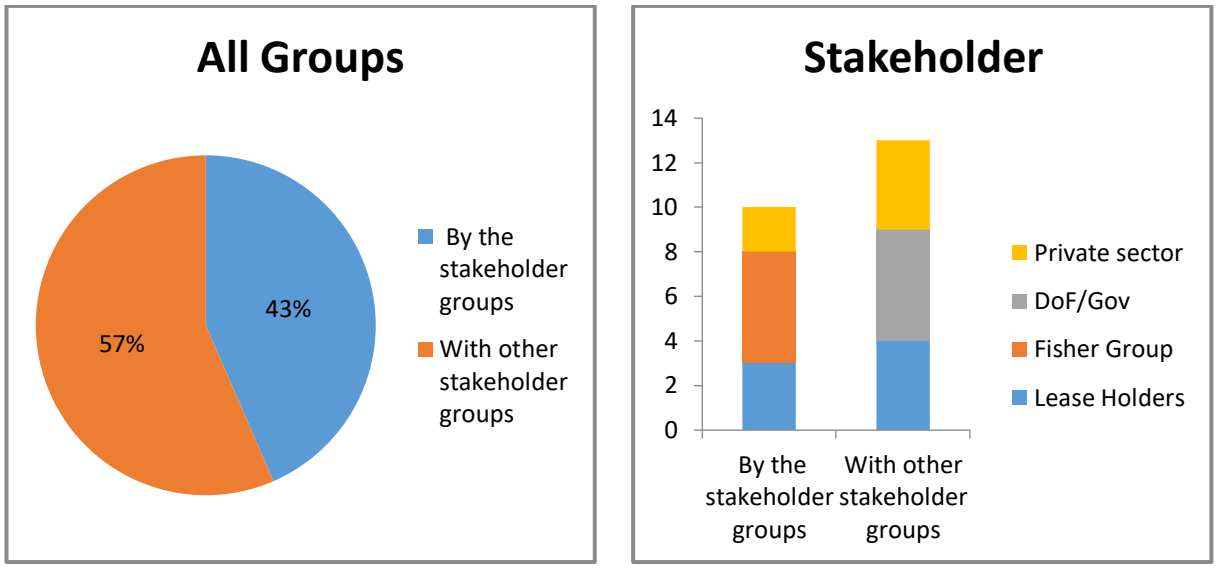


Figure 9. Stakeholders that can solved the constraints

5. Discussion

5.1. Specific entry point at the Fishery management level

Awareness raising by government authorities to the community. The workshop and interviews showed that people were not aware of the conservation practices being implemented in the lease area. They knew about the closed season but didn't know for what purpose or understood its intent was to increase the lease owner's catch during the peak season. They were unaware of the conservation intent of re-stocking/reseeding of the lease area. The communities were not aware of their rights regarding communal resources. They didn't know where to seek support when faced with issues related to the lease/sublease owners.

Use of previous experience to resolve current issues. The fishers cited previous experiences in resolving some issues in the lease with the lease/sublease owner, for example, demanding an increased price for their catch which the lease owner considered.

Diversifying livelihood opportunities for the fishers. The fishers could not leave or complain to the lease owner out of fear of losing their source of income. With the declining productivity of the lease area, it is important to bring in enterprises such as fish processing, aquaculture, and other trades or

services. It is also important to enhance stock re-generation through establishing fish refuges or conservation areas. Since the lease/sublease owners control and limit the fishing grounds, they need to extend their support to other fishers through provision of training on fish processing techniques, and provision of loans.

Intensifying government intervention in sustaining fisheries resources for most the poor people source of food and protein. The interaction of agricultural development and sustaining fisheries resources should be further clarified. The law on illegal fishing needs to be enforced strictly since illegal fishing in lease areas increases annually. Community-led enforcement of the illegal fishing law needs to be intensified in the surrounding villages since they are the ones who are in the area the whole day and can protect and conserve their resources.

5.2. Generic entry point at the higher level

Development of a government policy for integrated cooperation between different water-user stakeholders. All stakeholders cited decreasing catch within the lease area. This is attributed to many factors including the diversion of water for irrigation and enclosure of deep areas to be used for aquaculture. The stakeholders think that the change of the natural water flow affects the ecological and biological systems, especially for migrating species.

Resolving the issue of access to the lease area. The lease/sublease owner still chooses the area for fishers who are allowed to fish, reserving the productive areas for himself. The fishers are at a disadvantage regarding benefits and access rights. The government needs to intervene to include in the policy the provision of equity to the fishers, especially for the poor to have access during the open season. In fairness to the lease/sublease owners, a policy provision that they have control over fish marketing in the lease area with the consideration of a fair fish price.

Financial support to assist lease/sublease owner and the fishers' community. The fishery area for the lease system is still productive and serves as a major source of income for all fishery stakeholders. This meant that obtaining the lease through an auction system is still viable, with profits and benefits for various players. Investing in the fishery area and its system will enhance the productivity and improve the efficiency of the system. If the lease owners and the fishers can get financial support, they can invest to improve their production, including buying equipment, infrastructure development, and measures to increase sustainability of the fishery resources. Support by financial institutions may jumpstart fish processing and trading ventures.

Clear policies and regulatory management plan on aquaculture and fish refuge/conservation areas. Aquaculture is a rapidly emergent fisheries enterprise. There is need for regulations to determine aquaculture areas, with consideration for water passages and important fish stock refuges. A management plan should be developed in such a way that protected fish habitats and natural flooding system for migrating fish species are assured. Government should take the lead in policy development and planning of fisheries management areas. The plan should consider how the stakeholders in the lease system can be involved.

Government support on community management system. There should be a gradual shift from the current individual lease system to one that is more community-based. The latter ensures greater equity of benefits and a more consensual system of fishery resource management. There is a need to develop a policy that supports this shift. There is also need for an enabling environment that allows the community to manage the shift. For example, the lack of investment capital within the fishing community is a major issue. There is the question of management through a more engaged and

consensual manner. Such a shift will provide equal rights to the lease area and a better income or livelihood to small-scale fishers. It also places the role of the community into the core of the system—not just for livelihood but for biodiversity and common resources management. This will require a more focused technical assistance from government in order to enable communities to take on bigger roles in resource management.

Financial support to diversify fishers' income source. The fishers are dependent on the lease owner for access, decision-making regarding management of the leased area, boats and equipment, and loan-capital to conduct fishing. This dependency should be resolved. Support for capitalisation is crucial towards the community's self-determination regarding production, trade, and sustainable management of the fishery resources.

Township government and DoF endorsement of a policy to set up and make functional community fishery groups. Community fishery policy provides rights to small-scale fishers to set up a group that can acquire and manage the lease area. This will enable fishers have equitable access to the resources. This places them as central participants in regulating their fishery, resolving overfishing, setting up and managing conservation areas.

In summary, the generic entry point for the government in this case is to intervene trough development of clear polices and to develop a plan to promote and support sharing benefits, equity and access rights in order to achieve a sustainable fishery. It is also encouraged that the government supports the development of policies for the cooperation between different water users in order to have more sustainable sectors, which wouldn't impact one of the population's main sources of food and protein. Livelihood development is integral for the fishers, since the fisheries are deteriorating and needs time to regenerate. As for the specific entry point, awareness raising and motivation for the fishers to unite and invest for a co-management system that will ensure equal access rights, benefit sharing and equity, and achieve sustainability (Table 7).

Table 7. Summary of generic and specific entry points

Entry Points	Description	Issue addressed
Generic		
Government development of policy for integrated cooperation between different water-user stakeholders.	The government will develop an integrated cooperation policy that will guide the different water-use stakeholders in consideration of the fisheries as the same priority as the other sectors	Prioritisation of agricultural development
Resolving the issue of access to the lease area	The government should learn from the different experiences and use those as a basis for policy development regarding access rights and equity	Access rights, benefit sharing, and equity
Financial support to assist lease/sublease owner and the fishers' community.	The government should develop policies that support the provision of financial assistance to lease and sublease owners and the fishing community in order to manage their resources sustainably.	Limited availability of funds for management and conservation

Clear policies and regulatory management plan on aquaculture and fish refuge/conservation areas.	The government should develop policies and regulatory management plans that control and inspect the impact of aquaculture and agriculture on capture fisheries.	Mitigating impact of aquaculture and agriculture on capture fisheries
Government support for community management system.	The government should develop policies that will emphasise support for co-management.	Setting up and strengthening of the fishers' group management and government collaboration
Financial support to diversify the source of income for fishers	The government should develop polices to support livelihood diversification for fishers displaced from the lease area.	Support to the poor fishers displaced from the lease areas.
Township government and DoF endorsement of a policy to set up and manage a functional community fishery.	Continue to develop the policies on co-management to support sustainability of fisheries resources in the lease areas.	Equity and access of more people and sustainability of the fisheries resources
Specific		
Awareness raising by government authorities to the community	Extension activities need to be intensified to inform the fishers of co-management and conservation of the fisheries to achieve sustainability.	Conservation issues and sustainability of the fisheries resources
Use of previous experience to resolve current issues.	The government should learn from good practices previously implemented in the community to be included in policy development	Development of policies that is relevant to the fishers/community
Diversifying livelihood opportunities for the fishers.	Assistance for the diversification of livelihood activities to the displaced fishers in the lease.	Poverty alleviation for the poor
Intensifying government intervention on sustaining the fisheries resources	Co-management need to be intensified within the lease areas to ensure access, sharing, and rights for more people and sustainability of the fisheries.	Access rights, sharing of benefits, equity, and sustainability of the fisheries resources.

6. Conclusion

The individual lease fisheries management system is operational in the Maletto Auk Met Kun lease area. The system is auctioned off by the government for a period of one year. The winning leaseholder pays around 9,000 USD against an expected catch volume between 8 to 16 tons per year (estimated value at USD 41,600, therefore it is profitable). The leaseholder sub-leases the area by segments. They allow selected fishers to fish for a fee and those fishers obliged to sell their catch at prices 30% lower than prevailing trader prices, and take a loan on fishing boats, fuel and equipment from the leaseholders. The leaseholder collects all remaining fish before the lease tenure ends, thus, not ensuring the sustainability of fish stock for the following season.

This study affirms a definitive performance in terms of the system providing income and jobs to the fishery stakeholders. There is no equity, with the leaseholder and sublessee markedly favoured; the

former collecting payments by the sublessee and both of them earning income from fishers and collectors, through buying fish below market price from their selected fishers and through collection of loan repayments by fishers. While fishers affirmed good performance for access to the lease/resources and market, they are at a disadvantage compared to the leaseholder/sublease because of these conditions imposed on them regarding access and marketing of their catch. There is also the issue of an increasing number of fishers and illegal fishing by non-selected fishers which results in lower incomes for fishers and collectors.

The natural system is deteriorating as evidenced by lower catch and lower biodiversity. The factors contributing to this are the expansion of agriculture and aquaculture in the area, along with sedimentation and pollution, which affects fish spawning areas and water flow. The leasehold system-imposed re-stocking by the leaseholder is being done, but the potential benefits thereof are negated when all stocks are harvested at the end of the lease period.

There are definite gaps on issues of fair access (non-selected fishers and prohibitively high access fees) and equity (share of income from resource use). There is inadequate financial support to fishermen. Policy and regulation enforcement was negligible since the profit-motive of the leaseholder prevails over the sustainability of resources. The gender dimension is very weak because the stakeholders in the resource management (lease and direct fishing) are predominantly male, with few women mainly in the retail and fish processing.

The individual lease system has merits mainly on ensuring livelihood to the fishers selected by the leaseholder/sublease. However, this is in contrast to the absolute control by the leaseholder on fisher-selection, payment for access, fish prices, and the lack of empowerment of fishers -seen in their inability to bid for themselves as they lack capital and are not very engaged in resources management. The responses tend to show low merits for law enforcement and conservation. The main constraints are in the decreasing catch and fish price control by leaseholders. The system mainly favours the leaseholder and his sub-lessees, who dominate the system. The broader segment of stakeholders among selected and non-selected fishers, retailers/collectors, women and the community as a whole are exploited by the leaseholders by his hold over the lease and by his investment through which he profits from the resources.

The identified weakness/constraints of the system are more kinks in the management, rather the whole system itself. Issues of poaching, prices over catch and incentive during end-of-term harvest are solvable between the fishery stakeholders. Issues of degradation of the fishery area and inadequate financial and technical support are to be resolved at higher level with government and external stakeholder's intervention.

To ensure broader participation by the fishers' community, the individual lease system should transition to a community-managed system.

- One way to do this is divide the lease area into segments: one for individual lease system (to be rescinded later) and a pilot community-lease system.
- A step-by-step government plan is needed. This should be done in cooperation with the fishers' communities and external development agencies.
- A key aspect here is organising the fishers' communities in order to prepare them to bid and manage the lease area or its segments by themselves.

- This organising effort will require empowering them through financial support to be able to bid, firming up their operational and management plan (e.g. fishing regulations, equity management, local trade and external trade, etc.).
- This should go hand-in-hand with enhancing their capacity for sustainable resource management (e.g., patrol systems, community refuges for re-stocking).
- The transition plan should also foster a broader plan that encompasses how agricultural development, aquaculture and fishery conservation could be integrated.

Characterisation of Fisheries Management Systems in AD and CDZ

MYFISH 2

Case Study 3

Report

(Co-managed Lease)

Table of Contents

Abbreviation

AD	Ayeyarwaddy Delta
CDZ	Central Dry Zone
CSO	Civil Society Organization
DoF	Department of Fisheries
FAO	Food and Agriculture Organization
FDA	Fishery Development Association
FG	Fishers' Group
FGD	Focus Group Discussion
HH	Household
KII	Key Informant Interview
NGO	Non-government Organization
PDAM	Participatory Diagnosis Adaptive Management
RAAIS	Rapid Appraisal of Agricultural Innovation System
USD	United State Dollar
WF	WorldFish

Note:

Currency Exchange rate: 1 USD =1,346 Burmese Kyat

Weight Conversion: 1 Viss = 1.6 kilogram

1. Objective of the study

The aim of this case study is to generate an "in-depth" understanding of the co-managed lease fisheries management system in Maubin, with a focus on identifying major issues and potential entry points for addressing them. Hence the specific objectives are as follows:

- Assess performance of the Individual Lease fisheries management systems based on agro-ecological, social, and institutional environments in Malato Village tract, Maubin; and
- Identify key issues and opportunities for interventions to improve the performance of this fisheries management system.

2. Methodology

This case study documented the co-managed lease fisheries management systems based on its current performance, strengths/merits, and weaknesses/constraints using both quantitative and qualitative indicators. The final output was the identification of entry points both at the local and higher level for sustainable capture fisheries in the area. The selected case study is located in Malato Village tract, Maubin Township. The site was under an individual lease management system until 2017 when it was changed to a community fisher group management system. The information and data used in the analysis were from both primary and secondary data sources .

Review of Secondary data

A matrix was developed to compile existing information about the site, fisheries, and type of management in the target area. The information gathered to complete the matrix was sourced from census, FAO assessment, MYFish 1 fishery survey, MYFish 2 Component 2, and other available information from DoF District, Township and Region.

The Analytical Framework

The approach for the case study characterization process was adopted from the tool Rapid Appraisal of Agricultural Innovation Systems (RAAIS). RAAIS is a diagnostic tool originally developed for the agricultural sector that allowed for analysis of issues rangin from broad entry theme towards more specific entry points for productivity, natural resource management, social development, and institutional innovation. The RAAIS tools were combined with another theoretical framework tailored to the identification of fisheries management issues--the Participatory Diagnosis Adaptive Management (PDAM) (Table 1). The two frameworks were combined, adopted, and graphed into the radar issues of PDAM as the four analytical dimensions based on RAIIS results. The four dimensions are elaborated, as follows:

Table 1. List of Dimension Indicators

Assessment Dimensions	Indicators
People & livelihoods	Living conditions; diversification/income dependence; assets and income poverty
Natural system	Biodiversity; stock status and trends; fishing practices; aquatic ecosystem conditions
Institutions & governance	Fishing and development policies; organizational and institutional capabilities; access to markets and financial services; collective action abilities; governance performance and rights; legal frameworks
External drivers	Infrastructure development; conflicts with other sectors or users

Definition of the four Dimensions[1]

People & Livelihoods - this is the socio-economic aspect of the fishing communities and it encompasses household well-being, which includes household income, diversification of household

[1] Definition was taken from the MYFish2 - Characterization Component 2

livelihoods, household fish consumption, living conditions, norms and culture, and household assets. It also can include conflict with other users and resource use

Natural system – a biological classification of yield, biodiversity and sustainability of the fisheries resources and ecosystem, its stock status and trends (total catch, total catch by species, fishing effort, catch by unit effort, and number of species), fishing practices, and aquatic ecosystem condition, such as connectivity, breeding ground, pollution from upstream, agriculture, industry.

Institutions & governance – the manner in which a power is executed in the management of the fisheries sector. It is the enabling environment aspect in governing fisheries management in order to reach maximum sustainability (legitimacy, membership rules, access rights, management controls, representation rules, sanctions, enabling legislation/policies/legal framework, local support, financial management and services, access to market, organizational and institutional capabilities.

External drivers - outside influences that can impact the fisheries resources and its ecosystem. Various external factors can impact the ability of the fisheries to achieve maximum productivity/biodiversity and sustainability. These external factors might include infrastructure development, macroeconomic instability, climate change and environmental uncertainty, migration, market demand changes, price fluctuation, land use changes, migration.

RAAIS as a participatory diagnostic tool combines multiple methods of data collection, building on existing experiences with rapid appraisal approaches and (participatory) innovation systems analysis. The methods for the RAAIS shall generate both qualitative and quantitative data; facilitate 'insider' and 'outsider' analysis; targets different stakeholder groups across different levels with individual, group and multi-stakeholder perceptions on weaknesses/constraints and solutions; and provide sufficient detail on the main weaknesses/constraints under review, the capacity for innovation in the fisheries management system and the functioning of the fishery management system. On the other hand, the innovated framework will be used also to identify the performance, and strength/ merits (what has worked) of the management systems under review.

Methodological steps

Based on RAAIS tool, the following steps were taken to assess the existing fisheries management systems based on the context of each site: (i) identifying strengths/merits, and weaknesses/constraints; (ii) categorizing strengths/merits, and weaknesses/constraints; and (iii) exploring specific and generic entry points for recommendations for the current fisheries management system to achieve equitable and sustainable fisheries. The objectives, sessions and activities of each stage are presented in detail in Annex 1. The steps were conducted in the selected site to gather a broad range of information from relevant stakeholders and articulate a participatory assessment of existing fisheries management systems. These methodological steps are shown below:

Multi-stakeholder workshops focus mainly on insider analyses of the current fisheries management system and conditions of the system. Three groups of stakeholders identified, categorised and analysed strength/merits, weaknesses/constraints, and performance of the existing management system to provide specific and general entry theme for innovation in the fishery management system.

The DoF and WorldFish in Myanmar led the selection and organisation of stakeholders who participated in the multi-stakeholder workshop. A total of 18 participants, including 1 women attended the multi-stakeholder workshop activity. Figure 1 shows the percentage of participants in the three stakeholder groups. The Fisher Group had the highest participation, at 53% of total participants.

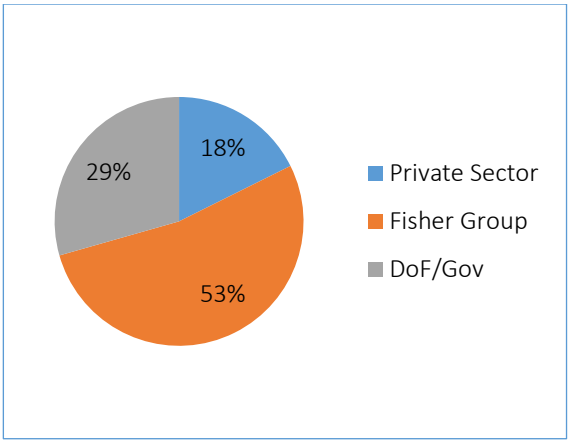


Figure 1. Participants of multi- stakeholder groups' workshop in Taputtanaungyi village, Maubin Township

Key Informant Interviews were facilitated through one-on-one conversations between WF/DoF team members and a key informant. Four key informant interviews were done, with a village CFG leader from Zee Kone village – who was also holder of Zee Kone segment of the lease, a village leader of Zee Kone and Lat Pan Kone villages, the vice-chief of Maubin Township Fishery Department and a village CFG leader and sub-village leader of Kon Dine Nay sub-village of Malato village track. The KIIs were used to gain extra in-depth information based on what was gathered during the multi-stakeholders workshop, to validate secondary information, and to understand the perspective on the existing fisheries management system in the area of relevant individual respondents.

Focus Group Discussions were facilitated with the representatives of full time fishers who are members of the CFG, and the private sector (fish collectors/traders). A total of 18 participants, including 1 woman, attended the focus group discussion. The FGD was used to collect more in-depth information related to that received during the multi-stakeholders workshop and to understand the perspectives of and dynamics between different groups under the existing fisheries management system in the area.

A total of 36 respondents participated in the information/data collection during three days of field work (12 – 14 August 2018) at Taputtanaungyi village, Malato Village track, Maubin Township. The Fisher Group and the private sector had the highest number of respondents participating in data collection (Table 1).

Table 2. Summary of methods and sampling strategies and sample size deployed during the study

Method	Type of analysis		Stakeholders groups targeted – Sample size				
	Stakeholder led	Researcher led	Fisher Group (Full time fishers)	Fisher group (Part time fishers)	DoF/ Village heads	NGOs/ CSO	Private Sector (Local fish collectors)
Multi-stakeholder Worksop	X		8	1	5		4
Key informant interviews		X	3		3		
Focus Group Discussion		X	8				4
Secondary data		X					
Total	36		19	1	8		8

3.

3. Fisheries System

3.1.1. Natural system and fishing techniques

The Hlaing Tar Mezali canal forms part of Toe (Thande) River floodplain, where seasonal flooding dominates the whole area. It was a burrow pit that was created in 1995 when the soil was excavated to build a section of road between Hlaing Tar and Mezali villages, which later became the main road between Yangon and Maubin. The road and the canal run across the floodplain north of Toe, (section of Thande River as appears on Map), between Malato and Gyi creeks. Originating at the river in the south, the canal extends northward, on both sides – the larger on the east and smaller on the west of the road. To the east of the canal lies a vast expanse of rice paddy.

As soon as the canal was completed a gate was installed to regulate water for irrigation. Over the last few years, however, more and more aquaculture ponds were developed by private individuals in areas not far from the lease, within the rice paddy landscape. In Maubin, over 50,000 acres of floodplain were reported to have been converted to fish ponds.

As the wet season starts in June, the water level in the Toe river swells and flows into the canal, however the gate is reported to be closed between May and August to prevent river water from entering. This was reported to protect rice paddy and, later on, aquaculture ponds from flooding. Rain and flood water in the wet season inundate the whole area thus providing productive fishing grounds outside of the lease itself. While villages are well established along the two creeks on both sides of the floodplain, eight villages along the canals are not that well established and were reported to have been established relatively recently with permission from the Department of Irrigation after the road was built. The residents settled in houses mostly covered with thatched roof and built on stilts slightly over 1 meter on the fringes of the flood area between the road and the eastern canal. These villages are among the poorest and are likely to depend on fishing more than on rice farming.

The lease was first put under individual holding arrangement, when it was divided into 5 segments by the holder who subleased them to other people. The holder, sub-lessees, and fishers prepared their fishing gears and equipment in August. They started fishing in September and fished until April, with most of the fishing taking place between September and November. The main fishing gears used are set and drifting gillnets, surround net combined with brush-park, stow net, cast nets, trammel net, drag nets, and traps.

DoF last year granted the lease to a Community Fisher Group (CFG) at the floor price without holding an auction. Under the new management the lease is divided into seven segments, following the milestones on the road. Eight non-fishing zone have been established, one by each village. In principle, each segment has a non-fishing zone except the segment where two villages are located – Haling Tar and Lad Pan Kone – where 2 non-fishing zones are established.

The main fish species caught in and collected from the lease area include rohu, catla, tilapia, snakehead, and snakeskin gourami. Fishers mentioned a continuous decline in fish catch for the last five years from 10 viss (16 kg)/day to only 3-4 viss (4.8-6.4 kg)/day and from 5 viss (8 kg)/day to 1 viss (1.6kg) per day in the high and low season respectively. The issue of declining catches was raised not only by fishers but also by other actors in the supply chain. Fish collectors and traders reported to collect only 20 - 30 viss (12.5 – 18.75 kg) from 10- 15 fishermen now (1-2 viss from each fisher)/day. This was reported to have partly contributed to the increase in fish price, for example, the price for snakeskin gourami went from 500 Kyat per viss to 1,300 Kyat (USD?) per viss now. Similarly, the price for snakehead fish went from 2500 - 3000 kyats (USD?) per viss to 5000 kyat per viss.

3.1.2. Changes in fisheries management

When the irrigation channels were turned into a lease in 1997, the floor price for the first auction was around 300,000 Kyat (223 USD). Generally, the auction starts in April and is granted in May. Closed season is from May to July. Until 2012, bidders included local residents and residents from elsewhere but this was changed to only allow local residents to place a bid. A recent change was seen in 2017 when a lease was granted directly by the DoF to a CFG at a floor price without a bidding process. This was done following a request by the CFG for a number of years and was decided in favour of CFG management by the regional government.

It started in 2013 when a local NGO - Networks Activity Group (NAG) provided over 200,000 Kyat (149 USD) to the CFG that year to organise awareness-raising activities concercing co-management. The Pyapon-based Fisheries Development Association (FDA) was engaged to raise awareness of the local fishers at Hlain Tar Mezali regarding CFG management. In the same year, 47 members from 4 different villages in the lease area joined to form a CFG, Kya Ye Unity Fishermen Association (KYUFA), mimicking the FDA's structure and operation. The early intention was to influence change in fisheries management in Maubin but not necessarily manage Hlain Tar Mezali directly. In 2014-2015 the CFG submitted a petition to Township DoF for a change in fisheries management in its area, claiming the local fishers were either denied access to the lease or the fees were too high for local fishers to pay back. The first demand was for a reduced fee and to allow CFGs to bid for the lease. The same complaint was submitted to the regional government. The regional government later gave instruction to permit CFG to bid for the lease/lease at a floor price below than four (4) million Kyat (2,972 USD) and this provided the basis for bidding on the lease by CFGs.

As the CFG gained support more and more fishers registered as members. Currently, the CFG has over 300 members, members are not necessarily from the Hlain Tar Mezali area. In 2017, the CFG secured additional support from NAG to negotiate with the regional government about granting a license to the CFG. Since there was only one CFG that submitted a bid for the lease, DoF decided to grant the lease to the CFG at the floor price for a one-year term. Once access was granted to the CFG in 2017, DoF helped with awareness raising concerning laws and regulations, and supported the CFG to control illegal fishing.

A CFG Management Committee for the lease was formed and was charged with managing the fisheries, delineating and protecting the no-fishing zone in each village, and allocation of 2 to 3 brush parks per village for fishing. Similar to the sub-lease system in the past, a fisher who pays an access fee to a particular village CFG leader may only fish in the relevant segment held by that leader. However, this rule is flexible as village CFG leaders negotiated for some fishers from one segment to fish in other segments as well.

The price of the lease consistently increased at about 10% per year between 2014 and 2016. However, the floor price offered to the CFG increased at a slightly higher rate, from 10.6 million Kyat in 2016 to 13 million Kyat in 2017 (Figure 2). On top of the floor price there is a commitment by the CFG to commit funds, 0.7 million Kyat in 2017 for example, for seed stocking by DoF, resulting in a total price of 14.3 million Kyat (10,524 USD).

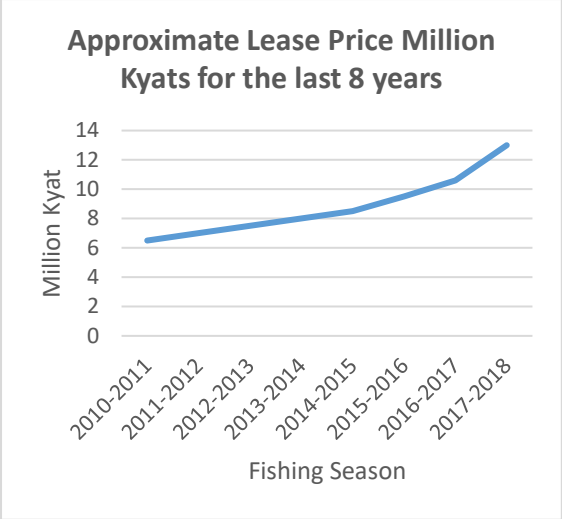


Figure 2. Trend of Hlaing Tar Mezali Lease for the last 8 years

There is a noticeable long delay this year as the bidding process had not taken place and was reported to be scheduled for 15th August. The actual auction was later reported to have taken place on 18th September. At least 2 CFG groups were reportedly prepared to submit their bid for the lease for 2018. Regardless of the 10% annual increase in floor price, every 5 years a recalculation is made based on 5-year average bid price to reset the floor price for the following year.

3.1.3. Current organisation and management

The lease was controlled and managed by an individual leaseholder since 1997. During this period ownership of the lease changed several times. The main leaseholder arranges the fishing activities by engaging labourers. The area can be subleased to others. Regardless of the fact that the lease is quite small it was divided into five segments, each of which was subleased to other individuals in the local area. Each segment was defined by the holder. The segments are not equal in size and are sold at different prices, which are negotiated with potential segment holders. The main leaseholder usually selects the people who submitted the highest offer as sublessee, however in some cases negotiations do take place. The fees for each subleased segment for a full fishing season had to be paid upfront.

While the leaseholder mostly hires labourers to fish for him, the sub-lessees either fish themselves and/or sell licenses to local fishers. Labourers were hired at a rate of 2,500Kyat/day and 4,000 Kyat/day (1.9USD/day, 3 USD/day) for women and men respectively. Women were mainly engaged in picking fish from the net. Both the leaseholders and sub-lessees sell fishing rights to local fishermen at 60,000-150,000 Kyat (44.6USD-111.4USD) per fishing season. Few local fishers were able to make the full payment upfront and consequently decide themselves what to do their catch. Most fishers couldn't afford the full payment. They were allowed to fish, but could only sell their catch to the leaseholder or relevant sub-lessees at lower prices. Fishing was only allowed between 3.5 to 5 months a year.

Under the single lease holding system, it was difficult for local fishers not only to access fishing but also to sell their catch to whom they choose because the local market was controlled by the leaseholder and to some extent the sub-lessees who dictate fish prices. Poor fishers had to sell their catch at rates that were only half of the prevailing market prices.

In 2016 more fishers launched complaints against the fee system claiming the fees were too high. After intervention by the DoF the leaseholders agreed to make a compromise regarding the fee, for

those lodged the complaint. This marked the start of the growing consensus among community members for the CFG to claim the rights to holding the lease. With permission from the regional government, DoF arranged to grant the lease to the CFG, without an auction process, at the floor price of 13 million Kyat for the 2017-2018 fishing season. The DoF set certain requirements when the lease was granted: limit the number of set gillnets to three, a closed season must be observed between May and July, and non-fishing zone must be established within the lease area.

In 2017, the cost was split into 7 parts as follows: 1) Hlain Tar and Lad Pan Kone - 5.3 million ; 2) Zee Kone - 2.4 million; 3) Atet – 2.4 million; 4) Pa Pin – 1.7 million; 5) Pa Laung – 3.3 million; 6) Khanaungee – 1.6; and 7) Alan Oak – 0.3 million. The total cost amounted to 17 million Kyat, including the floor price of 13 million, administrative costs for the CFG management committee, a commitment to restocking fish seed, cost for the conservation area, and repayment of interest on loans.

Currently, the Lease Management Committee (LMC) for Hlain Ta Mezali, also for KYUFA, has Taputanaugi village CFG leader taking overall leadership role, a deputy leader from Tamalo village, a secretary from Thayatengu Village, a vice secretary from Zee Kone Village, an finance from Thayatengo, an accountant from Khanaungiye, an auditor from Athet village, and 4 other members. Under the current management system, the lease is divided into 7 segments following the village administrative boundaries after consultation with the LMC, a village tract chief, and township DoF staff. For each segment a non-fishing zone, about 100m x 10m in size, is designated. The LMC supervises how fishing is allowed in each and all segments. Practically, a village CFG leader is the holder of the segment and makes an investment upfront to contribute to the overall cost for the lease. For example, for Zee Kone village segment 4 CFG members pooled together 2.4 million Kyat to pay for the rights to hold the segment. During the LMC's quarterly meeting, the Village CFG leaders report on the fishing status in each segment, on conflicts in fishing, on pressure coming from external drivers, and on level of compliance. Regardless of the change from the single holder to the CFG management system, it is reported that some of the segment holders are the same, as for example, segment #1 has had the same holder for the last 5 years.

It is to note also that the KYUFA does not only work at the Hlain Tar Mezali lease. With its experience and the large membership beyond the lease, in 2017 it facilitated winning the auction of between 40 to 50 out of a total 146 leases in Maubin. However, most of the leases are under management by other CFGs and it directly manages only Hlain Tar Mezali and two leases in the township. As it operates from Taputtanaungyi village, where the leader resides, KYUFA claims to cover all its operational costs from membership fees alone.

For Hlain Tar Mezali, KYUFA has developed guidelines on fisheries conservation management that were submitted to the township DoF office at the time of the auction. The guidelines provide for conservation within the lease area with the aim to maintain fish resources and species diversity and to provide a regular source of income for fishers. Suggested management activities include 1) defining conservation areas; 2) allocating funds for conservation activities by segment holders; 3) raising awareness with local fishers on protection of the area; 4) demarcation of the conservation areas; 5) enforcement of regulations. A general schedule is provided by the CFG for fines and penalties to be imposed on fishers on violation of the conservation measures. This include an average 10,000 – 15,000 Kyat (7.4-11.1USD) for each fishing gear; 100,000 Kyat (74.3USD) fine on electrofishing and for oversized fishing gears; and a reference to provision of relevant laws for destruction of information panels. The process from these will go to CFG's Fund of the relevant CFG.

Aside from the closed fishing season required by DoF and the non-fishing zone for each segment enforced by village CFG leaders, the current management system only allows small-scale fishing. However, there is no limitation on the number of fishers, gears, or fishing duration. The reduced

accessed fees have enabled many more local fishers to access fishing and the rule applies equally to all without any preference. The CFG issues warnings and fines between 50,000 and 500,000 Kyat when perpetrators are caught.

4. Results

4.1. Performance of the system

4.1.1. Overall performance

The overall performance of the current fisheries management system was determined based primarily on the perceptions of three types of stakeholders who shared their responses in the multi-workshop activity. The PDAM framework was used to assess the performance based on the four dimensions: natural system, people and livelihood, governance/institutions, and external drivers. The performance score of each indicator was divided into three, with 3 as the highest score.

Stakeholders' responses showed not much difference in current performance for all the four dimensions. Institution/governance scored highest, followed by livelihood and people, and natural system and external drivers scored joint-lowest, as shown in Figure 3. By performance indicators, 'enforcement of regulation' and 'environmental degradation' had the highest score. Biodiversity, stock status, food security, market access, and access to resource & resource sharing were second-highest followed by income, access to financial services, policy and regulation, and illegal fishing. Habitat and infrastructure affecting environment got the lowest scores (Figure 4).

Several patterns emerged from the workshops. The fishers and government groups scored biodiversity and stock status highly, while giving habitat a low score. The private sector and the government groups had the same opinion regarding the average performance for food security. The fisher group gave this a high score. The fisher group gave almost all indicators for institution and governance a high score, while the private sector group gave all the indicators in this category a medium score. The government group gave a high score to regulation enforcement, a low score to policy and regulation and the remaining indicators in this category got a medium score. For indicators under external drivers, the opinions among the three groups didn't show distinct patterns. The private sector group gave medium scores to all the 3 indicators under this category, the government group rated the performance for illegal fishing and environmental degradation highly, and the fisher group gave a high score to environmental degradation and a low score to illegal fishing, with no knowledge about infrastructure affecting the environment.

In the coming five years, the performance for three of the four dimensions is expected to improve, with the exception of 'external drivers' which is expected to get worse. There is consensus by all three groups on the expected performance for the 3 indicators under natural system – improvement for biodiversity and stock status, a decline for habitat. For the indicators under livelihood, the government group foresees an improvement for both indicators – food security and income - from medium to high. Both other groups expect no change from the current level, which is high for both indicators according to the fisher group and medium and low respectively for the private sector group. All indicators under institution and governance are similarly expected to increase to high for all indicators by all three groups. For the external driver dimension, all three groups expect that performance on illegal fishing will decrease to low from a current score of average and high for the private sector and the government group respectively. For 'environmental degradation', the government group expects the score to go down to medium. The fisher group expects it to remain high and the government group expects it to decrease to medium. Although the private sector and government groups expect to see

no change from current scores of medium and low, respectively, for infrastructure affecting the environment, the fisher group has neither knowledge of the current nor the future trend.

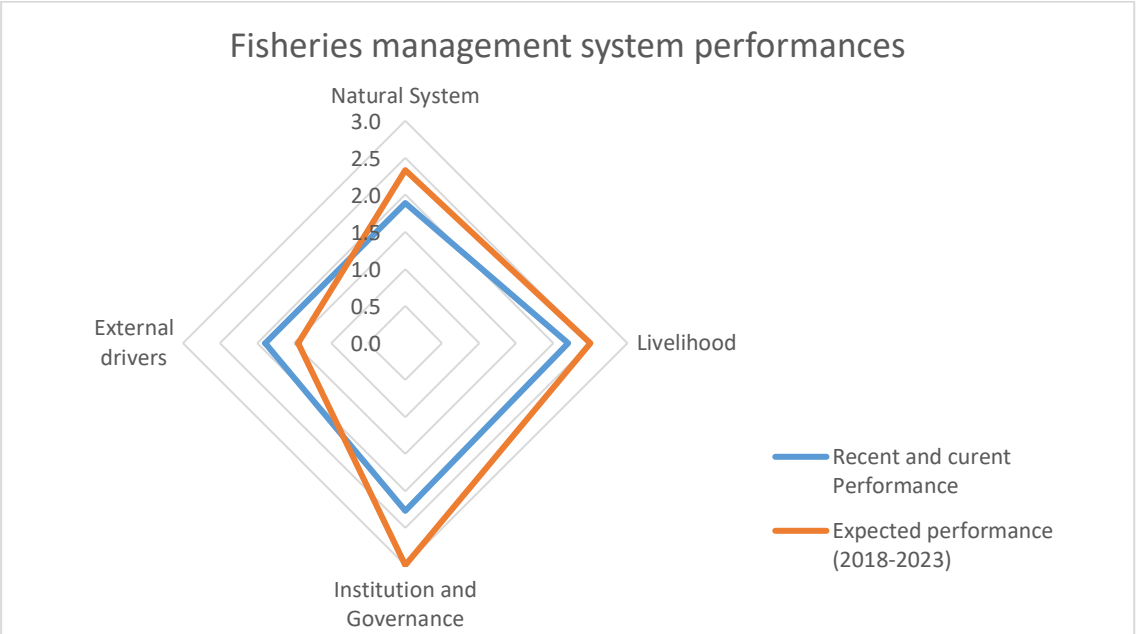


Figure 3. Current and expected performance of the fisheries management system

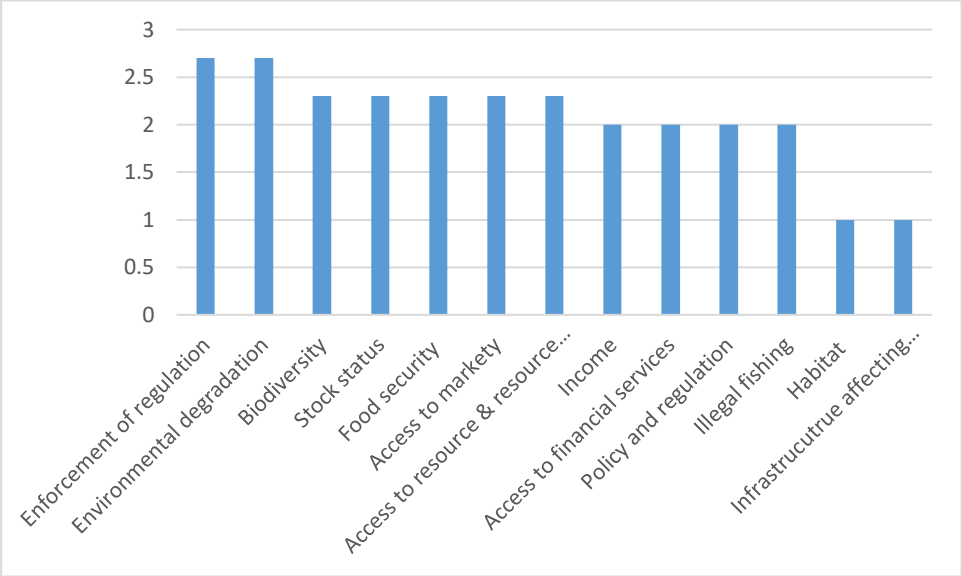


Figure 4. Current Management Performance Indicators

Natural system

The assessment of the performance of the natural system was based on biodiversity, stock status, and habitat. All the respondents agreed that the biodiversity in the lease continued to degrade until 2017 when the single holder management system was replaced with co-management by the CFG. They noted that the fact the nearby channel and other waterways were equipped with gates to control

water for irrigation has had long-term effects on the natural floodplain system where the lease is located.

The gate is now reported to close in May and open in September. As they expressed the gate should be open when it closed in the flooding season to allow for water and with it fish from Thande River they understand that preventing paddy and fish farmed fish from damage by flood is the priority of the current policy but also the power of the affluent people. Operation of the gate is said to be under the authority of the Department of Irrigation but it is also influenced by local actors. It is reported that people paid 10,000 to 20,000 Kyat to influence how the gate is operated. The last 5-7 years have also seen aquaculture ponds expanding in size within the floodplain and the ownership of the fish ponds reinforces how the gate operates now. Embanking fish ponds and operating the gate are said to cause habitat fragmentation and obstruction to fish migration respectively. Pollution from chemicals used rice and aquaculture production have become of concern. More intensive agriculture production was thought to increase sedimentation causing the lease to become shallower.

While all the groups unanimously agreed that habitats will decline as the current use pressure will continue and the natural system will change in response. Annual seed stocking can help replenish wild stocks and should be able to compensate for the losses in fish stocks and biodiversity.

Livelihood

All three groups mention that the natural system is under increasing pressure and daily catches have been on the decline for the last 5 years. They praise the current management and say it enables more local fishers, particularly the poor, to be able to fish and do so all year round. This is said to significantly improve local livelihoods and income for some people in the community. The reduction in fishing fee, access to interest-free loans and the possibility to sell their catch at market price allows local fishers to save money, contributing to improvements to their livelihood. Other actors in the fish value chain, such as fish collectors and fish processing households also benefited. Salted fish, dried fish, and fish paste are the main fish products being produced.

All groups thus agree that now fishers get higher incomes than in the past because they, particularly poor fishers, were deprived of their fishing rights in the past. They argued that with higher incomes they are able to buy fish elsewhere, if needed, to supplement their local supply to meet their food security needs. They claim that aquaculture fish should play an increasing role in ensuring food security. The government group contends that, although wild fish are in decline, because fresh fish can be sold at higher prices this helps maintain a steady income for fishers and fish collectors.

Institution and Governance

The performance of 'institution and governance' was assessed based on access, enforcement, and policy and regulations. The CFG argues that there is more fish now in the water compared to the time before co-management was in place. This was partly due to the establishment of no-fishing zones that were made possible through discussions between village CFG leaders, village track leaders, and DoF staff. Another argument is that there is now a better arrangement in place where the CFG coordinates between fishers and farmers so that farming does not infringe further on waters closer to the lease. The fish collectors' group agrees with the CFG that access improved for all fishers. They also agreed that village CFG leaders have improved knowledge, which allows them to manage fisheries more effectively and the CFG structure allows it to negotiate with the government for improved access for all fishers. This last point is in line with the government response that when there was no CFG group

local fishers were afraid of seeking support from the government fearing repercussion from leaseholders, but that now the CFG can represent them.

The CFG has limited power and authority and mainly deal with local issues involving its members. For example, only the DOF has the authority and power to punish perpetrators coming from outside of the community. When it comes to dealing with interests beyond the lease fisheries, for example rice farmers and more powerful fish farm owners, support from other actors is needed, for example from NGOs or appropriate authorities, but not yet available. DoF requires that leaseholders or CFGs assume management responsibility from the time they win the auction, which usually takes place in May, until end of April the following year when the closed fishing season starts. However, due to the delay by DoF in the bidding process until mid-August this year, there legally was a gap in management responsibility but the existing CFG was said to continue its management until the new auction takes place.

External drivers

Performance of external drivers was assessed based on illegal fishing, environmental degradation, and infrastructure affecting the environment. All stakeholders mentioned that illegal fishing activities in the lease area had been increasing until 2017 and drastically declined afterwards. The main reasons were: (i) many fishers, particularly the poor, were deprived of fishing access, (ii) the access fees were high, (iii) the areas where fishing was allowed were small, and (iv) fishing was allowed for only 3.5 to 5 months a year. In the past, leaseholders normally stopped perpetrators and handed them to the local police just to find that no action was taken by the police against the perpetrators, because they felt sympathy because they are poor.

All groups mentioned changing the system in 2017 has led to better compliance with the rules, as the new rules were developed through a participatory process. All fishers, including the poor, are allowed to fish all year round, and enforcement was preceded by awareness raising. The CFG argues that when all local fishers, including the poor, are given fishing access year-round they do not see the need to violate the rules. However, poaching by residents from other villages, particularly during the closed season, created conflicts with the CFG members. Electrofishing and poisoning are being used and affected larvae and juveniles of many fish species.

The stakeholders mentioned that the ecosystem was degrading because of agriculture, aquaculture, and infrastructure development. The CFG and government groups mentioned the increase in intensive agriculture and later aquaculture, including using more chemicals, has been the main cause of water pollution and sedimentation in the lease area. Village leaders were said to have advised farmers who ignore it. The irrigation gate is seen a major barrier to fish migration as it closes in the wet season between May and August. The private sector group noted the expansion of aquaculture in the nearby wetlands reduces available space for fishing. They also praised improved road access, which facilitates market access and allows fishers to sell their fish when they are still fresh (Table 3).

Table 3. Summary of Performance of the current management system

Dimensions	Rank	Key point/highlight
Natural system	4	Biodiversity, fish stock and habitats are degrading as agriculture and aquaculture are prioritised; no consideration of fish migration in sluice gate operation; destructive fishing methods; and environmental degradation such as sedimentation and pollution impact the system. However, local perception is that, regardless of the habitat degradation and pollution, seed

		stocking would compensate the losses and may eventually be able to enhance fish production.
Livelihood	1	Although the poor may be most affected as they depend on capture fisheries for their own consumption their improved access help secure their food security. This is also true for fishers' and fish collectors' income. Fish are also available from aquaculture. This adverse effect on local income may be offset by new improved road access and the ability to sell the fish catch at higher prices when it is still fresh.
Governance	2	The current co-management systems is reported to bring improvements to fisheries management. Broader access to fishing for all, designation of no-take zones, participatory decision-making, and roles play by the CFG management to represent the CFG are among the improvement made.
External drivers	3	Inappropriate operation of irrigation gates continues to affect fish migration; illegal fishing and poaching were mainly due to restricted access for poor fishers; environmental degradation due to agriculture, aquaculture, and pollution. However, improved road access allows fishers to sell fish at high prices when it is still fresh.

4.1.2. Productivity and income

All respondents mentioned that catch from the lease decreased compared to five years ago. According to the fishers, they previously caught 10 viss (16kg) of fish per day during peak season. Now, they catch only 3-4 viss (4.8-6.4 kg) per day during the peak season. During low season fishers previously caught 5 viss (8 kg) per day, compared to just 1 viss (1.6kg) per day now. A former segment holder in Zee Kone village said he caught between 20 and 30 viss (32-48 kg) a day depending on what gear he used.

Village fish collectors could not compare the catch they collect now to the past as mainly leaseholders and sub-lease holders collected catch in the past. It is estimated, however, that five years ago the trade in fresh fish was between 8,000 and 10,000 viss/year and has only been between 2,500 and 3,000 viss in recent years. Each fish collector now gets between 20 and 30 viss a day from between 10 to 15 fishers, at an average of one to two viss per fisher. The decline was attributed to the irrigation gate causing barriers to fish migration, to destructive fishing methods in recent years, intensification of agriculture that had led to use of more chemicals, and the expansion of aquaculture which threatens the availability of fishing ground for wild fish.

As can be seen in fig. 2 above the bid/floor price for the lease kept increasing. The increase was more than 10%, from 10.6 million Kyat in 2016 to 13 million Kyat in 2017. Leading CFG members have to raise funds, with able members also contributing - the village CFG leaders to meet the overall lease price set by DoF. For 2017, the costs were split between the holders of the 10 segments, each of which is represented by one or more CFG members. The contribution of each village SFG to the total cost for the lease is discussed and decided by all village SFG leaders. Each share is not necessarily equal and is decided based upon the catch volume recorded in recent years. For Zee Kone village segment, for example, 4 CFG members jointly invested 0.24 million Kyat.

In the past each fisher was charged between 60,000 and 150,000 Kyat, depending on the gear type, to fish for 3.5 - 5 months. Today the fee is 10,000 Kyat for a set gill net and 20,000 Kyat for a trap, with no time restrictions (between 40 and 50 traps). Whereas the leaseholder and sub-lease holders entered into an agreement with selected fishers, most of whom received loans and repaid their loans with the fish they caught at half market price, collecting fish from the fishers is now done through a different arrangement. The village CFG leaders don't necessarily act as fish collectors. Each collector provides interest-free loans to fishers at 150,000 Kyat each to around 10-15 fishers. The fishers pay back in catch to the collector, at market price until the loan is repaid. Then the fishers may decide to sell their catch to different collectors for the remainder of the fishing season. If they fail to repay within the year the remaining debt will transferred to the following year and the balance will be deducted from the amount they are eligible for when taking another next loan. In 2014 people could access credit from the MoALI Mya Sein Yaung project. Each village was entitled to 2 million Kyat loan but some villages haven't been able to pay back their loans.

For three villages – Kha Naung Gyi, Condi Lay and Led Pan Kone – about 40% of local people fish between November and January (high season) and about 60% of them fish in the low season, when they process it into dried fish and work in their paddy field. All fish collectors are also part-time fishers.

The village CFG has additional commitments, some of which are passed on from DoF. For example, The Zee Kone village segment has to pay 0.2 mill Kyat for the segment and 0.15 mill for seed stocking to pass on to DoF. In addition, this village CFG had to pay a 50,000 Kyat transportation fee to the TMC and 0.1 million to the Village Development Fund, which was partly spent on school repairs. Thus, in total the segment holder had to pay 0.24 million Kyat to hold rights over this segment. For example, in Zee Kone village four CFG members mobilise a joint share of 0.24 million Kyat to be able to get hold of the segment. The amount breaks into 2 million Kyat for access to holding the segment, 0.15 million for seed stocking by DoF, 50,000 Kyat for transportation of CFG leaders to facilitate all the arrangement and meetings, and another 0.1 million Kyat for village development fund. A fisher may pay between 5,000 and 20,000 Kyat, for example 10,000 Kyat for cast net, 20,000 Kyat for a set of traps.

However, not all villages contributed to the fund. There are 50 fishers from 320 HHs in Zee Kone village. Other livelihood activities for the village include rice farming, small businesses, and daily wage labour. Income from fishing varies by season and ranges from 4,000 – 5,000 Kyat per day in the low season to 20,000 – 30,000 Kyat/day in the high season.

Overall, no change in income was reported. Although their catch declined, they were able to sell it at a higher price. For Snakeskin gourami, the price was 500 Kyat per viss but now is 1,300 kyat/viss.. The price for snakehead was only 250 – 300 per viss but now it can reach up to 5,000 Kyat/viss.

4.1.3. Benefit sharing and equity

The individual management of the lease until 2017 disadvantaged small fishermen. The leaseholder and the sublessees charged a high price for fishing access, therefore only a few fishers were able to afford the fee and be allowed to fish. Others were hired as wage labourers. Fishers were allowed to fish only between 3.5 and 5 months. The holder and sub-lessees would be the only ones fishing for the remainder of the season. In addition, some fishers who couldn't make the payment in full upfront were given access to fishing and were paid half market price for their catch. It is clear that under the

past management the leaseholder and sub-lessees benefited most. The few fishers who were able to make the payment upfront had some benefits. Those who had to pay back in cash benefited the least. The vast majority of local fishers could not benefit from the management system. In addition, as the holder and sub-lessees also fished, they could make an additional profit from selling higher up the fish value chain.

Under the CFG management system, the lease is divided into 7 segments. Each segment is held either by a single member or by a group of CFG members called village CFG leader. Each segment holder has to collect the share from the local members of the CFG within the corresponding village. In regards to the equity, the responses were that there is no requirement for each member in the group to provide an equal share but proceeds from access fees are shared within the holding members proportionate to the size of each share. Everyone in the group is satisfied with this arrangement. However, since there is no limit in the number of fishers, the more fishers pay access fees in a particular segment the more that segment holder can earn.

There is a commitment that the segment holder pays a certain amount, depending on the floor price for that segment, to the village development fund. In Zee Kone village the contribution to the village fund was 0.1 million Kyat, which was used to maintain facilities in the village. This ensures that other villagers also benefit from the lease management. As the access fees were reduced, more fishers are able to access the lease, which allows for more equitable benefits among local fishers. The functioning of some part-time fishers who are not necessary the segment holder to collect fish through interest-free loans to local fishers also expand the access to poor fishers who cannot make upfront payment for their access fee.

However, households with small children and women-headed households tend to benefit less due to their lesser involvement in fishing. The village CFG leaders, who invest in the lease, generally benefit more than regular fishers.

4.1.4. Access rights

The difference in how the lease is segmented prior to 2017 and after was that the former's purpose was mainly rent-seeking and sharing the management responsibility of the lease to sub-lease holders. The latter was made corresponding to the number of villages dependent on fishing in the lease. The decision regarding access under the former was made unilaterally by the lease holder and sub-lessees had to bid to get their respective sub-leases. Under the new arrangement there is consultation in the LMC on how much each segment should cost. Members of the CFG discuss which share each of them has to contribute in order to raise sufficient funds for each segment. The holders of the 10 segments decide on a fair and uniform fee imposed on fishers who apply for fishing access in any of the other segments.

CFG members who opt out or are not able to put in their share for a holding arrangement of a segment pay a set of fees upfront if they want access to the fishing area. The fees vary depending on the gear they use. CFG members, not necessarily segment holders, look for a group of local fishers – frequently between 10 and 15 - to form his/her own network so he/she can buy catch in exchange for an interest-free loan. The fishermen sell fish to the collector, at market price until their loan is repaid. Then the fishers may decide to sell their catch to different collectors. But if they fail to repay within the year the

debt will transferred to the following year and the balance will be deducted from their eligibility for the next loan.

For example, in Zee Kone village four CFG members mobilise a joint share of 0.24 million Kyat to be able to get hold of the segment. The amount breaks into 2 million Kyat for access to holding the segment, 0.15 million for seed stocking by DoF, 50,000 Kyat for transportation of CFG leaders to facilitate all the arrangement and meetings, and another 0.1 million Kyat for village development fund. A fisher may pay between 5,000 and 20,000 Kyat, for example 10,000 Kyat for cast net, 20,000 Kyat for a set of traps.

4.1.5. Conservation

The requirements set by DoF when awarding the lease to the CFG were that the closed season is between May and July, an amount has to be paid to DoF to stock seed in the lease area, and only 3 set gill nets are allowed within the lease. Additional guidelines are provided by the township CFG management committee to ensure effective management of the lease. The guidelines provide for a set of activities including defining conservation areas, their physical demarcation, installing information panels, and conducting awareness raising.

As a result, in each segment a non-fishing zone is established, with an average size of 100x10 m, where fishing is banned all year round. Signs are placed in the four corners of each no-fishing zone. The CFG creates small brush parks in each non-fishing area to create a fish refuge.

For 2017-2018, the LMC paid 0.7 million Kyat to DoF for seed stocking and also worked with DoF to define a number of stocking locations in the lease. The species stocked by DoF are rohu, catla, mrigal, and Taiwanese barb.

Local fishers and fish collectors contended that some species tend to be less abundant including Carplet (Mola?), sheatfish, *Puntius*, walking catfish, butter catfish, freshwater prawn, stinging catfish, catfish, *Wallago*, spotted snakehead. The cause for the decline is mentioned to be the operation of a sluice gate, which acts as a barrier to fish migration. Pollution from pesticides used in agriculture and expansion of fish ponds are other reasons. However, some respondents mentioned a return of or an increase in certain species such as Barb, tilapia, snakeskin gourami, Carplet (Mola), climbing perch, and sucker fish.

With the change to CFG management in 2017 there is no limit in number of people fishing and fishing is allowed year-round, except during the closed season. As more people are allowed to fish, illegal fishing by local fishers is reported to have reduced substantially, but not by residents from other villages. A simple conservation measure is put in place through no-fishing zones with artificial habitats - brush parks - established. An overall performance of the lease is summarised in Table 4.

Table 4. Summary of performance of each indicator

Indicator	Rank	Key point/highlight
Productivity and income	1	While the fish stock decreases the price of wild fish increases. The high fish price is partly because fish can be sold when they are still fresh as access to transportation is improved. This also provides good income for all, the segment holder, fishers and fish

		collectors. Local poor fishers enjoy full year round access to fishing something they were deprived off in the past.
Benefit sharing & equity	4	More equitable benefit sharing from the arrangement as CFG members voluntary involved in investing for segment of the lease and the poor can also enjoy full year round fishing at lower fee. A village development fund provide benefit to larger community.
Access right	3	All members have the same access right to investing in segment of the lease and also in fishing full year round at affordable fees. Those cannot pay upfront can still arrange to get free interest loan and repay in catch at market price.
Conservation	2	DoF restocks seeds, local CFG and DoF jointly decide on place to stock. Closed season observed and local conservation actions including designation of no-fishing zone and awareness raising are provided.

4.1.6. Gender dimension

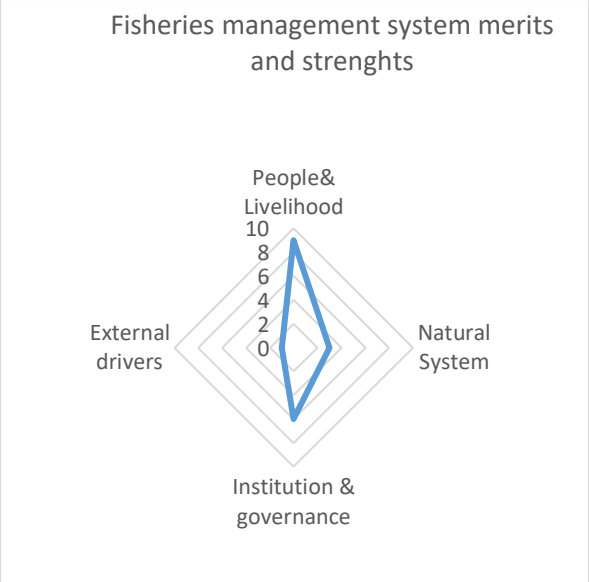
All the CFG leaders investing in holding rights to all segments are men. However, women are involved in the TMC. For the lease, a group of 19 members is established with responsibility over fisheries conservation in the area. This includes eleven member of the LMC, four women fish collectors, and four other members. The members are involved in discussion and development of rules governing the conservation of the lease. In the past, under the single holding system, women were engaged as labourers to pick fish out of the nets and to clean the nets. Now women also go fishing alone.

However, there is still a challenge for women to earn as much as men. With most of the CFG management committee members being male, women have fewer chances to attend workshops or meetings at township level or elsewhere. Women are also mentioned to be a source of worry when they have to travel far from home. Although women are engaged in fishing, they do not fish as much as men. Women are reported to mainly be involved in fish processing, collection, and marketing. Women have a higher representation than man in fish collection.

4.2. Dimensions of strength and merits of the system

The strengths/merits of the current fisheries management system were assessed using the four dimensions of the PDAM framework. The assessment (Fig. 5) showed that almost all of the strengths and merits identified fell under the ‘people and livelihood’ dimension for all stakeholder groups, in particular for the local fishers and the private sector.

The dimension receiving the second highest score was ‘institution and governance’, which was noted by all stakeholder groups. Better communication between farmers and fishers was noted as a result of this new management arrangement. Establishment of no-take zones was seen as a factor to be improved. The fisher group and the government group see the CFG groups as a strong association that can do more in the future to improve fisheries management.



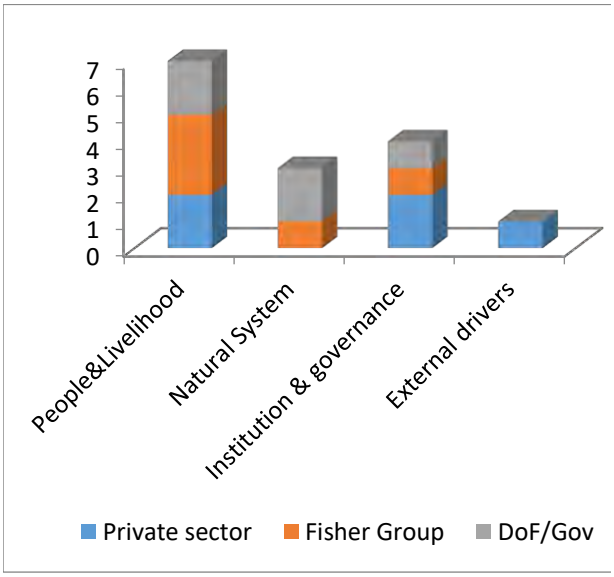


Figure 5. Strength and merits of the current management system

Fisher Group

The fishers considered improved access to fishing, particularly for poor fishers, is an important strength of the changed fisheries management system. Fishing is the main livelihood activity for the poor, so access to fishing year-round is very important to them. Other strength, merits, and associated implications include:

- Fishing access for local fishers in general helps secure their livelihoods, provides them with food security and additional income so they do not have to migrate to the city for work or to poach in the lease.
- Under the new management more people were engaged in decision-making and drafting local rules. By being engaged in the whole process, they learn to become managers and are able to negotiate for and mobilise support.
- Establishment of the no-fishing zones provides a safe fish refuge for fish to grow and these fish can then serve as brood stock in years to come.

Government Group

The group agrees that fishing access and benefiting from the lease is more equitable and as a result the well-being of the local residents improved. The participants noted that under the single management system only a few people then set the access fees, and decisions on who is eligible to access fishing were solely for profit. Other merits of the current management system noted by the group were:

- A different resource protection measure is put in place with no-fishing zones designated for each segment of the lease.
- Engagement of CFG members and TMC in relevant activities and in decision-making enabled them to learn more about not only fishery management but also about their rights. CFG became a stronger association that is able to represent the interests of their group before the government.

- Under the new management system local residents are more considerate about the fisheries and work more closely with DoF to improve compliance with the rules and regulations. This should improve the chances of the fishery to be sustainable.

Private Sector (fish collectors)

The fish collector group sees that opportunities to derive equal benefits from the fisheries have not increased for local residents compared to the past when it was in the hands of a small group of elites. They maintained that even though they are part-time fishers they are also able to buy catch and create a network with poor, local fishers for an interest-free loan and to get paid back in fish catch at market prices. This groups see other merits as follows:

- Not only those who invest in getting rights to the lease can get involved in the fish value chain but also small part-time fishers like them.
- Most members of the community can be mutually dependent to benefit from resources available to them – the poor fishers depend on loans from the community and the community depends on fish caught by the fishers – so both benefit from the lease.
- The management arrangement is good for CFG as it helps improve knowledge for a more effective fisheries management, by the CFG management in particular, and enables them to learn to represent their group before the government.
- Improvement of road access to markets and being sold at higher prices because it is still fresh as a result were reported to be the main positive factors contributing to improving their livelihoods.

The overall strength and merits under the co-management arrangement are that fisheries are no longer the subject of exclusive management used by a small group of wealthy people and access to fishing is no longer a luxury for local, poor fishers. Where local groups made participatory decision on the management rules it appeared to them that part of compliance was achieved through awareness raising when in the past leaseholders had to depend solely on law enforcement. Key highlights of the strengths and merits are shown in Table 5.

Table 5. Merits and strengths common to more than 1 stakeholder groups

Merits/Strengths	Common to Groups	Description
Better access to fishing and fish collection	Fishers group, Government, Fish collectors	From 2017 the lease is put under CFG and access fees were reduced and fishers can sell their catch at will
Different conservation measures were put in place	Fisher group, Government	A no-fishing zone designated for each segment of the lease, in addition to limits on number of set gillnets, and closed fishing season set by DoF.
Livelihood improvement/more food security for local fishers	Fishers group, Government, Fish collectors	Poor fishers can fish year-round, fish can be sold at higher prices when they are still fresh, and fishers can get interest-free loan and repay those by selling their catch at market prices
CFG became a local association to protect local fishers' interests	Fisher groups, Government	CFG management and members make participatory decision and the management represent CFG interest before government and when negotiationing with other groups.

4.3. Dimension of issues - weaknesses and constraints

Most of the identified constraints and weaknesses of the current fisheries management fall under the livelihood and governance dimensions of the framework. While the fish collector group identified more weaknesses regarding 'livelihood', the CFG identified more in both the 'livelihood' and

'governance' dimensions. The government group identified governance and external factors as the dimensions with a high number of weaknesses. No group sees weaknesses in the natural resource system.

Application of agrochemicals is blamed for the pollution that killed fish as noted by the CFG and fish collector groups. Expansion of aquaculture and agriculture is said to have reduced fish spawning and feeding habitats as noted by the government and fish collector groups. The CFG mentioned that one issue is sedimentation in the lease due to intensification of rice production. Government policy prioritising two sectors – rice farming and aquaculture – is also said to give opportunities for those sectors to grow at the expense of wild fisheries. Regulating natural water flow, allegedly to protect paddy and aquaculture ponds from flooding, is said to create barriers to natural fish migration in the wet season as noted by the CFG and government groups. For the governance dimension the government group claims that poor relations between villages on how to manage fisheries resulted in more CFGs being established in order to compete with the current CFGs. The CFG groups said that poor compliance by DoF on who is eligible to access the lease is a weakness.

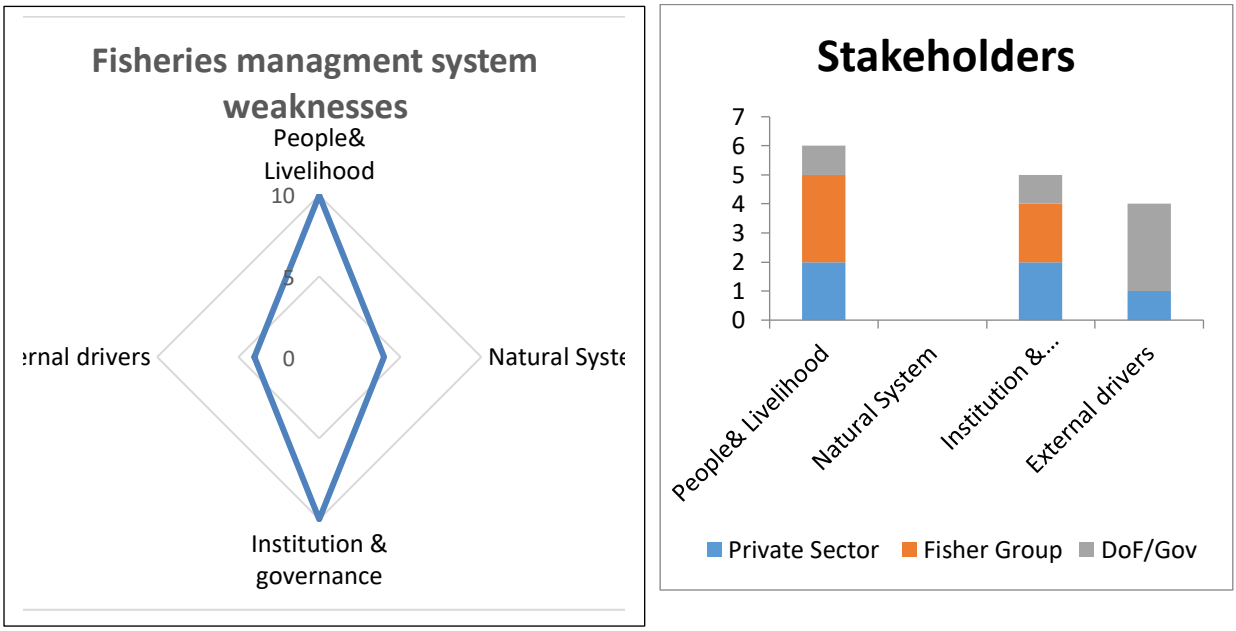


Figure 6. Constraints and weaknesses of the current fisheries management system

Fisher group

The main constraints for fishers prior to in 2017 was that only the non-poor and the well-off were able to access fishing and for many the access was only for 3.5 to 5 months per year. The leaseholders and the sub-lease holders were the ones who decided on access fees and the fish price as they provided loans to fishers, who paid back with the fish they caught at half the market price. For the last fishing season, when the lease was under CFG co-management arrangement the main constraints that were mentioned are:

- The fishing ground is getting shallower due to sedimentation and lack of maintenance since a road was constructed in 1995. This was said to be aggravated by more intense rice farming in fields next to the channel. Household settlement is said to have compounded it. Since the ten villages are established in the waters between the channel and the main road all waste and discharge flows directly into the surrounding waters. The lease which acts as a water channel between Rive Thande and the floodplain does not have a flowing current for some parts of

the year due to operation of the irrigation gate. This enhances sedimentation and acts as a barrier to fish migration from the river into the lease and surrounding floodplains.

- Paddy fields located north of the lease have been cultivated for years but recently an increase in application of agrochemicals (pesticides and fertilisers) was seen. The high dosage and indiscriminate use of pesticide types -as farmers have no interest in catching fish, only in growing rice- has resulted in pollution. Fish deaths in paddy fields is not an unusual event.
- The CFG work has been only one year and they are still learning how to improve fisheries management. Others may disagree as there is a trend that as more CFGs are established there is a feeling that competition by others to bid for the lease may result in management of the lease no longer being profitable, thus leaving no room for improving the lease.

DoF/ Government

One of the main constraints of the current management system noted by the group is the decline in fish species and production due to pollution from agrochemicals, but also the legacy of illegal fishing practices that were common under the previous management regime before 1997. Other constraints cited by government respondents were:

- Recent interest in the last 5 – 7 years in aquaculture development, which takes up space at the expense of natural fish habitats in the floodplains, in addition to rice farming. The operation of the gate was originally meant to benefit rice farming but now also to accommodate the benefit of aquaculture ponds by protecting the area from flooding in the wet season. It is now harder to negotiate for the gate operation in favour of opening the gate in the wet season for unobstructed fish migration between the floodplain/lease and Thande River.
- Cooperation between fishers remains weak as some other fishers do not get involved in the current scheme. This can be a challenge to them as they may organise into a different group and compete with the current CFG for the rights to the lease.

Private Sector (fish collector/part-time fishers)

Decline in fish stocks was noted as an important legacy from the past management arrangements together with a number of other factors including:

- More investment in areas outside of capture fisheries had undermined the natural habitats needed to support the capture fisheries sector. It is not just that fish and rice farming are being expanded but also that they are done by the well-off who have the power to influence how the whole area is managed, in addition to having the unchallenged authority to pollute the area.
- Although illegal fishing had reduced drastically, illegal fishing is still taking place and current methods have been more efficient, mainly by residents of other villages.
- Some fishers have changed their livelihood away from fishing, seeing fishing is no longer a viable livelihood.

The constraints common among stakeholders are presented in Table 6: decreasing fish catch affecting income and livelihood of both the lease owner and the fishers; limited access of many fishers to the lease area, lease owner controlling the selection of few fishers for his benefit; and increase of the auction price, the lease owner is hesitant to continue bidding in the lease because of the increasing price and decreasing catch in the lease area.

Table 6. Constraints common to more than one stakeholder group

Constraints and weaknesses	Common to Groups	Description
Increasing pressure from other development on the lease area	CFG, Fish collector, Government	The law does not allow conversion of agricultural land to fish ponds thus aquaculture development

		encroaches on floodplain. Rice intensification and the flood control, and the lease area becoming shallower are considered constraints.
Illegal fishing persists by other villages	Fish collector, Government,	Due to lack of effective enforcement mechanisms in place and poor collaboration with other villages
Fish production declines	CFG, Government, Fish collector	Due to application of chemicals in paddy fields by rice farmers, degradation of habitats, and changes to the hydrological regime.

4.4. Interaction between constraints

Constraints have been categorized under the four dimensions of the PDAM framework; (i) Livelihood; (ii) Institutional/Governance; (iii) External driver; and (iv) Natural system (Figure 7). Results of the workshop indicated that issues related to 'livelihood' and 'institutions and governance' are more apparent. Under the (i) livelihood dimension, declining fish catches , particularly for poor fishing communities during the wet season , competing interests among different producers, limited inclusion of and collaboration with other villages, and fishing becoming less dependable as livelihood are among the main constraints. These issues are linked to the (ii) institutional/ governance in relation to limited restrictions on fishing effort as the system is now open to all after restrictions for many years under the single holding arrangement, policy priority is given to rice farming and aquaculture thereby producers in other sectors do not have interest in or practice without due consideration on impacts on the fisheries, the fact that the CFG is new they need to build their capacity and trust with other stakeholders, and also limited institutional support is another constraint to them. The inherent external factors (iii) include illegal and destructive fishing, land use changes that resulted in how the water gate is operated and associated pollution from pesticide application. In the end these external drivers (iv) resulted in habitat degradation, the inherent decline in fish species and fish stocks, which in turn affected the catch of the -mostly poor- local residents.

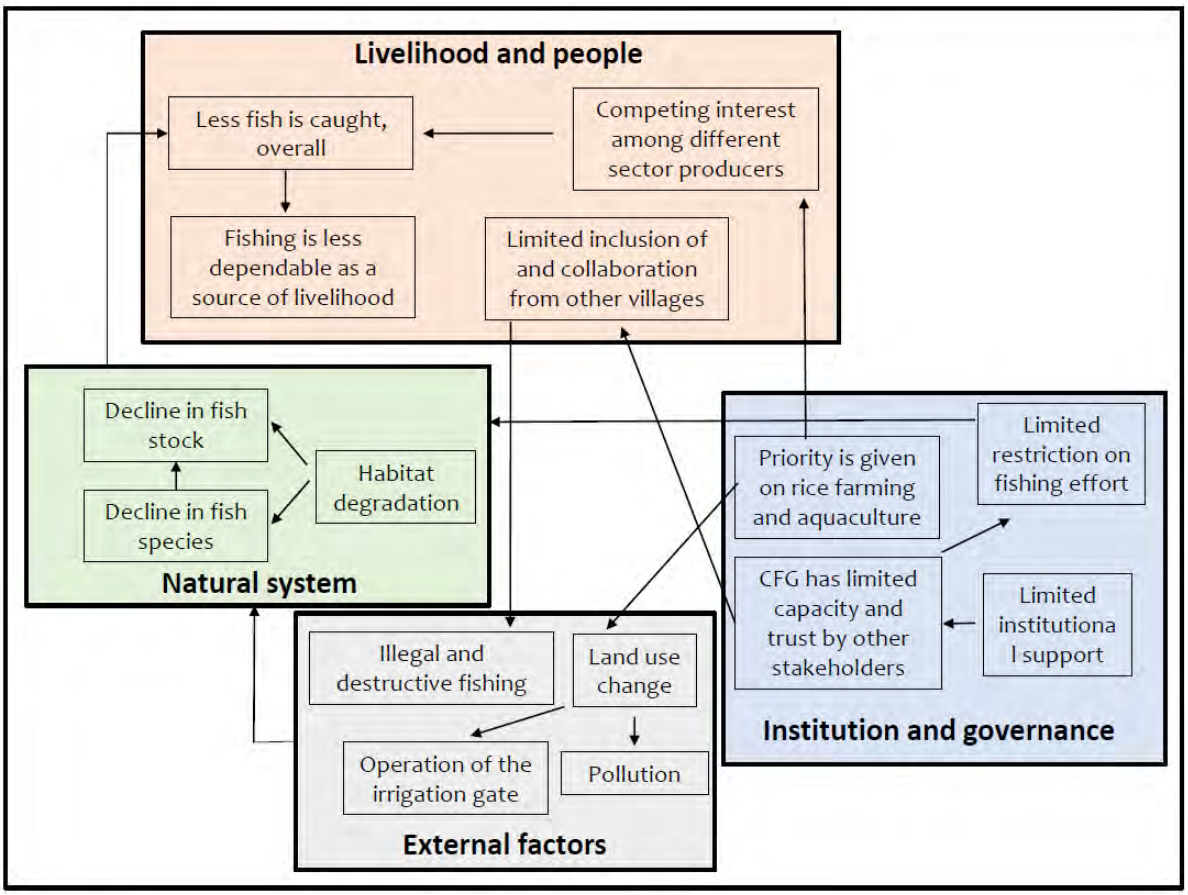


Figure 7. Framework of interaction between constraints

4.5. Entry points for improvement of the management system

Based on the interaction of constraints, the main entry points to improving the government should be policy support of the institutional/ governance to harmonise different competing land and water uses and help strengthen the functioning of the newly established CFGs. Policies aiming to reconcile intensification of rice farming, the development of aquaculture, and sustainable use and protection of the local fisheries are needed. Assistance from relevant township authorities is needed to help build capacity and strengthen operation of the current CFG mechanism. Other local stakeholders should be involved in the planning and decision-making process. This will encourage more voluntary compliance with the local rules by residents from other villages, harmonising the regulation of flows in and out of the lease, and adoption of rice farming and aquaculture techniques that are more environmentally friendly. This will also involve partnering with local residents from other villages or other CFGs to obtain the rights hold and manage the lease at the floor price rather than the auction price.

4.5.1. Constraints to can be solved at local and higher level

The respondents think that around 39% of the constraints they identified can be solved at the village or township level (Figure 8). These include: ineffective enforcement of the rules; decreasing catch; pollution; limited inclusion of and collaboration with other villages; limited CFG capacity, and restrictions on fishing. For higher level interventions, the constraints mentioned are: policy support for conservation practices; harmonisation of competing interests between different sectors; technical support from the government for livelihood diversification.

Results from the workshop showed different perspectives of the stakeholders on where issues and constraints can be solved. The private sector group thinks most of the issues it identified, such as illegal fishing, declining catch, and habitat degradation, can be solved at the local level. The government group, however, has a broader perspective on all the issues it identified such as illegal fishing, habitat degradation, change in local hydrology, and CFG capacity. They think it requires intervention from higher government levels. The group believed that constraints can be easily solved if there are corresponding policies to support the intervention, in particular on harmonising interests and priorities among different production sectors. The CFG thinks that about one third of the issues it identified can be solved at local level and two thirds can be solved at higher levels.

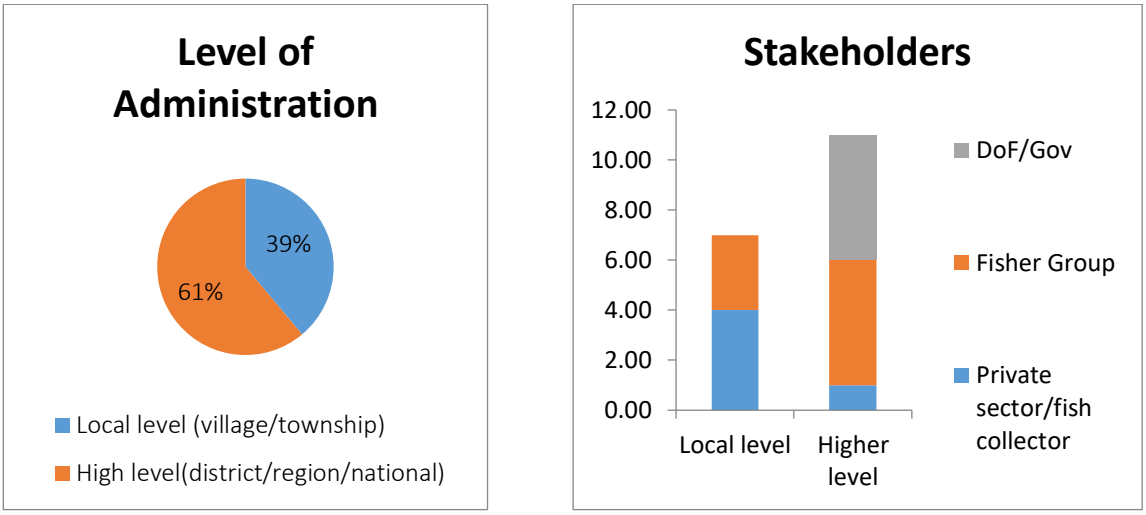


Figure 8. Administrative level where constraints can be solved

4.5.2. Constraints that can be solved by stakeholders

The respondents determined who is able to address the weakness/constraint they identified during the discussion. Around 74% of all weaknesses/constraints have been identified as issues to be addressed by other stakeholders rather than by their own group (Figure 9).

- The CFG think that all the challenges they identified need interventions at multi-stakeholder level but also think they have an important role in initiating the process to address most of the issues to ensure that other stakeholders are aware of and understand the scale of the issue and the need for their engagement. For example, for an issue 'Area of the lease becomes shallower' the group thinks its own role is to raise awareness among different stakeholder groups. Nearby rice and fish farmers should opt for more environmentally friendly practices, local residents by the canal should not dispose waste in the lease area and DoF could potentially dredge the area.
- The private sector is of the opinion that almost all the issues they identified need more than a single group to address. The group mentions that it could not buy/collect fish during the closed season in an effort to contribute with the CFG to protect the fish stocks in order to collectively address the issue of species and stock decline.
- The perspective of the DoF/government differs from all other groups. Although it appreciates the collaboration by all relevant multi-stakeholders in addressing all the issues it identified it

feels that it alone can address none of them. The group sees that no solution can be found without the participation of the stakeholder groups who depend on the resources for their livelihood.

Results of the workshop reflected the knowledge, attitude, and decisions of each of the stakeholder groups. It was observed that fishers have a good understanding of local issues, their rights, as well as of the support needed. They have been unable to link up with a specific potential supporter or enabling policies. They have a limited awareness of any government assistance they can receive, even from stakeholders outside their communities. The group does see that the resource is at stake and it would be the one most affected if proper management is not in place and it is unwilling to manage all the relevant tasks.

The government group has a more in-depth understanding of the main issues and how these link to broader policies at higher government levels, but it would refer to its agency policy and mandate when asked if an issue is relevant. The private sector has a fairly good understanding of related issues and tends to be supportive of a soft approach and for multiple benefits.

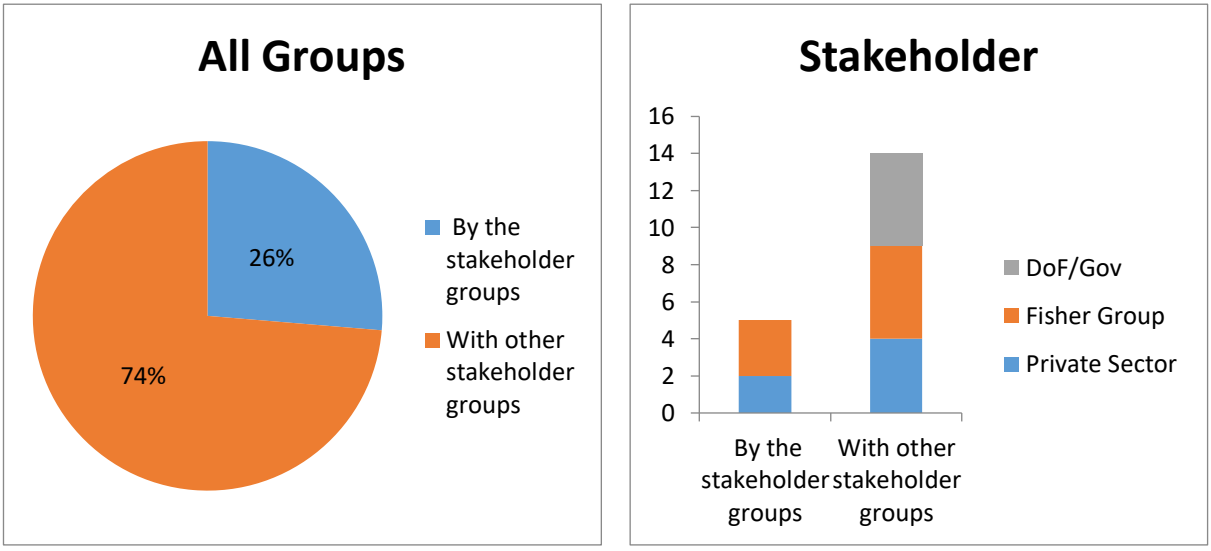


Figure 9. Stakeholders that can solved the constraints

5. Discussion

5.1. Specific entry point at the fishery management level

Awareness of the community. There is poor understanding among the CFG members and even poorer among non-CFG members of why a change in the lease holding system was made in 2017, aside from the issues of high access fees and resulting restricted fishing access. Awareness campaigns should be done highlighting the full range of benefits since the change, including their fishing rights, their right to protect the fisheries, the need for accountability in co-management arrangement, and inclusion in participatory planning and decision-making. While everyone understands that they have the right to fish they should also understand that this comes with a duty to protect the resources. It is up to them to understand that the keys to success in co-management are participation and voluntary compliance.

Technical and institutional capacity support. From the perspective of fisheries co-management, the current CFG management is new and had received very little training and guidance before implementing its operations. Aside from a guideline by the Township CFG Committee there are no

other specific materials to guide the work of the CFG. The CFG needs guidance on sustainable use and protection of its fisheries, how to establish its management structure to respond to the mandated tasks and potential conflicts that may arise. The CFG needs training to build their capacity to collect, record, maintain, and use relevant data. It also needs capacity to plan and implement actions such as patrolling and monitoring of fishing activities. What legal procedures are applicable and who responsible law enforcement actors are need to be clarified as past experiences showed that local police did not provide effective support. Much of the support is now expected to be provided by DoF but this may not be available in a timely manner.

Pilot an improved CFG co-management. There is an understanding that the current CFG management has neither practical experiences nor clear and concrete guidelines for managing the lease. Much of the work is done through oral arrangements that are made based on current needs. There is a need for the CFG to go through a series of key management exercises of fisheries co-management. This should include participatory development of a management plan for the lease, setting local fishing rules and regulations, planning and assigning roles to the CFG management and members, enforcement of local fishing rules and regulations. The current access regime is clearly not sustainable as there is no limit to fishing effort and thus having a quota on fishing effort should be piloted. The CFG management should assess the benefits of stocking fish seed and the effectiveness of the no-fishing zones. This may require support from NGOs, but more importantly the CFG should collaborate with the township Department of Fisheries office to strengthen law enforcement in particular.

Guidelines on use of CFG village development Fund to support conservation of the lease fisheries. There is a requirement that villages/segment holders/CFG village leaders make systematic contributions to the community development fund. However, not all the segment holders were reported to have made such a contribution. There is no report on how, for what amount, and for what purpose the fund can be accessed. The only reported case is that it was once used for the repair of a local school. There is therefore a need for a set of criteria and guidance on how the fund should be used for and the inherent decision making process. Records should be kept on how the fund has been used. It should be possible contributions are not only made by segment holders but also by other fishers. It should be allowed to use the fund not only for social purposes but also for fisheries conservation.

Improvement of fish value chain opportunities for the fishers. Much of the fish caught was reported to be sold fresh. Little has been kept for local consumption, processing or sale during the closed fishing season, either locally or at other markets. An analysis should be done on feasibility and profitability of selling fresh catch compared to processed fish products. Not only fishers but also fish collectors may engage in fish processing and provide advice on which processed products have a high market demand and a high value. Most poor fishers are dependent on fish collectors for access to fishing and to buy certain fishing gears. This dependency should be reduced. Fish do not necessarily have to be sold fresh but can be kept for household consumption, for processing, or for sale during the low or closed seasons when prices are higher.

5.2. Generic entry point at the higher level

Policy for integrated development among different sectors with competing uses of land and water resources. The current government policy priorities and focuses on rice production. Nevertheless, a rapid increase in investments in aquaculture pond development was seen. This entails aquaculture production on land mostly under long-term landholding arrangements. Long-term land tenure rights

are not present in capture fisheries. This, coupled with the fact that the access fee increases by 10 percent annually creates little incentive for any investment to take place in development and protection for the sector. Even though recently local communities – usually the poorer layer in society - became more involved in fisheries management.

Although rice remains a high priority, there is a need for policies that encourages integrated land use planning and cooperation of different production sectors, particularly at township or lower administrative levels. This will help ensure that more consideration is given to sectors with little incentive for private investment, such as open access fishing areas as they compete for land and/or water. The need to produce different types of food for poorer household should also be considered. A harmonised land and water use between rice and fish farming, and wild fisheries would not only ensure optimal and sustainable production but also provides diverse foods that are accessible by the local poor.

This will ensure that the system is protected from harmful and non-sustainable practices, such as excessive use of pesticides, fish pond development, and operating water gates so connectivity and seasonal fish migration are maintained, and protection of important fish stock refuges.

Regulation of water flow into the lease to optimize different competing uses of water between fishers and other production sectors. Clearly the operation of gate is mainly to protect rice fields and fish ponds from flooding at the expense of seasonal fish migration to the lease and through the lease into the floodplain. The operation of the gate is influenced by the greater power of fish farm owners. It is important that the local government investigates how the gate would best be operated to balance the need for water and to flow into the floodplain and the need to protect of rice fields and fish ponds. It may necessary to conduct a study exploring if fish ponds can be protected with higher dikes or nets and if the farming season can be adapted to mitigate potential impacts from seasonal flooding. A local group may be created to oversee an operation following the study's recommendations.

Government support for a strengthened co-management system. CFG is given specific privileges in access to bidding for fisheries but it comes with certain requirements that need to be met related to environmental protection and social responsibility for local residents. However, there are increasing concerns by local communities that where there is no proper process to register a CFG in place it may lead to formation of more powerful CFG groups that don't really represent the local community. It is suggested that guidelines with a specific set of criteria for CFGs be adopted to guide CFG formation to ensure that the group represents the local community and bears the social responsibility for the community and responsibility for the environmental protection of the fisheries. The group should have a clear legal status and a clear structure. A guideline for establishment and organisational structure of grouped holding should be developed.

Currently KYUFA has initiative and is successful in facilitating other CFGs to bid for other leases. It also established simple guidelines for conserving resources at Hliang Tar Mezali. There is an opportunity to help facilitate CFGs to take a leading role in coordinating other CFGs for a more an improved co-management system as well as creating CFG networks for sharing lessons across sites.

The current licensing system is also recommended to extend to at least a 3-year-cycle or a long-term holding license scheme to provide stronger incentives for sustainable fisheries resource protection while at the same time minimising the investment and maintenance costs for the CFG. Special provisions should be made for the CFG management to avoid a 10% increase in annual lease fees. This because of the social and environmental responsibility they have. It will reduce the risk that a 10% annual increase eventually prices local CFGs out of bidding and thus the lease would fall back in the

hands of local or national elites who have little or no interest in environmental and social responsibility.

Guidelines on CFG joint holding and financing and access/benefit sharing. There is now no guidance on how a CFG should mobilise their resources in order to bid for the lease. There are signs that former sub-lessees are current segment holders or village CFG leaders. Therefore, there is a risk that CFG management ends up in the hands of local elite groups. The guidelines, therefore, should provide for how finances can be mobilised by the CFG, with a cap on the proportion of each individual share to avoid elite capture. Special preferences/exemptions for the poorest households and people with disabilities may be provided to enhance social equity and to protect the disadvantaged people in the community.

Financial support to diversify the source of income of local fishers. Local communities in the area had accessed credit from Mya Sein Yaung project by MOALI in 2014 to support local livelihood development. However, this project has stopped. There is, on one hand, a need to revitalise the current credit scheme by MoALI or a different but similar scheme in order to provide support to the CFG to finance their bid for the lease. It should also be provided to individual households to promote income diversification – promotion of fish processing and other value chain activities, and to purchase fishing gears for the poorest households. On the other hand, fishers need to diversify their sources of income and adopt a more integrated livelihood strategy. They cannot continue to depend on a single income source in the long run due to the limited resources locally available, be it for fishing or crop and animal production.

A summary of the generic and specific entry points is provided in table 7.

Table 7. Summary of generic and specific entry points

Entry Points	Description	Issue addressed
Generic		
Policy for integrated development among different sectors with competing uses of land and water resources	The government to develop an integrated cooperation policy that will guide the different land and water-use stakeholders in consideration of the fisheries as the same priority as the other sectors	Provision of prioritising agricultural development and the de-facto aquaculture development
Regulation of flow into the lease to optimize different competing uses of water between fishers and other production sectors	The government to study how operation of the gate would best provide benefits to rice, farmed fish and wild fisheries production and introduce more harmonised practices in farmed fish and rice production.	Unfavourable operation of water gate due to conflicting interests of different production sectors
Government support for a strengthened co-management system	The government should provide guidelines with criteria and requirements for how a CFG should be established and they should change the bidding cycle to at least a 3-year cycle or longer	Long-term viability of the fisheries and local elite capture
Guideline on CFG joint holding and financing and access/benefit sharing	The government should provide guidelines on how local funding should be raised so that holding and managing the lease become more participatory and transparent	Equity and local elite capture

Financial support to diversify the sources of income of local people	Revitalise the MoALI Mya Sein Yaung project as in 2014 or develop a similar scheme to provide loans to local fishers to diversify their income sources and to adopt a more integrated livelihood strategy	Diversification of income sources
Specific		
Awareness of the community	Extension activities need to be intensified to inform the fishers of their access rights, obligations, and the need for their participation in the overall fisheries co-management and conservation process	Awareness, participation and voluntary compliance
Technical and institutional capacity support	DoF and NGOs should provide key institutional and technical capacity for the operation of CFGs.	Guidelines and procedures and key capacity for effective CFG operation
Pilot an improved CFG co-management	Support should be mobilized to have CFG engaging in key fisheries co-management process including on planning, setting rule and regulation, enforcement and monitoring.	Weak operation of the current CFG
Guidelines on use of CFG village development Fund to support conservation of the lease fisheries	A guideline is needed on contribution and decision on use of community development fund.	Improved benefit sharing, and local development
Improvement of fish value chain opportunities for the fishers	A study is needed to explore the potential for improvement of fish value chain and engaging those in the sector to improve fish processing and marketing	Improvement of income and local livelihood

Characterisation of Fisheries Management Systems in AD and CDZ

MYFISH 2

Case Study 4 Report

(Community-managed Lease)

AD	Ayeyarwaddy Delta
CDZ	Central Dry Zone
CSO	Civil Society Organization
DoF	Department of Fisheries
FAO	Food and Agriculture Organization
FDA	Fishery Development Association
FG	Fishers' Group
FGD	Focus Group Discussion
HH	Household
KII	Key Informant Interview
NGO	Non-government Organization
PDAM	Participatory Diagnosis Adaptive Management
RAAIS	Rapid Appraisal of Agricultural Innovation System
USD	United State Dollar
WF	WorldFish

Note:

Currency Exchange rate: 1 USD =1,346 Burmese Kyat

Weight Conversion: 1 Viss = 1.6 kilogram

1. Objective of the study

The aim of this case study is to generate an "in-depth" understanding of the fisheries management system in Pyapon, with a focus on identifying major issues and potential entry points for addressing these. Hence the specific objectives are as follows:

- Assess performance of the community-managed leasable fisheries based on agro-ecological, social, and institutional environments in Kyon Ka Dun, Pyapon; and
- Identify key issues and opportunities for interventions to improve the performance of this fisheries management system in the area.

2. Methodology

This case study documented the community-based leasable fisheries management systems based on its current performance, strengths/merits, and weaknesses/constraints using both quantitative and qualitative indicators. The final output was the identification of entry points, both at the local and higher administrative levels to improve the performance of fisheries. The selected case study was located in Kyon Ka Dun village, Pyapon Township. Until recently the fishery was under an individual lease arrangement. The conversion to a community management occurred in 2017. The information and data compiled in the present report consists of a mix of primary and secondary data.

Review of Secondary data

A matrix was developed to compile existing information about the site, fisheries, and type of management in the study area. The information gathered to complete the matrix was sourced from official census, earlier assessments from WorldFish and FAO, as well as preliminary consultations with DoF District Office in Pyapon Township.

The Analytical Framework

The proposed analytical framework is adapted from the Rapid Appraisal of Agricultural Innovation Systems (RAAIS). RAAIS is a diagnostic tool originally developed for the agricultural sector and it allows the analysis of agricultural issues from broad entry themes towards more specific entry points for productivity, natural resource management, social development, and institutional innovation. We propose to combine RAAIS with another theoretical framework tailored to the identification of fisheries management issues: the Participatory Diagnosis Adaptive Management (PDAM). We combined these two frameworks by selecting the four radar issues of PDAM as the four analytical dimensions to be investigated when using RAIIS. These dimensions are elaborated in **Box 1**.

Box 1: PDAM dimensions – Definitions and indicators

People & Livelihoods: the socio-economic aspects of the fisheries communities. This encompasses household well-being, which include household income, diversification of household livelihoods,

household fish consumption, living conditions, norms and culture, and household assets. It can also include conflict with other users, and resource use.
Indicators: Living conditions; diversification/income dependence; assets and income poverty.

Natural system: the biological classification of yield, biodiversity, and sustainability of the fisheries resources and ecosystem, its stock status and trends (total catch, total catch by species, fishing effort, catch by unit effort, and number of species), fishing practices, and aquatic ecosystem conditions, such as connectivity, breeding ground, pollution from upstream, agriculture, industry.
Indicators: Biodiversity; stock status and trends; fishing practices; aquatic ecosystem condition.

Institutions & governance: the manner in which a power is executed in the management of the fisheries sector. It is the enabling environment aspect in governing the fisheries management to achieve maximum sustainability (legitimacy, membership rules, access rights, management controls, representation rules, sanctions, enabling legislation/policies/legal framework, local support, financial management and services, access to market, organizational and institutional capabilities.
Indicators: Fishing and development policies; organizational and institutional capabilities; access to markets and financial services; collective action abilities; governance performance and rights; legal frameworks.

External drivers: Outside influences that can impact the fisheries resources and its ecosystem. Various external factors can impact the ability of the fisheries to achieve maximum productivity, biodiversity, and sustainability. These external factors might include infrastructure development, macroeconomic instability, climate change and environmental uncertainty, migration, market demand changes, price fluctuation, land use changes, migration.
Indicators: Infrastructure development; conflicts with other sectors or users.

The resulting framework relies on multiple methods of data collection, building on existing experiences with rapid appraisal approaches and (participatory) innovation systems analysis. Our investigation generate both qualitative and quantitative data; facilitates 'insider' and 'outsider' analysis; targets different stakeholder groups across different levels with individual, group and multi-stakeholder perceptions on weaknesses/constraints and solutions; and provide sufficient detail on the main weaknesses/constraints under review, the innovation capacity in the fishery management system and the functioning of the fishery management system.

Methodological steps

Based on RAAIS tool, the following steps were conducted to assess the existing fisheries management systems based on the context of each site: (i) identifying strengths/merits, and weaknesses/constraints; (ii) categorizing strengths/merits, and weaknesses/constraints; and (iii) exploring specific and generic entry points for recommendations for the current fisheries management system for equitable and sustainable fisheries. The objectives, sessions and activities of each stage are presented in detail in *Annex 1*. The following research steps were conducted in Kyon Ka Dun village over the course of 3 days to gather a broad range of information from relevant stakeholders. The participatory assessment of the fisheries management system was facilitated by a research team of 10 members (incl. 4 WorldFish staff and 6 DoF staffs).

The **multi-stakeholder workshop** represented the first step of the research and focused mainly on 'insider' analyses of the fisheries management system. A total of 21 stakeholders were invited and convened in four groups, namely large-scale fishers (i.e. operating large stow nets), small-scale fishers (i.e. operating only small gears), government officials (i.e. DoF township officers, village tract head, and community leader), and CSOs (i.e. women's association operating in the village). The workshop offered an opportunity for each group to assess the overall performance of the fisheries management system and identify associated strengths, and constraints. As such, this first step provided entry points for the next two steps of the study.

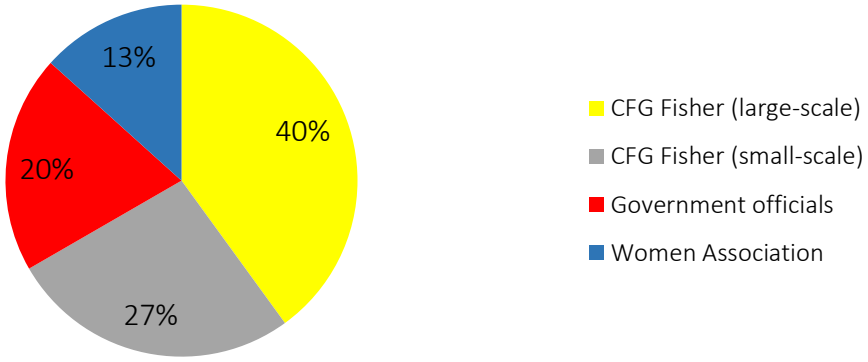


Figure 1. Participants of Multi-stakeholders Workshop in Kyon Ka Dun (N = 21)

The workshop was followed by targeted **Key Informant Interviews (KIIs)** and **Focus Group Discussions (FGDs).** These consisted of conversations with one or multiple stakeholders of importance respectively. These stakeholders were identified during the workshop. The KIIs and FGDs were used to gain in-depth insight on the information gathered during the multi-stakeholders workshop and understand the perspective and dynamic of different groups on the existing fisheries management system in the area. Three KIIs and three FGDs were held in total. The KIIs were held with stakeholders who had participated in the multi-stakeholder workshop (i.e. government officials) while the KIIs extended to 'outsiders' (i.e. paddy farmers, fish retailers, and fish collector). All discussions revolved around the strengths and constraints identified by the different stakeholder groups during the workshop.

Altogether, a total of 21 respondents contributed to the information gathering during three days of field work (27th – 29th August 2018) held in a monastery at Kyon Ka Dun village, in Pyapon Township. A detailed list of these stakeholders across the different methodological steps is provided in *Table 1*.

Table 1. Summary of data collection methods and participants

Methodological steps	**Stakeholders groups targeted – Sample size**						**TOTAL**
	Fisher group (large)	Fisher group (small)	Government Officials	Women Association	Paddy farmer	Fish traders	

Multi-stakeholder Worksop	6	4	3	3			16
Key Informant Interview			3				3
Focus Group Discussion	5				2	3	10
Secondary data							
TOTAL	6	4	3	3	2	3	**21**

3. Study site

3.1. Background information

Figure 1. Map of Kyon Ka Dun Yay Yoe Gyi leasable fisheries

Pyapon Township is located in along the Pyapon River, a tributary of the Ayeyarwady River. It is located about 12km south of Yangon. The Township notably serves as a centre rice collection from the surrounding agricultural areas. Kyon Ka Dun Yay Yoe Gyi leasable fishery is a 5 miles-long creek located in Kyon Ka Dun village tract, 30km further south of Pyapon town. The fishery is only 9km away from the sea and characterised by brackish water. The village extends over 4 lots adjacent to the fishery with a total population approximating 1,660 households (total population of around 8,657 people). The main occupation is primarily agriculture with a reported area of 7,607 acres of farmed land (mostly paddy), followed by fishing. Kyon Ka Dun village is reported to have experienced an important agricultural development following the construction of an irrigation scheme and a sluice gate in 1985.

The project was funded by the World Bank and aimed at increasing agricultural productivity through improved irrigation and a reduction of saline water encroachment from the sea.

3.2. Fisheries System

3.2.1. Natural system and fishing techniques

Kyon Ka Dun Yay Yoe Gyi leasable fishery consists of a brackish water river creek spanning 5 miles and connected with both natural tributaries and irrigation network canals. There seems to be a division of fishing activities along 2 zones: (A) a more productive area corresponding to the natural tributaries with a relatively good water flow year-round and (B) a less productive area located within the irrigation network, largely drained from October to May. The fishery is further divided into 6 distinct segments, each of which encompasses a large stow net.

Overall, the production consists mostly of shrimp. They represent over 80% of the catch and their peak fishing season extends from June to October. They are primarily caught by stow nets in (A) but to a lesser extent, they are also targeted by smaller drift pull, cast, and push nets operated in both (A) and (B). These smaller gears are used year-round and target featherback, seabass, snakehead, and catfish from October to May. In addition to these species, there seems to have been an important increase in tilapia catches since the cyclone Nargis in 2008. It is reported that these have largely escaped from devastated fish farms and have since bred in the wild, negatively affecting more endemic fish assemblages.

There are reports that the (so-called World Bank) irrigation scheme is the origin of some sedimentation problems. Together with the sluice gate operation in favour of agriculture productivity, these have reduced the overall level of the water in the lease (particularly in area B), contributing to an overall decrease in fish production. There are consistent reports that individual fish catches from small operators have declined by around 25-50% over the past 5 years.

3.2.2. Former fisheries management

For the past 10 years (2007-2017), Kyon Ka Dun Yay Yoe Gyi leasable fisheries was allocated by the DoF every year to an individual leaseholder through an auction process. The successful leaseholder commonly subleased the six segments of the lease to six local stow net operators (most of them also being fish collectors). These sub-leaseholders were expected to sell all of their catch back to the leaseholder. Under this system, the latter had an overall control over the trade (and market price) of fish caught in the lease. Most of the fish caught was traded at Pyapon market and/or exported to Yangon.

The sub-leaseholders in turn controlled access over their respective river segments. In addition to their own fishing operations, they were entitled to collect annual access right fees from local fishers operating smaller gears. As such, they had the authority to regulate the number of fishers but also define areas where these fishing operations could take place. The number of fishers was reported to vary between 110 and 160 along the year and their most common fishing gears were push, pull, and drift nets.

Here below is the evolution of the leasable fisheries auction price over the past 10 years. From 2008 to 2012, the increase of the lease price corresponds more or less to the 10% floor price increment enforced by DoF under the *Union Freshwater Fisheries Law* (1991). The drop in the lease annual cost experienced in 2012 marked the onset of the decentralisation process with the enactment of the first *Ayeyarwady Freshwater Fisheries Law* (2012), allowing States and Regions to reset the floor price system. The reasons behind the important price variations experienced from 2013 to 2017 are still unclear.

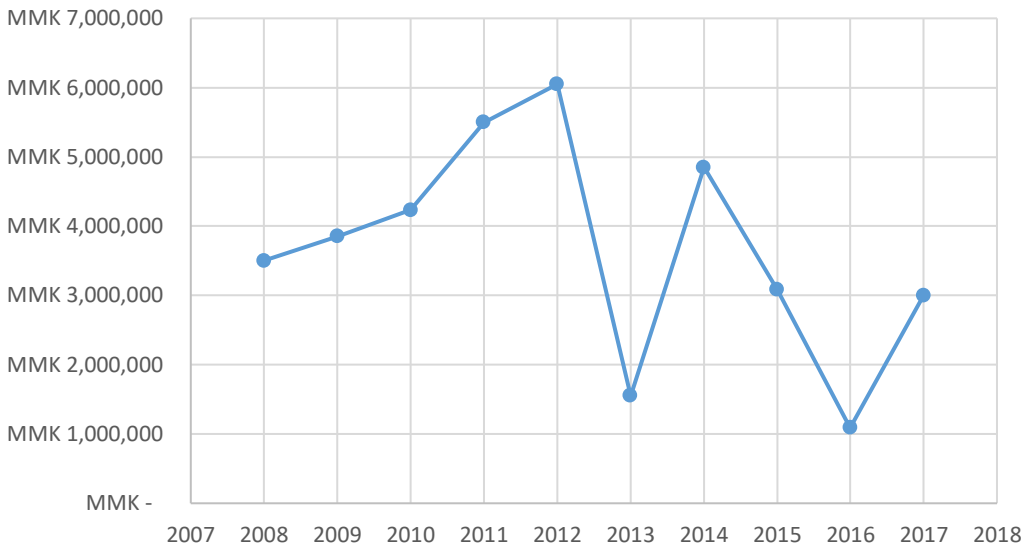


Figure 2. Value of Kyon Ka Dun Yay Ye Gyi annual license cost over the past 10 years

There was very limited information regarding the costs of subleasing operations in the 6 segments of the fishery under the former management system. Stakeholders reported that these varied significantly from one year to another depending on the leaseholder and the water flow conditions (i.e. lease segments with areas enjoying a better water flow fetched higher prices) but no specific details were provided on the exact prices of the sub-leases. There were many specific references made regarding the annual access rights fees paid by smaller fishers. For example, a fisher operating trammel drift nets in a productive area was charged around MMK 50,000 of annual access fee to be paid to the responsible sub-leaseholder.

Under this system, small-scale fishers commonly entered into a credit arrangement with their local sub-leaseholder. The most common scenario was as follows: the sub-leaseholder would extend the annual access right fee on credit, and in return, the fisher would sell back all of its catch at a discounted rate upon full repayment.

Except from the enforcement of a ban by DoF on poisoning and electric fishing, evidence suggests that there were no management measures in place at the site while under the former regime.

Table 2. Key changes in past fisheries management systems

Year	Key events

1985	Construction of the World Bank-funded Irrigation channel network
2008	Cyclone Nargis struck the delta region in early May
2012	Enactment of the *Ayeyarwady Freshwater Fisheries Law* (2012) Authority transferred from Central to Regional DoF
2016	Advent of the NLD administration
2017	Change in leasing system from individual to group management
2017	Enactment of the *Ayeyarwady Freshwater Fisheries Law* (2018)

3.2.3. Current organisation and management

In 2017, local parliamentarians requested DoF to convert the leasable fishery to a community-based management system. This request coincided with broader regional policy change that prevented 'minor licensed' fisheries (i.e. leases and tender with annual license price under 4 million Kyats) to be auctioned. The new policy required them to be systematically allocated to local fishing communities at the floor price. The process requires a group of local fishers (40-200 people) to officially constitute a Community Fisheries Group (CFG), a CFG management committee to be appointed, a CFG financial structure to be set up with a dedicated (revolving) fund that covers for the license (floor) price as well as the day-to-day operations of the CFG.

It is in that reform context that the community leader actively approached the DoF and held consultations with fishers operating in the lease (allegedly both large stow nets and smaller gears) in order to make the best of the opportunity. Through these consultations, the CFG was constituted and the organization and management structure described below were adopted.

The 6 (large-scale) stow net operators cover the full cost of the fishery license by pooling their money together[1]. With the community leader, they effectively form the management committee of the CFG. They in turn collect access right fees from other fishers operating in the lease. Annual access right fees are set up at MMK 100,000 for pull nets, MMK 70,000 for cast nets, and MMK 30,000 for drift and push nets. On the contrary to the previous system, these fees are now collected centrally and cover access to the whole fishery (not specific lease segments only). The money collected by the CFG committee covers the lease floor price (MMK 3,000,000), cost of restocking (MMK 300,000)[2] and the extra amount is saved on a bank account (revolving fund) dedicated to the CFG operations.

The most significant change brought by the reform hence consisted in removing the leaseholder from the management system and reducing the access costs for individual (large stow net) fishing licenses in the process. This saving was partially passed on to the small-scale fishers who benefit from an overall decrease in their access rights fishing fees. Finally yet importantly, the new management system made it possible for all fishers to sell their catch to their preferred buyer. Importantly, the decision-making is now very much in the hands of the large-scale (stow net) fishers who are the only members to sit in the CFG committee.

4. Results

[1] The 4 largest stow net operators contributed over MMK 1,000,000 while the other 2 contributed each under MMK 1,000,000.
[2] This restocking cost is automatically paid to DoF together with the licence but there had been no restocking done at the time of our visit, nor any plan to do so.

4.1. Strengths and merits of the management system

During the workshop, participants were asked to elaborate on what they identified as the most important positive changes brought by the new management system. We present a summary of their views by stakeholder group here below, before proposing a summary of those strengths that are shared across stakeholder groups (Table 3).

Large-scale stow net fishers:

Stow net fishers identified most of the merits of the community management system within the people & livelihoods dimension. They reported that their access to the license at floor price had significantly reduced their own costs and allowed them in turn to lower access fishing fee for other fishers. Another important positive change brought by the new management system was reported to be the freedom for fishers to sell their fish to their preferred buyer. Whereas the old system had made it compulsory for all fishers operating in the lease to sell their catch at a discounted rate to the leaseholder. This change has also contributed to render more fish available at local markets. The leaseholder was reportedly mostly trading fish at the township level. As a result of these positive changes, fishers were reported overall to enjoy higher living standards than in the past.

Small-scale fishers:

Small-scale fishers categorised the benefits of community management in both the institution & governance and the people & livelihoods dimensions. The lowered cost of fishing access rights along with their access to more fishing areas within the lease have made their livelihoods easier as fishers. Under the new management system, small-scale fishers also reported the benefits of being able to choose from a wider selection of approved fishing gears as they see appropriate. Like the large-scale fishers, they praised the freedom of being able sell their catch to a retailer of their choice. Finally, yet importantly, although they had not yet witnessed such investment in practice, they appreciated the intention of having some of the money generated from access fees reinvested in the village fund, allowing further development to be done to the benefit of the local community.

Government officials:

To the government officials, most strengths of the community fishing group administration lie within the people & livelihood dimension. The government officials largely reported the same benefits as those reported by small and large-scale fishers. As such, they refer to the benefits for local communities to access the lease at floor price, thereby allowing fishers to keep a larger share of their catch revenue and improve their living standards. They also referred to the freedom to sell their catch to the preferred buyer leading to better margins and more access to fish locally. In addition, the government officials reported the important institutional benefit of having fishing communities interacting more regularly with DoF officials, enabling them to increase awareness about fishing legislation, and improved collaboration in effectively implementing rules and regulations in the area.

Women's Association:

For the Women's Association as well, most of the strengths of community management were attributed to the people & livelihood dimension. The community management system reportedly allowed fishers to experience more working freedom compared to the individual leaseholder system. They also referred to the lowered costs incurred for fishing access, which were particularly beneficial

for small-scale fishers as it increases overall access for low-income members, in turn creating more work opportunities for vulnerable people within the village. Because of this change in management system, the women's association reported that fishers from the village were more cohesive, resulting in a significant reduction in internal conflicts. As the lease area is also better monitored, conservation measures can be enacted effectively, as community fishers are held accountable for maintaining their fish stocks to remain viable in the long run.

Merits/Strengths	Groups	Description
Lower cost of fishing access	Large-scale fishers Small-scale fishers Government Women Association	The access of the fishery at floor price has allowed large-scale fishers to reduce their access costs. The savings were passed on to the small-scale fishers through a reduction of their access rights fees
Improved market freedom	Large-scale fishers Small-scale fishers	Fishers can now sell their catch at a retailer of their choice. In the previous system, they had no other option than selling back to the leaseholder at an agreed, discounted rate
Better access to fish locally	Large-scale fishers Government	Under the previous system, the leaseholder would usually sell all fish at the township market. Now these fish are increasingly traded at the local markets
Better living standards for fishers	Large-scale fishers Government	Under community arrangements, fishermen can obtain more income (higher living standards) to better support their households

Table 3. Strengths shared across stakeholder groups

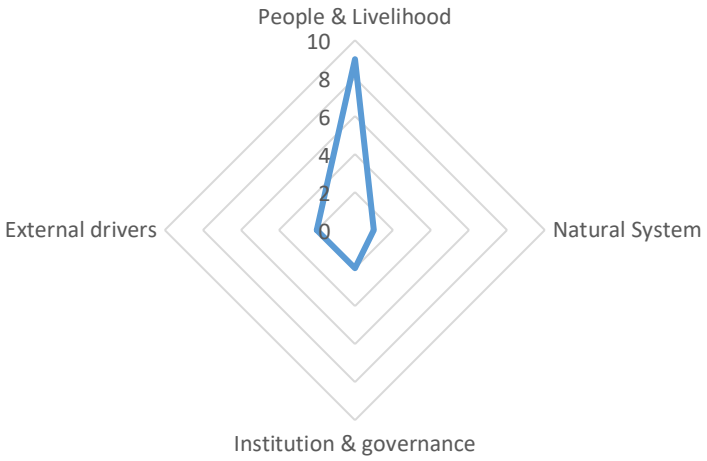


Figure 3. Dimensions of the merits brought by new management system

4.2. Weaknesses and constraints of the management system

Similarly, participants were asked to elaborate on what they identified as the most important constraints and challenges brought on by the newly established community-management system.

Below a summary of assessments made by the different stakeholder group is presented before proposing a summary of those challenges that are shared across stakeholder groups (Table 4).

Large-scale stow net fishers:

For large-scale fishers, the constraints of the management system were mostly assigned to the people & livelihood and dimension. Fish resources were reported to decline in part because of the mangrove deforestation experienced near the lease area. Large-scale fishers were not expecting this trend to improve in the future. Another concern had to do with the loss of fish stocks due to pesticide use in neighbouring paddy fields. Because the fish-spawning season coincides with the planting season for rice, fishers reported that fish eggs and fry in the fields were exposed to the damaging chemicals. Reduced water flow attributed to altered waterways for irrigation also caused a decrease in catch yields for high-value prawn and shrimp. Other challenges were categorised under the institutions & governance dimension, such as the fact that small-scale fishers avoided paying their fishing access fees given there is little enforcement by the CFG. The large-scale fishers believed that they were virtually paying for the whole lease by themselves while small-scale fishers operate for free, leading to a sense of inequality among them.

Small-scale fishers:

For small-scale fishers, most of the constraints brought by the new management system were identified under the people & livelihood dimension, followed by institution & governance. Although not directly related to the management system, the lack of financial support services was identified as a critical barrier to purchasing better fishing equipment. Small-scale fishers also reported that they experienced restrictions in fishing in waterways adjacent to fields as farmers were concerned that their crops would be damaged by their fishing operations. Further, sedimentation caused by irrigation infrastructure was identified as an important constraint, making the waterways shallower, thereby reducing the water flow and viable fish spawning habitats available. Finally, illegal fishing and pollution in the lease were pointed to as additional strains on aquatic organisms present in the lease, resulting in a trend of declining fish stocks.

Government officials:

Most of the constraints identified by Government officials were attributed to the people & livelihood dimension. As the lease area intersects with part of the World Bank Funded irrigation network, fishing access is officially restricted in overlapping waters by the Department of Irrigation (DoI) but not by the DoF (who participated to the workshop). They expressed the discontent of fishers, leading them to either ignore the fees that they are expected to pay to the CFG or illegally utilise more equipment than allowed in order to increase their catch. Some fishers do not respect the community regulations; illegal methods such as electrofishing and poison dumping are of serious concern in the lease. Lastly, government officials reported that farmers whose fields are adjacent to waterways do not clearly demarcate their property with proper embankments, potentially causing unnecessary conflict between them and fishers.

Women's Association:

Lastly for the women's association, all weaknesses brought by community-management system were placed under the people & livelihood dimension. They reported that the reduction of mangrove forests near the lease areas had reduced fish stocks. Reports were made about declining fish

biodiversity resulting from the use of pesticides by neighbouring farmers. Sedimentation of the waterways due to tidal action has resulted in narrower and shallower water channels, further deteriorating viable fish habitats. The size of the lease area is decreasing as farmers dikes that reduce fishing areas, and the intersection of the irrigation canal through a stream in the lease has put up/created legal restrictions. Finally, the lack of financial assistance from NGOs or government groups was pointed out as a serious limitation for fishers to afford better quality equipment.

Weakness/Constraints	Groups	Description
Habitat degradation	Large-scale fishers Small-scale fishers Women Association	The combined strain from pollution (e.g. chemicals from rice farming), increased sedimentation of the waterway and mangrove deforestation have contributed to an overall environmental degradation causing a deterioration of fish habitat
Fishing access restrictions	Small-scale fishers Government Women Association	The lease area is subject to restrictions enforced by the government (DoI) and/or by locals (paddy farmers) which are essentially different from the DoF rules and regulations
Fishing gear restrictions	Small-scale fishers Government Women Association	Small-scale fishers are constrained by the quantity of gear they can use but an important proportion of them end up not abiding by the restrictions
Avoidance of access fees	Large-scale fishers Government	Because the lease was accessed at floor price by the large-scale fishers, small-scale fishers largely believe that they can operate free of charge and avoid paying their access fee contributions

Table 4. Weaknesses shared across stakeholder groups

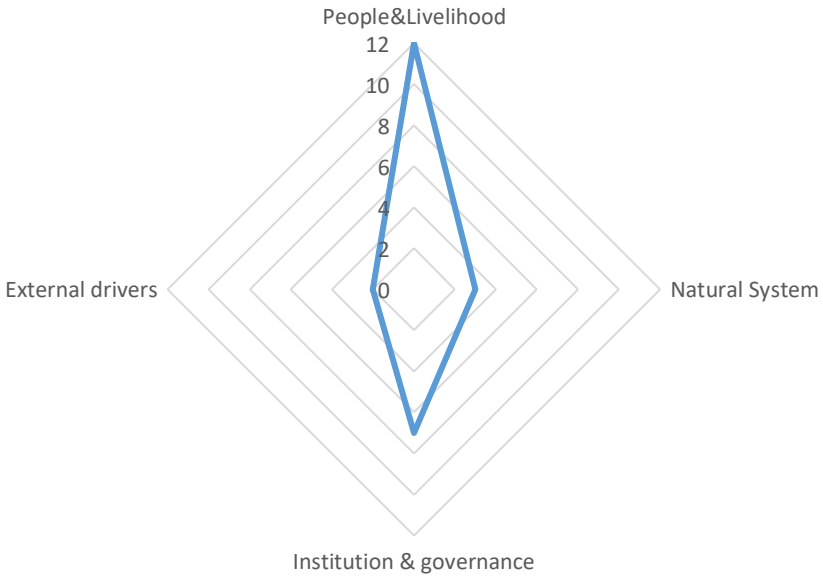


Figure 4. Dimensions of the constraints faced by new management system

4.3. Performance of the management system

Participants were invited to reflect on the performance of the management systems along the four dimensions of the PDAM (see Box 1), considering on one hand the current performance (i.e. evolution of key indicators over the past 5 years) and on the other hand future performance under current management conditions (i.e. inferring on the trend of these key indicators over the next 5 years). The results of this assessment are presented and discussed below. Overall the assessment indicates relatively poor performances of the systems along the natural system and external driver dimensions, and to a lesser extent, the people & livelihood dimension. Rather good performances were assessed along the external drivers, and the institutions & governance dimensions. Importantly, there is little change expected in the performances across all the dimensions of the system (Figure 2).

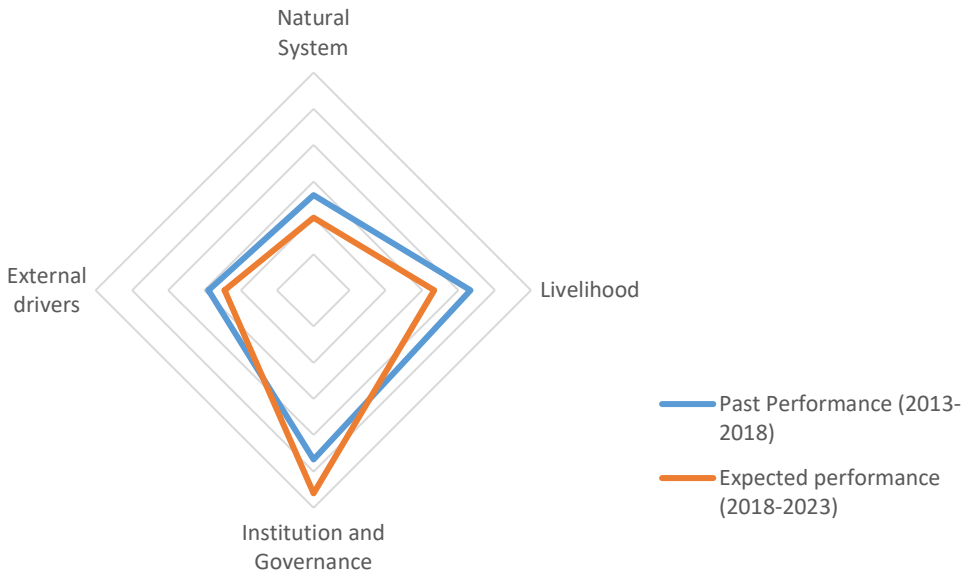


Figure 5. Past and expected performances of the fisheries management system

Overall, participants consistently reported deteriorating ***natural system*** and ***external drivers*** dimensions, with limited prospects for improvement under the present management. Many stressors were identified by the different stakeholders. The most commonly cited stressor was the shrinking of the surrounding mangrove by local communities who use the wood for domestic purposes (i.e. cooking stoves). This alteration of the fish habitat is impacting the natural breeding of some species (e.g. seabass is reported to have been impacted the most). The CFG seems to have very limited control over mangrove deforestation. Agricultural activities in the surrounding areas were also blamed for negatively affecting natural fish productivity. Small-scale fishermen reported decreasing catches due to sedimentation and decreasing water levels caused by the irrigation sluice gate. In addition, there were complaints about the high level of chemicals used by neighbouring farmers which primarily affects shrimp production. Finally, overfishing and climate change were seldom pointed to as other important stressors on the natural productivity of the fishery. Importantly, participants considered that the performance of the natural system would keep deteriorating in the future, perceiving most of the stressors to be beyond the reach of the CFG.

To a lesser extent, participants reported a relatively poor performance along the ***people & livelihoods*** dimension. Here, most of the participants agreed that because of both the dwindling resources and the increasing demand for fish outside the fishery, the amount of fish consumed by local communities

would keep decreasing over the years, thereby affecting local food security. Small-scale and large-scale fishers both reported that the contribution of fisheries to domestic consumption used to be better and steadier under the previous management system, although no direct causal link was made to the CFG management. Justifications indicate that the decreasing contribution to food security is to be partly explained by the increasing population. Contrary to the food security indicator, there were very conflicting assessments made regarding the financial benefits brought by the CFG. On the one hand, large-scale fishers and government officials reported that income generated from fishing had been improving under both the previous and the new management system because of the increased fish price. On the other hand, small-scale fishers and CSOs reported that the increasing fish price had only partly compensated for the lower catch, and that the overall income of fishers was still decreasing.

Finally, participants reported good performances and anticipated positive trends along the indicators of the ***institutions & governance*** dimension. All participants agreed that access to market for fishers operating in the lease was increasing. This trend was largely justified by the freedom for all fishers to sell their catch to their preferred buyers under the CFG management, but also more generally by the increasing demand and overall number of fish collectors. Similarly, there was a very positive trend observed regarding equitable access to fish resources. All participants agreed that the decreased access right fees enabled by the CFG management (for both large and small-scale fishers) were very positive developments for the local fishing community. However, questions were raised regarding the capacity of the CFG to enforce regulations. Large-scale fishers, government, and CSOs reported an improvement of the situation while small-scale fishers indicated that the CFG still had difficulty enforcing the rules in the fishery. However, all participants agreed on the value of the CFG management in increasing awareness of the fishers about the DoF rules and regulation. Yet, participants indicated that illegal fishing activities (e.g. use of chemicals to catch shrimp, continuation of fishing during the closed season) were worsening, representing an important threat for the sustainability of the fishery. Conversations indicated that an important next step will be for the CFG to come up with its own conservation measures. Finally, the lower performance along this dimension was attributed to access to financial services. Participants commonly reported that fishers get indebted with private moneylenders charging very high interest rates. Except for the government, participants appeared uncertain on the capacity for the CFG to provide such services in the future.

5. Discussion

The case of Kyon Ka Dun is one of a transition towards community-based management with very little technical support from DoF and no support from civil society organizations. As such, the case does illustrate some of the limits of the reform process towards genuine community-based management on the ground.

To start with, it can be said that under both (present) community-based management and (previous) individual management, no attention had been granted to resource conservation measures. Except for the prohibition of poison- and electrofishing which are compulsory policies commonly enforced by DoF, the CFG did not enact any management plan, nor any specific regulations (e.g. no-take zone, gear limitation, seasonal closing, etc.).

The most important changes brought by the community-based management regime are to be found in the access to the fishery at a floor price, which allowed all fishers (both large- and small-scale) to see their access fees considerably reduced. In addition, the freedom of trade was consistently reported as a critical change for the livelihoods of fishing communities.

Despite these positive changes, it can be said that fishing operations before and after 2017 are largely the same. Effectively, the stakeholders fishing in the lease are largely the same and there seems to have been an actual transfer of decision power from the leaseholder to the sub-leaseholder between the old and the new regime.

The study indicates that there is an important level of mistrust between small and large-scale fishers, notably around the use of the CFG fund, which has as a consequence that an important number of small-scale fishers (allegedly 75%) end up not paying their contribution at present.

The limited extent of changes brought by community-based management in the case of Kyon Ka Dun is perceptible in the expectations around the future performances of the fishery. Participants largely expected that none of the dimensions of the system would record any improvements in the future.

Characterisation of Fisheries Management Systems in AD and CDZ

MYFISH 2

Case Study 5 Report

(Individually managed Lease)

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AD	Ayeyarwady Delta
CDZ	Central Dry Zone
CSO	Civil Society Organization
DoF	Department of Fisheries
FAO	Food and Agriculture Organization
FDA	Fishery Development Association
FG	Fishers' Group
FGD	Focus Group Discussion
HH	Household
KII	Key Informant Interview
NGO	Non-government Organization
PDAM	Participatory Diagnosis Adaptive Management
RAAIS	Rapid Appraisal of Agricultural Innovation System
USD	United State Dollar
WF	WorldFish

Note:

Currency Exchange rate: 1 USD =1,346 Burmese Kyat

Weight Conversion: 1 Viss = 1.6 kilogram

1. Objective of the study

The aim of this case study is to generate an "in-depth" understanding of the individually managed lease fisheries management system in Pyapon township, with a focus on identifying major issues and potential entry points for addressing them. Hence the specific objectives are as follows:

- Assess performance of the Individual Lease fisheries management systems based on agro-ecological, social, and institution environments in **Ah Paung Village** tract, Pyapon; and
- Identify key issues and opportunities for interventions to improve the performance of this fisheries management system in the area.

2. Methodology

This case study documented the individually managed lease fisheries management systems based on its current performance, strengths/merits, and weaknesses/constraints using both quantitative and qualitative indicators. The final output was the identification of entry points both at the local and higher level for sustainable capture fisheries in the area. The selected case study was located in Ah paung Village tract, Pyapon Township. The site has been under an individual lease management system since 2008, with the same owner since 2013. The information and data used in the analysis were both from primary and secondary data sources.

Review of Secondary data

A matrix was developed to compile existing information about the site, fisheries, and type of management in the target area. The information gathered to complete the matrix was sourced from census, FAO assessment, MYFish 1 fishery survey, MYFish 2 Component 2, and other available information from District, Township, and Region DoF.

The Analytical Framework

The proposed analytical framework is adapted from the Rapid Appraisal of Agricultural Innovation Systems (RAAIS). RAAIS is a diagnostic tool originally developed for the agricultural sector and allows the analysis of agricultural issues from broad entry themes towards more specific entry points for productivity, natural resource management, social development, and institutional innovation. We propose to combine RAAIS with another theoretical framework tailored to the identification of fisheries management issues: the Participatory Diagnosis Adaptive Management (PDAM). We combine these two frameworks by adapting the four radar issues of PDAM as the four analytical dimensions to be investigated by RAIIS. These dimensions are elaborated in **Box 1** below.

Box 1: PDMA dimensions – Definitions and Indicators

People & Livelihoods: the socio-economic aspects of the fisheries communities and this encompasses household well-being, which includes household income, diversity of household livelihoods, household fish consumption, living conditions, norms and culture, and household assets. It also can include conflict with other users and resource use.
Indicators: Living conditions; diversification/income dependence; assets and income poverty.

Natural system: the biological classification of yield, biodiversity, and sustainability of the fisheries resources and ecosystem, its stock status and trends (total catch, total catch by species, fishing effort, catch by unit effort, and number of species), fishing practices, and aquatic ecosystem conditions, such as connectivity, breeding ground, pollution from upstream, agriculture, industry.
Indicators: Biodiversity; stock status and trends; fishing practices; aquatic ecosystem condition.

Institutions & governance: the manner in which a power is executed in the management of the fisheries sector. It is the enabling environment aspect in governing fisheries management to reach maximum sustainability (legitimacy, membership rules, access rights, management controls, representation rules, sanctions, enabling legislation/policies/legal framework, local support, financial management and services, market access, organisational and institutional capabilities.
Indicators: Fishing and development policies; organisational and institutional capabilities; access to markets and financial services; collective action abilities; governance performance and rights; legal frameworks.

External drivers: Outside influences that can impact the fisheries resources and its ecosystem. Various external factors can impact the ability of the fisheries to achieve maximum productivity/biodiversity and sustainability. These external factors might include infrastructure development, macroeconomic instability, climate change and environmental uncertainty, migration, market demand changes, price fluctuation, land use changes, migration.
Indicators: Infrastructure development; conflicts with other sectors or users.

The resulting framework relies on multiple methods of data collection, building on existing experiences with rapid appraisal approaches and (participatory) innovation systems analysis. Our investigation generates both qualitative and quantitative data; facilitates 'insider' and 'outsider' analysis; targets different stakeholder groups across different levels with individual, group and multi-stakeholder perceptions on weaknesses/constraints and solutions; and provides sufficient detail on the main weaknesses/constraints under review, the capacity for innovation in the fishery management system, and the functioning of the fishery management system.

Methodological steps

Based on RAAIS tool, the following steps were taken to assess the existing fisheries management systems based on the context of each site: (i) identifying strengths/merits, and weaknesses/constraints; (ii) categorising strengths/merits, and weaknesses/constraints; and (iii) exploring specific and generic entry points for recommendations for the current fisheries management system to achieve equitable and sustainable fisheries. The objectives, sessions, and activities of each step are presented in detail in Annex 1. The following research steps were conducted in Ah Paung village over the course of three days to gather a broad range of information from relevant stakeholders. The participatory assessment of the fisheries management system was facilitated by a research team of nine members (incl. three WorldFish staff and six DoF staff).

The **multi-stakeholder workshop** represented the first research step and focused mainly on 'insider' analyses of the fisheries management system. A total of 20 stakeholders were invited and convened in four groups (figure 1), namely Lease main fishers (i.e. operating large fishing gears during the high fishing period, and representing 40% of the workshop participants), Secondary fishers (i.e. operating only small gears with a restricted access to the fishing ground), CSO (i.e. NGOs operating in the village, local associations) and Private sector (i.e. Farmers, aquaculture farm, retailers, collectors…). The workshop offered an opportunity for each group to assess the overall performance of the fisheries management system and identify associated strengths, and constraints. As such, this first step provided entry points for the next two steps of the study.

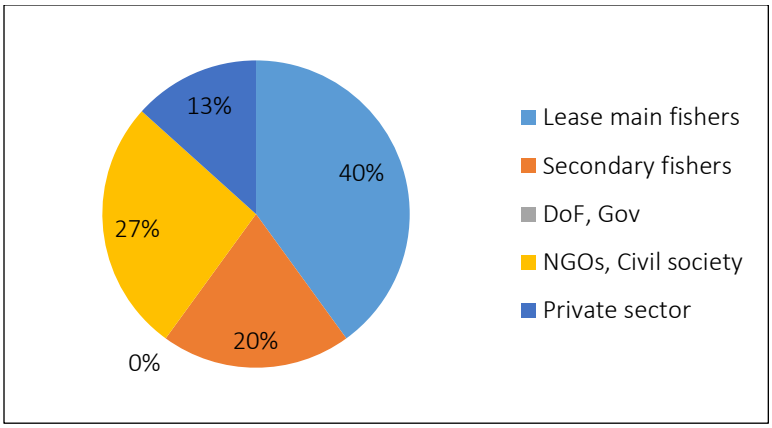


Figure 1: Participants proportion

The workshop was followed by targeted Key Informant Interviews (KIIs), and Focus Group Discussions (FGDs). These consisted of conversations with respectively one and multiple stakeholders of importance that were identified during the workshop. The KIIs and FGDs were used to gain in-depth insight on the information gathered during the multi-stakeholder workshop and understand the perspectives of and dynamics between different groups on the existing fisheries management system in the area. Three KIIs and two FGDs were held in total. The KIIs were held with stakeholders who had participated in the multi-stakeholder workshop (i.e. Main fishers, Part-time fishers, government officials) while the FGDs extended to 'outsiders' (i.e. paddy farmers, fish retailers, and fish collectors). All discussions revolved around the strengths and constraints identified by the different stakeholder groups during the workshop.

Workshop group (Photo© Romain Langeard)

In total 27 respondents contributed to the information gathering during three days of field data collection (10 – 12 October 2018) at Ah Paung village, Pyapon Township. The lease owner and full-time Fisher Group had the highest number of respondents participating in data collection. A detailed list of these stakeholders across the different methodological steps is provided in Table 1.

Methodological steps	Stakeholders groups targeted – Sample size					
	Lease main fishers	Secondary fishers	Government Officials	NGOs/CSOs	Private sector	TOTAL
Multi-stakeholder Worksop	6	3	0	4	7	20
Key Informant Interview	1	1	1			3
Focus Group Discussion				2	2	4
Secondary data collection						
TOTAL	7	4	1	6	9	27

Table 1: **Summary of data collection methods and participants**

3. Study site

3.1. Background information

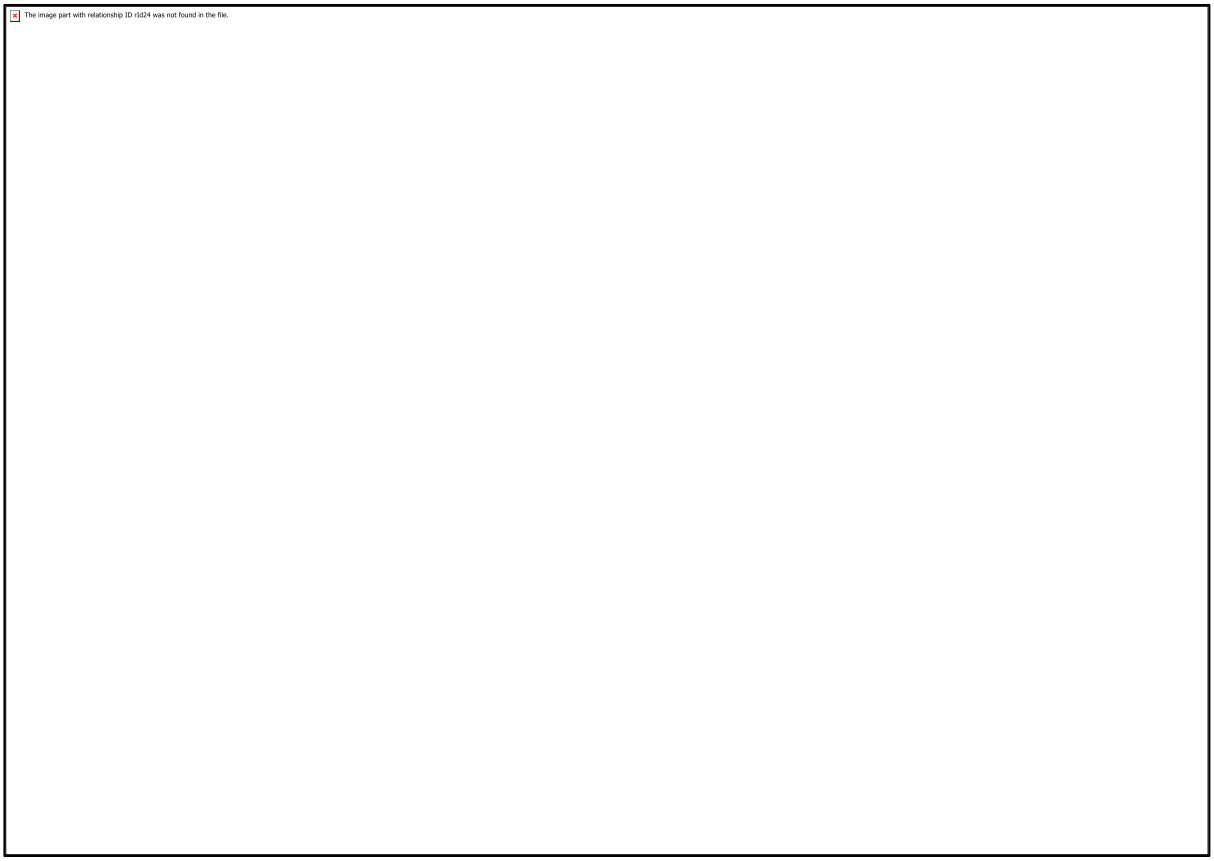


Figure 2: Map of the Ah Paung lease

The study site is located in Ah Paung village tract, Pyapon Township. The lease area is a creek of two channels of 4,2 km long, the larger one is 30 m wide directly connected to the Pyapon river downstream at about 10 km of the sea shore. The channels run between two villages: Shit Pe village at the crossroads of the main road and the beginning of the lease, and Ah Paung village at the other

side of the lease near the junction with Pathein river. This lease includes six villages from three village tracts: Ah Phang, Sat Su, Aye Tar Yar, A Charlay, Tha Mane Htaw, Kone Tan.

Area (km2)	Lease area: 3810 meters x 33 meters
Demographic	Ah Paung village: 715 male, 698 female = 1413, 280 Households
# of fishers	40 full-time and 48 part-time fishers
# of others	55 Farmers in paddy field (Total of 1200 Acre)
Start Date of this lease management	2014
Date of this kind of management (individual or community based)	2008
Lease price	Around 100 Lakhs (Approx. 10 000 000 Ks = 7400 USD)
Peak fishing season	June to November
Low fishing season	February to May

Table 2: Lease general information

3.2. Fisheries System

3.2.1. Natural system and fishing techniques

The Ah Paung lease is a canal connected to other small inland canals in an intensive paddy farming area (see Figure 2). The uniqueness of this lease lies in its direct connection to the Pathein river in a near-costal area, which explains the brackish water we find here. Another unique characteristic of this lease is that it is located downstream of a large irrigation sluice gate (seasonally closed to limit the salinity of the up-stream cultures).

The accessibility of the lease is good but only possible by boat. Nevertheless, it is possible to reach the inland side (west side) of the lease by the main road linking Pyapon to Kyonkadun (approx. 15 min drive). The banks of the canal have a high plant and tree diversity and some infrastructure development (group of one to five houses). Most infrastructure is related to/used for very small-scale farming (Duck, pigs, chicken) or aquaculture activities. It is likely that some parts of the lease have benefited from reforestation and dyke construction as a result of those farming activities.

The high fishing season starts around June when water levels rise. During this period the main fishing gears used by the owner are several stow nets set in four out of five lease segments. During this period the lease owner allows other fishing gears to be used after payment of a fee (e.g. 50,000 Ks for a boat with cast net, 30-50k for a trammel net depending on the size of the gear). Fees are lower for smaller gears (e.g. big cast net 7,400 Ks, small cast net free). The utilisation of Bawon pike (a type of surrounding net put in places where fish are hiding in shallow water, on the bank, or in brush parks) costs 7 to 8 lakhs (1 Lakh = 100 000 Ks), but can only be used after the stow net utilisation. The periods in which certain gears are used depend mainly on the water level in the lease at that time.

The lease, which is under individual management, is usually divided into 5 segments by the owner. The owner will exploit those segments at the beginning of the fishing season (June) using stow nets, until the yield decreases (around October). After this productive fishing period, the owner subleases the segments to three to four other fishermen in the area.

From November until March, the use of the Bawon pike is possible in the area after the owner finishes using stow nets. From December until March, fishers using small-scale fishing gears for subsistence fishing are allowed to fish for free, while for other gears a fee has to be paid.

The main target species in the high season (October to November with roughly 2,000-3,000 viss/season compare to the low season when catch volume is around half) are freshwater prawns, seabass, *Channa striata*, *Notopterus spp.*, and *Mystus spp*.

The target markets are Yangon or Pyapon market. Only a small proportion of caught fish are sold locally. According to the fish collectors, even during high season out of 100 Viss collected per day only 2-3 viss are sold on site. Collectors' prices on site are 50,000 Ks/Viss for freshwater prawns, 5,000Ks/viss for Seabass, 3,000Ks/viss for *Channa striata*. In Yangon, the price increases by 500 to 1,000 Ks per viss.

3.2.2. Former fisheries management and changes over the time

This lease has been under an individual management system for over ten years, and it has had the same owner for the last five. Hence the changes in the fisheries management are minor compared to when a fishing system would have switched towards a new management type (like community-based management). The major changes that occurred seem to be related to fishing access rights and productivity of the lease. In the five previous years, fishing fees increased from 20,000Ks to over 50,000Ks (Table 4). According to some main fishermen involved in the lease the productivity was about 5,000-6,000 Viss/day 5 years ago, while now it is in the range of 3,000 Viss/day (Table 3). The local fish collectors and retailers confirmed this evolution as presented in the table below in table 3.

Category	Daily catches in 2013 (5 years ago) (in Viss)	Daily catches in 2015 (in Viss)
Total catch	5,000 – 6,000	3,000
Freshwater prawn	10	3 - 4
Seabass	3 - 4	1.5 - 2
Channa striata	5	1.5 - 2

Table 3: Catches evolution in the past 5 years

According to the local actors (main fishers and private sector) the decline in productivity is mostly due to use of pesticides in farming combined with impacts from climate change. The rains start later and later every year, which wash pesticides from the fields directly into the lease during the fishing season. Other causes of the decline, according to the private collectors and retailers, are the use of poison by illegal fishers and the impact of the irrigation sluice gate on the water level and on fish migration.

Table 4: Price evolution over 10 years

Year	Key events
1985	Construction of the World Bank-funded Irrigation channel network
2008	May- Cyclone Nargis struck the delta region
2012	Revision of the Ayeyarwady Freshwater Fisheries Law Authority transferred from Central to Regional DoF
2016	Advent of the NLD administration
2017	Change in leasing system from individual to group management

Table 5**: Key past events**

3.2.3. Current organisation and management

Since the lease price is above 40 Lakh, the request to the DoF by local parliamentarians to convert some leasable fisheries into a community-based management system was not applied here. In this site, the main stakeholders identified are as follows:

- The main fishers (including the lease owner, the sub-leaser owner, the full-time fisherms employed by the owner),
- The secondary fishermen (part-time fishermen, outside fishermen),
- The private sector (Collectors, retailers, farmers),
- The Civil societies (NGOs and associations),
- The government (Village tract head, DoF district officer)

Access management

The full management of the lease is left in the hands of the lease owner, who applies what regulations and management measures he wants regardless of DoF policies. In this lease, the owner is a rich man living in Pyapon who hires a local man to manage the lease on a daily basis. The lease is divided into five main segments. The lease owner usually exploits four and then sub-leases the fifth to a “main sub-lessee” who is responsible for the management of that segment.

In the segments under his management, the lease owner puts in place some ground rules, such as banishing poison or electrofishing, through local awareness raising. The owner is the only one who uses a stow net in the lease. He allows fishing for five months (June to November), after payment of a fee depending on what gear or boat is used. During the rest of the season (December to May), which coincides with reducing water levels and the lease owner's fishing season, it is still possible to fish after paying a fee. Very few fishers fish during this period because catches are low and access right fees are high. However, if authorised by the owner, fishers are allowed to operate small fishing gears to fish for home consumption.

The major change that occurred in the past five years was the possibility for small-scale fishermen to get access to the lease resources. This was possible thanks to the intervention of the Union government who pushed and facilitated the negotiations between the lease owner and the communities. The government came up with a list of sixteen fishing gears that are allowed to be used by local communities between January to March, and only for personal consumption.

Although the lease owner is the only one using stow nets in the lease, he alone does not decide on the number of allowed gears and where they are placed. The DoF is jointly responsible and sets the number of allowed stow nets at one per segment. In addition to this, the DOF is requesting the owner to monitor the fish population in those locations so they can move the exploited section in case of resource depletion. But beside this, the DOF involvement in the lease management is very low.

Illegal fishing

Illegal fishing remains low in this area. Some cases do occur in the small channels during the flooded season, even though fishing is not allowed in this period, but nothing serious it is very small-scale fishing. The small size of the canal makes it easy to control, which probably reduces the occurrence of illegal fishing. When an illegal fisher gets caught, the lease owner confiscates his gears. The real issue seems to lie in destructive fishing methods, such as poison or electrofishing.

Opinion on the management

The local part-time fishermen are complaining about restricted access to the lease and would like to see it shift to a community-based management system. Local fishers still have access to other local fishing grounds, such as Pyapon river, which is an open access system and has a high productivity. The local fishers feel that fishing fees in the lease are becoming more and more expensive, which pushes them to fish in other areas (such as at the coast or in Pyapon river).

At the same time, the fish collectors (which in some cases are the main sub-lessees) are not willing to see the lease change to a community management system. Under the individual management system, it is easier for them to give access rights or loans to the fishermen, and control that they get paid back (in cash or with fish catches). If it was not under an individual management, the fishermen could get loans and sell back to whomever they choose, which would spell the end of their monopoly. The fish collectors agreed that the fees are becoming more and more expensive. They think that the fishermen would be happy with any kind of management as long as the fees would be reduced.

The lease owner feels that the fishing sector is too vulnerable (due to weather fluctuations and high labour costs to fixed workers). This pushes him to shift his focus towards the agricultural sector.

The DoF and local administration (village leader) think the individual management system has two main advantages. It reduces illegal fishing because regulations are strongly enforced by the lease owner, and the DoF has a higher revenue due to the high lease price (which would be much lower in

the case of community management and small gears licencing). In addition to this, the DoF believes that this management is good for the sustainability of the resources.

External conflicts

There are some tensions between fishers and farmers regarding water management when the rains decrease in September-October. At that time, the farmers close the upstream irrigation sluice gate to conserve water and prevent salt intrusion, but this results in a lower stream flow and shallower water in the downstream lease, in addition to a fish migration barrier between the floodplain and the lease. It seems there is some agreement between the lease owner and the farmers on this matter. The same issue is seen in the small channels of the lease where farmers will block the waterway for the same reasons as above. This creates issues for fishers, who know the importance of these small channels for breeding and migration for both fish and prawns. Again, the lease owner seems to try to convince farmers by compensating them financially to open the channels earlier in the season.

4. Results

4.1. Strengths and merits of the management system

During the workshop, participants were asked to elaborate on what they identified as the most important positive changes brought by the new management system. We present here below a summary of their views per stakeholder group before proposing a summary of those strengths that are shared across stakeholder groups.

Lease main fishers

They reported that the powerful management in place (in the person of the main lease owner) is increasing the system performances trough efficient regulation enforcement, which favours the lease production. This management allows for a quicker decision-making process through centralisation of the responsibilities from the DoF to one single person, inter-sectorial management with the farming activities, and the creation of well-paid jobs providing a regular source of income for the local communities. Besides this, local livelihoods are supported through development of the lease surroundings by reinvesting profits, and through good access to fish products (in a context of increasing regional fish prices).

Secondary fishers

According to this group, the merits of this system lie in the close, natural connection to a large river, and the agreement from the lease owner to use the canal as a navigable waterway. This is making fishing and trading, including women's retailing activities, in the surrounding areas easier. In addition, the lease exploitation is offering lucrative seasonal work opportunities under the individual management system. Finally, the presence of an agreement on how water resources should be managed across different sectors benefits local livelihoods, which for a large part depend on paddy farming.

Government officials:

This stakeholder group was very small during the workshop and was not really aware of the situation in the lease. This group was consulted several times on the subject prior to the workshop through Focus Group Discussions and in Key Informant Interviews. The individual management status of this lease might be the reason for the disconnect between the DoF and the fishing community.

NGOs and CSOs

The governance of the lease, combined with its natural isolation from large pollution sources, results in a high productivity in terms of fish and freshwater prawns. It supports local livelihoods through seasonal access granted to the small-scale fishermen, and agreement with agricultural sectors around the lease which plays a role in lowering out-migration. In addition, this group considers the important infrastructure development done by the lease owner an asset for local businesses and population mobility in the area, and is raising the population's access to new markets, education and healthcare.

Private sector:

The fact that the lease area is the only one in AD that has authorisation from the DoF to fish year-round, and the direct connection to a large river near the coastline certainly contributes to the area's productivity. Combined with this, the lease area presents real advantages in term of accessibility (markets but also livelihood needs in general), and local business development. This group supports the idea that the local arrangements between fishermen and farmers have a positive impact on the livelihoods of the local population. This arrangement has led to increased catches for some and better water access for others.

Merits and strengths	Groups	Description
A powerful management supporting lease productivity	Lease main fishers NGOs and CSOs Private sector	The strong individual management of the lease is keeping the productivity high by enforcing fishing regulations. The sustainability of the system is linked with the natural position of the lease, but also to the seasonal access regulations put in place by the lease owner.
Creation of job and business opportunities	Lease main fishers Private sector	The high productivity of the area, and its connection with the larger river creates opportunities for small businesses, in addition to seasonal work in the lease. This provides a regular income for the surrounding population.
Local livelihood support	Lease main fishers Secondary fishers NGOs and CSOs Private sector	One of the main benefits of this lease to the community's livelihoods is the accessibility and transport access. Thanks to the possibility to navigate the lease, the local communities get better access to new markets, education, healthcare. This has reduced out-migration in the region. In addition to this, even if there are strong regulations in place by the owner, the seasonal access to the lease granted to small-scale fishermen is a real support to local livelihoods (essentially composed of paddy field farming for the part-time fishermen) especially during the flooded season.
Local area infrastructure development	Secondary fishers NGOs and CSOs Private sector	The profits from the lease are in part reinvested in the area (road building, electric generators…) which pushes real infrastructure development to the lease surroundings, and supports local communities on a daily basis.
Trans-sectorial management	Secondary fishers NGOs and CSOs	One of the main causes of conflict in the area, according to the DOF, is around water use between fishermen and paddy farmers. In this lease, there seem to be few conflicts thanks to an arrangement made between the fishing community (lead by the lease owner) and the farmers. The fact that most of the part-time fishermen are also paddy farmers may have helped in the process which has led to concrete benefits to both farming and fishing activities.

Table 6: Main merits and strength of this management system

4.2. Weaknesses and constraints of the management system

Similarly, participants were asked to elaborate on what they identified as the most important constraints and challenges brought by the new management system. Below a summary of assessments made by the different stakeholder group is presented, before proposing a summary of those challenges that are shared across stakeholder groups.

Lease main fishers

In this lease, the DOF was not very involved, which meant that the owner had to deal with certain situations alone (illegal fishing, conflicts with farmers…) without being able to exert any real level of pressure. This is even more an issue considering that external drivers were mentioned as being the main challenge to the system (climate change, other sectors activities, irrigation sluice gate use). After the upstream irrigation sluice gate was closed, the group stated that the water level is decreasing faster, which shortens the fishing season and has an impact on the potential benefits. In addition to this, the group did not exclude that using the water gate impacts fish migration which could explain the loss of productivity observed over the past few years. This group is also aware of the local small-scale fishers' frustrations. They would like to get broader access to the lease, not just seasonally and with the owner's permission, this increases uncertainty for their livelihoods.

Secondary fishers

The high accessibility of the lease facilitates access to new markets in large cities that offer better prices to the fishermen, but this results in rising local prices. This wouldn't be a big issue if the lease access rules were more flexible and allowed regular fishing for home consumption, but the fees are very high and the local community is not allowed to use the lease freely. This group mentioned that even fishermen who received permission to fish from the owner catch less, because the productivity of the lease is in decline. Other groups believe that the decline is mostly linked to external drivers such as climate change impacts or use of the upstream irrigation sluice gate. The major livelihood activity in the area is paddy farming and this represents an important source of income for many part-time fishers. Paddy farming is under pressure by increasing soil salinity.

Government officials:

This stakeholder group was very small during the workshop and the participants were not really aware of the situation in the lease. This group was consulted several times on the subject prior to the workshop through Focus Group Discussions and in Key Informant Interviews. The individual management status of this lease might be the reason for the disconnect between the DoF and the fishing community.

NGOs and CSOs

One of the major challenges of this system, according to this group, concerns the restricted access to the lease for local residents. Fishing is an unreliable source of income due to the high fishing fees and the fact that authorisation to fish is decided solely by the lease owner. In addition to this, the boundaries of the lease and surrounding farms are not clearly demarcated, and the sluice gate is used without consultation of different stakeholders, which occasionally creates conflict. Another issue is the increasing prices for fish products. Selling fish products is more profitable at the nearby Pyapon market, but this in turn drains the local fish supply, and pushes local fish prices up.

Private sector:

The high fishing fees imposed by the owner and the limited access rights are the main challenges of this system. These access restrictions "force" the local community to continue paddy farming. Paddy farming is also costly because there is a need to invest in temporary water control gates annually. In addition, in some cases paddy fields were damaged or destroyed by illegal fishers who didn't have access to the lease.

Constraints & challenges	Groups	Description
Fluctuation in **fish product prices**	Lease main fishers Secondary fishers NGOs and CSOs	The new access to the large city market (Pyapon) pushes fishers to sell their catch to city retailers (who offer better prices), who then re-sell around the lease area at much higher prices (70% more expensive than local retailers).
Main **livelihood** in the area **is under pressure**	Secondary fishers NGOs and CSOs Private sector:	The primary livelihood sector in the area is paddy farming and it is directly linked to the lease management (water management among other things). This area faces different challenges such as a lack of water control gates (which causes increased salinisation of the soil), illegal fishing damaging the plantations, and the dialogue with the lease owner regarding water use.
DOF support is very low	Lease main fishers	The DoF is not involved in the lease management and hence does not offer support regularly. The illegal fishing cannot be addressed by the lease owner themselves and needs the presence of the DOF to enforce local legislation.
Important access **restriction**s to the lease **lease for local fishers**	Lease main fishers Secondary fishers NGOs and CSOs Private sector:	The high regulation of the lease access doesn't allow the local population to fish year-round. Even though the lease creates some well-paid jobs, the number of those is still very limited. Local fishers either need to get the owner's permission or pay expensive fees to get access (even for small-scale fishing) which is not always approved by the owner. This makes fishing an unreliable activity for local communities.
Decease of the productivity	Lease main fishers Secondary fishers	This decrease is mostly explained by the stakeholders by the construction of a water control gate upstream of the lease. This reduces the water level earlier in the year, and disrupts the migration of some species, which leads to decreased productivity. Another justification could be climate change (but no specific arguments are given).

Figure 2: Main constraints and challenges for this management system

4.3. Performances of the management system

Participants were invited to reflect on the performance of the management systems along the four dimensions of the PDAM (see Box 1), considering the current performance on one hand (i.e. evolution of key indicators over the past 5 years) and future performance under the current management conditions on the other (i.e. inferring the trend of these key indicators over the next 5 years). The results of this assessment are presented and discussed below (extra information found in ANNEX 1 and ANNEX 2).

4.3.1. View by stakeholders

Lease main fishers

This group was composed of the lease owner, some full-time fishers, and the main sub-lessees. They considered the current performance of the management system to be low for the ***people & livelihood***

and n***atural system*** dimensions, stable for ***institution and governance***, and high for ***external drivers*** dimension. They expect the performance for ***people & livelihood*** and ***natural system*** to decrease, for ***institution and governance*** to remain stable, and for ***external drivers*** to improve (Figure 8).

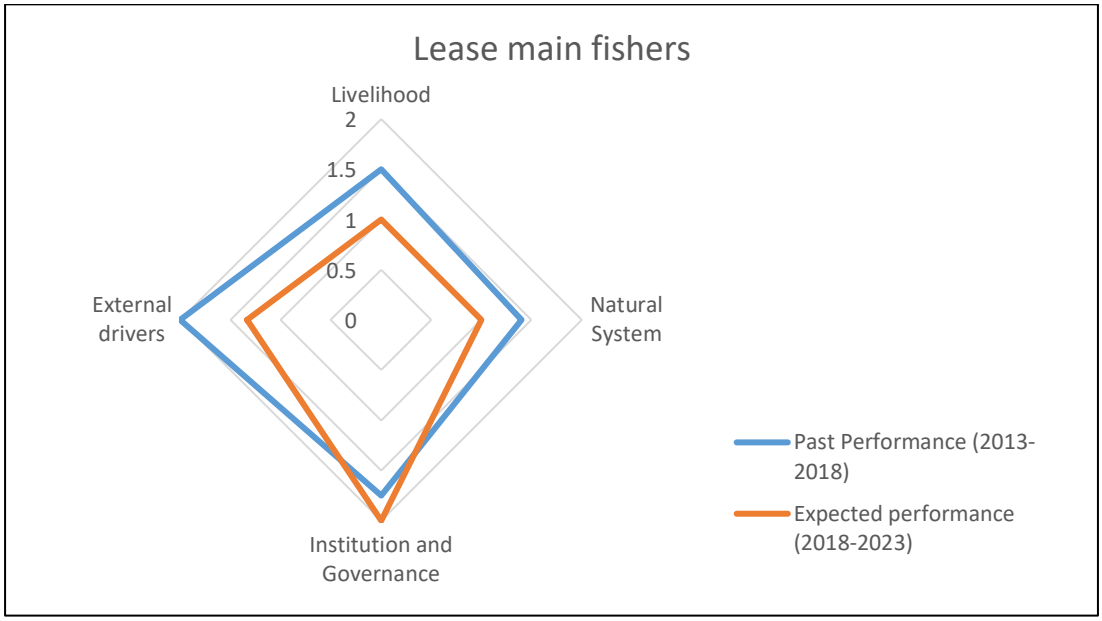


Figure 3: Strength view by the Lease main fishers group

The low performance for the ***people & Livelihood*** and ***natural system*** dimensions, and their expected decline can be explained by the fact that this group perceived a decline in stock status since the cyclone Nargis. The performance of the ***natural system*** has decreased due to intense paddy farming around the lease area. There is a perception food security will decrease in the coming years, due to uncertainty surrounding access to the lease for daily fishing activities. The stability in the perception of the performance for ***institution and governance*** in the coming years can be attributed to an expected decrease in enforcement of regulation (disengagement by the DOF) being offset by an increase in the expected performance for "Market access" and "Access to financial services". The expected improvement in the performance for ***external drivers*** seems to be linked to good control of "illegal fishing", good management of "infrastructure development" and "environmental degradation". The performance for this last criterion is expected to increase in the coming years.

Secondary fishers

This group was composed of outside and/or temporary fishers. They consider the actual performance of the management system as stable for the ***people & Livelihood*** dimension, declining for ***natural system***, and stable to improving for the ***institution and governance*** and ***external drivers*** dimensions. They are expecting the performance for ***people & livelihood*** to decrease even further and the performance for ***natural system*** to remain stable. The performance for both the ***Institution and governance*** and ***external drivers*** dimensions are expected to increase in the future (Figure 9).

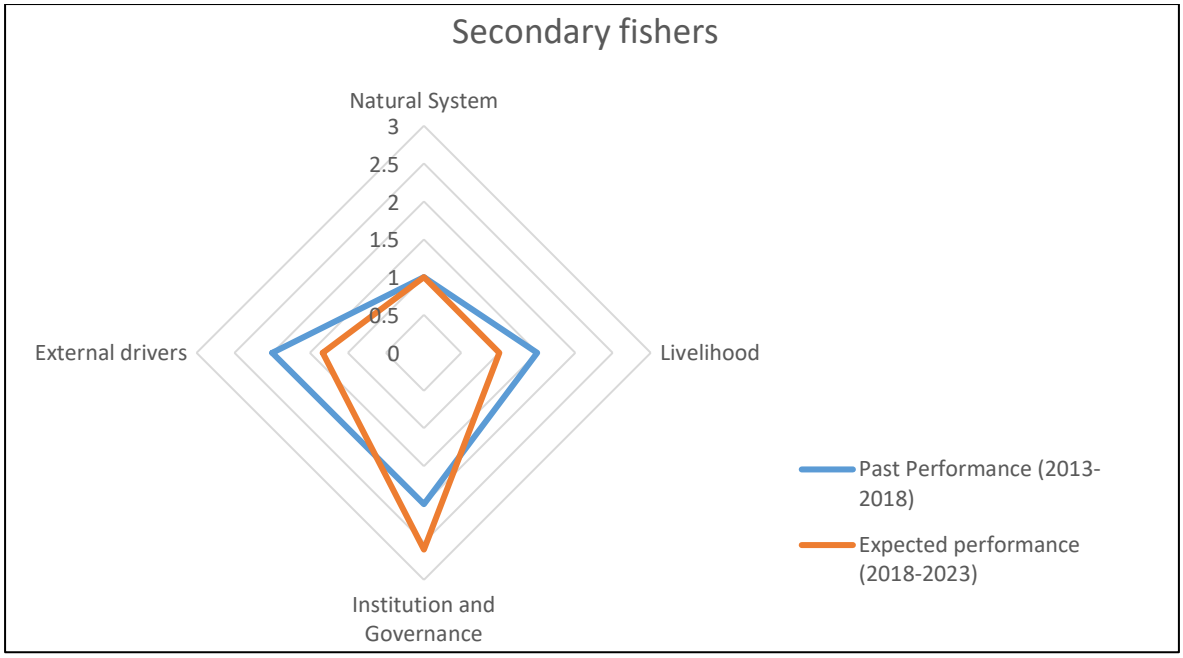


Figure 4: Merits and strength view by the Lease main fishers' group

The low performance for the ***people & livelihood*** and ***natural system*** dimensions and their expected decline could be explained by the fact that this group expects a decline of fish stocks coupled with an price increase, and by the fact that the performance for ***natural system*** has decreased due to delays in the rains last season and sedimentation which reduces water flow. The stable performance for the ***Institution and governance*** dimension seems to be due to an already good performance of the "enforcement of regulations", and its rise is mostly due to the expected improvements in "Market access" (through getting better sale prices although catches are declining) , "Access to financial services" (through new services provided by NGOs) and "Policy and regulation" (through a better definition of policies in order to achieve sustainability of fishing activities in the lease).

Private sector:

This group was composed of farmers, retailers and collectors, and small (grocery) shop owners. They considered the current performance of the system as increasing strongly for the ***people & livelihood*** dimension, increasing for the ***external drivers*** and the ***natural system*** dimensions, and stable for the ***institution and governance*** dimension (Figure 10).

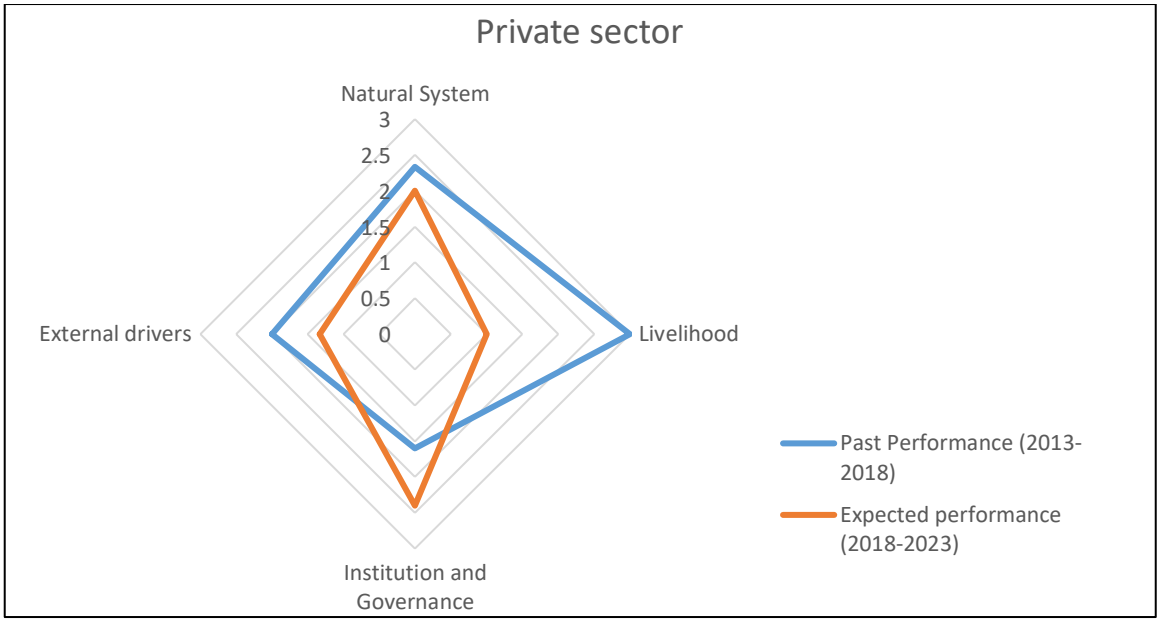


Figure 5: Merits and strength view by the Private sector group

They expect the performance for all but the ***Institution and governance*** dimension to decrease in the future, with the highest expected decrease for the ***people & livelihood*** dimension. The small expected decrease in the performance for the ***natural system*** dimension can be explained by the fact the rising use of illegal fishing methods (electrofishing and poisoning) is compensated by the appearance of new species in the lease (tilapia, *Wallago attu*, *Labeo calabasu*). This seems to be linked to the reduced salt intrusion thanks to the water control gate and expansion of fish farming. The expected strong decline in the performance for the ***people & livelihood*** dimension is linked to the reduction in access to fish, an increasing focus on export rather than local markets, and to the increase of the fishing fees. The expected small decline in the performance for ***external drivers*** seems to be due to the increasing illegal fishing methods around the lease combined with the building of a new water gate what is impacting the lease productivity. The expected increase in the performance of the ***Institution and governance*** dimensions seems to be linked to two main factors: the increased access to loans through the establishment of a new NGO, and the increased access to export markets by new fish collectors and interesting prices.

NGOs and CSOs

This group was composed of FAD and World Vision members. They considered the actual performance of the system stable for the ***people & livelihood*** and ***external drivers***" dimensions, slowly increasing for the ***institution and governance*** dimension, and slowly decreasing for the ***natural system*** dimension (Figure 11).

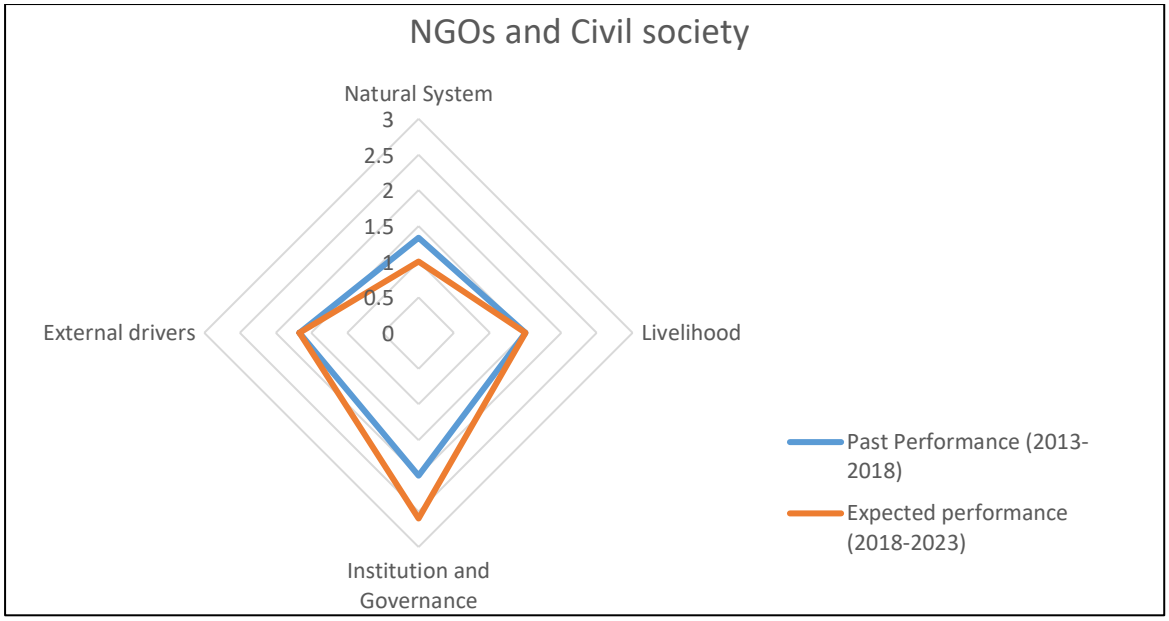


Figure 6: Merits and strength view by the NGOs and Civil society group

The expected performances of the system follow this trend by remaining stable for the ***people & livelihood*** and ***external drivers*** dimensions, decreasing faster for the ***natural system*** and increasing for the ***institution and governance*** dimension. The decline in the performance of ***natural system*** to be due to a combination of climate change impacts on the water level, overfishing, and poison fishing activities. This group stated that the expected stability in the performance for ***external drivers*** and ***people & livelihood*** is due to efforts made regarding food security despite the decrease in fish catch, good support for infrastructure development by the lease owner, and the expectation to have better access to subsistence fishing activities in the future.

4.3.2. View shared across the stakeholder groups

The performance of the current fisheries management system was determined based primarily on the perceptions of four types of stakeholders participated in the multi-workshop activity. The PDAM framework was used to assess the performance based on the four dimensions: ***Natural system***, ***People & livelihood***, ***Governance & institutions*** and ***External drivers***. The performance score of each indicator

was divided into three, with three being as the highest score (Figure 12 and 13).

Figure 7: Merits and strengths versus constraints and challenges

It is clear that according to the different stakeholders involved in the case study the majority of the merits & strengths are found within the ***people & livelihood*** and ***natural system*** dimensions, while the weaknesses & challenges are mostly related to the ***external drivers*** and ***institution & governance*** dimensions (Fig. 9B and 9D). In addition to this, it is also clear that most of the strengths and weaknesses of this system had an impact on the performance for the ***people & livelihood*** dimension since it is highly represented in both fishery management system approaches (Fig. 9A and 9C).

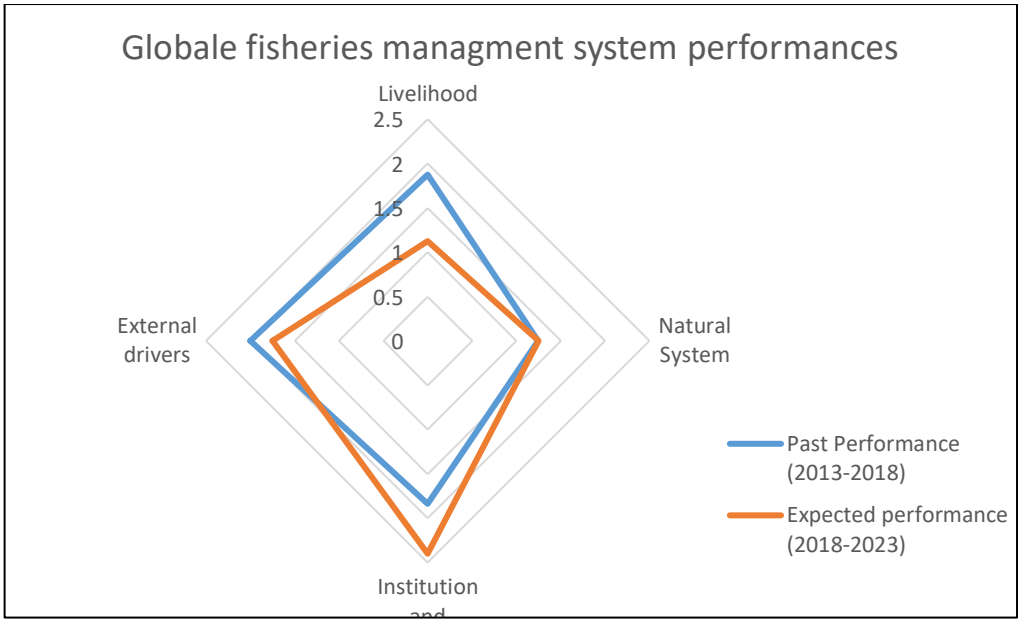


Figure 8: Summary of the strength shared across the stakeholder groups and the four dimensions

Overall, participants consistently reported an equal performance for the ***people & livelihood***, ***external drivers***, and ***institution & governance*** dimensions (Figure 12). This is mostly supported by improved access to new markets, local infrastructure development, strong governance, and high support to the local food security. They also reported a weak performance for the ***natural system*** dimension, mostly due to illegal poison fishing and farming activities, which lowered the biodiversity and increased sedimentation in the lease.

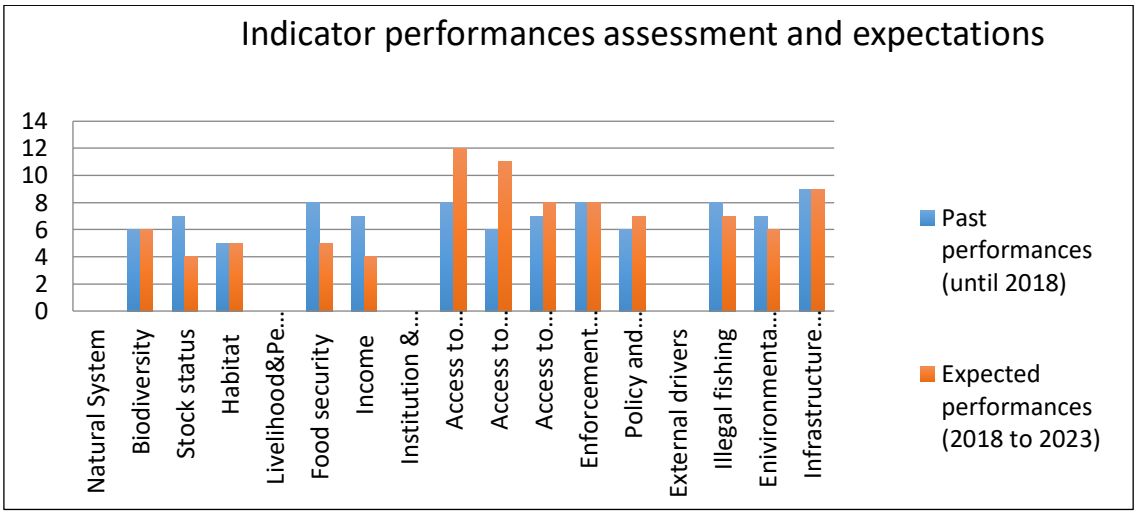


Figure 9: Indicator performances shared by stakeholder groups

Regarding the expected performance of this management system, the participants agreed the performance for ***people & livelihood*** and for ***external drivers*** decreased. Only the Civil society and NGO group doesn't expect the current medium score for those dimensions to change in the future. This is due to the opportunity to renegotiate access to the fishing ground with the lease owner, and the continuous development of infrastructure in the area. The 'others' group links this expected decrease to a decline in food security and income, together with the reduction in fishing access for the local population, a decrease in lease productivity, and most importantly a decrease in access to fish products. This last point relates to the increasing access to urban markets, which pushes fishers and retailers to export their products at higher prices, rather than selling it cheaply at local markets. This resulted in an increase of local prices. Combined with the limited access to the lease led to a decrease in availability of fish products for local communities.

To a lesser extent, the participants expect a decrease in performance for the ***natural system*** dimension. They expect the stock status to decrease further even though biodiversity in the lease was rated highly. If the fishing season for the main fishers is indeed shortened by use of the water control gates, its biodiversity does not seem to be heavily impacted, due to the presence of paddy fields around the lease. The major concerns lie in the increasing sedimentation of the water body and the impact on fish stocks by illegal fishing methods (e.g. use of poison).

The participants consistently expected a significant improvement in the performance for the ***institution and governance*** dimension in the coming years. This seems to be mainly related to an increase of financial and market access due to the local lease management (facilitating product transport) and the new opportunities for financial support (NGOs, private). Even though the expected performance for this dimension is good, there are still some points where the system doesn't perform well, like the institutional support with the DoF on the enforcement of regulations and illegal fishing control.

5. Discussion

Leases under with an individual management system are common in the Delta. The unique characteristics of the Ah Paung lease are the fact that there is no sub-leasing as is seen in many other sites. Instead it is owned and managed by a single owner. Another important point is the fact that the main livelihood in the area is agriculture, mainly rice farming. The geographical characteristics of the lease and the fact fishing is allowed year-round according to the Pyapon district regulations have resulted in a brackish water environment with a high diversity.

The individual powerful management has contributed to maintaining a good productivity by regulating the pressure on the resource by restricting access to the fishing ground. This in combination with the beneficial natural position of the lease, directly connected to a large river and far away from large pollution sources, gives an impression of biological sustainability. Even though the lease is under individual management and has restricted access, the positive impacts on the area are substantial. There is a high degree of reinvestment of profits in local infrastructure development. The lease creates many well-paid seasonal jobs. This increase in accessibility of the area favours the development of local business and the opening of new markets for local retailers and fishers. There is local consensus that the dynamic brought by the lease activity has reduced out-migration towards larger urban centres as opposed to what is seen in many parts of the Ayeyarwady delta. In addition to this, because of the high proportion of part-time fishermen being farmers themselves, the lease owner and the farming community often compromise on how water should be managed in each season. Several

arrangements exist. Fishers are allowed to harvest in the small paddy-field channels at a certain moment of the year, and in return farmers have the possibility to use water from the lease earlier in the year if needed.

Despite the merits of the system mentioned above, several challenges contributed to a decrease in performance, sustainability, and support to the local community year after year.

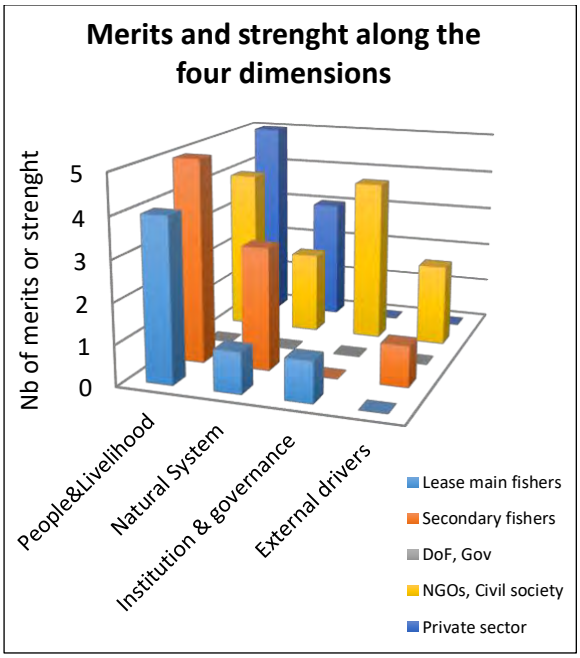
Although infrastructure development, supported by the lease owner, has increased market access and access to transport in the lease area, this has resulted in higher local prices for fish products. Due to the higher prices on the export market, fish products are increasingly sold outside of the area, which in turn reduces the local population's access to sources of cheap fish. The restrictions on access to the lease, while increasing the sustainability of the lease, have removed a source of daily fish products, primarily for people who live adjacent to the water body. Additionally, a decrease in productivity and profitability of the lease has been reported. The main argument explaining this decrease is the impact the use of an upstream water control gate to support farming activities has had. It has shortened the period in which larger gears can be used, while also not being profitable for farmers located downstream of the water control. All these factors have contributed to the fact exploitation of the lease has become more expensive and the price of the lease increased yearly. Finally, the DoF has not provided support for management of the lease or for the application of policies regarding illegal and destructive fishing practices, because the lease is under an individual management system. This has reduced the sustainability of the lease.

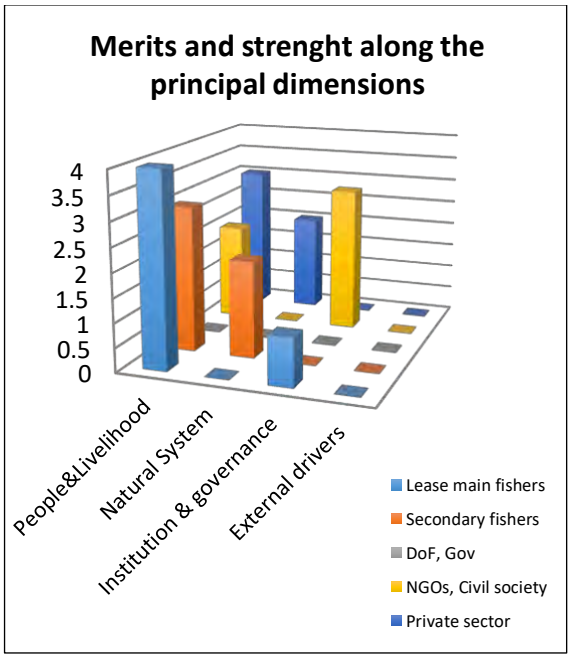
The limits to this management system are highlighted by the participants' perception of the evolution of its past and future performance. Only the ***institution & governance*** dimension is expected to improve and achieve a good score. None of the other dimensions are expected to record any improvement in the future, quite the contrary. Among other things, the expected drop in the performance of the ***people & livelihood*** dimension translate to real concerns the population has regarding their food security and incomes. The pressure from ***external drivers*** and the performance of the ***natural system*** are also expected to decrease.

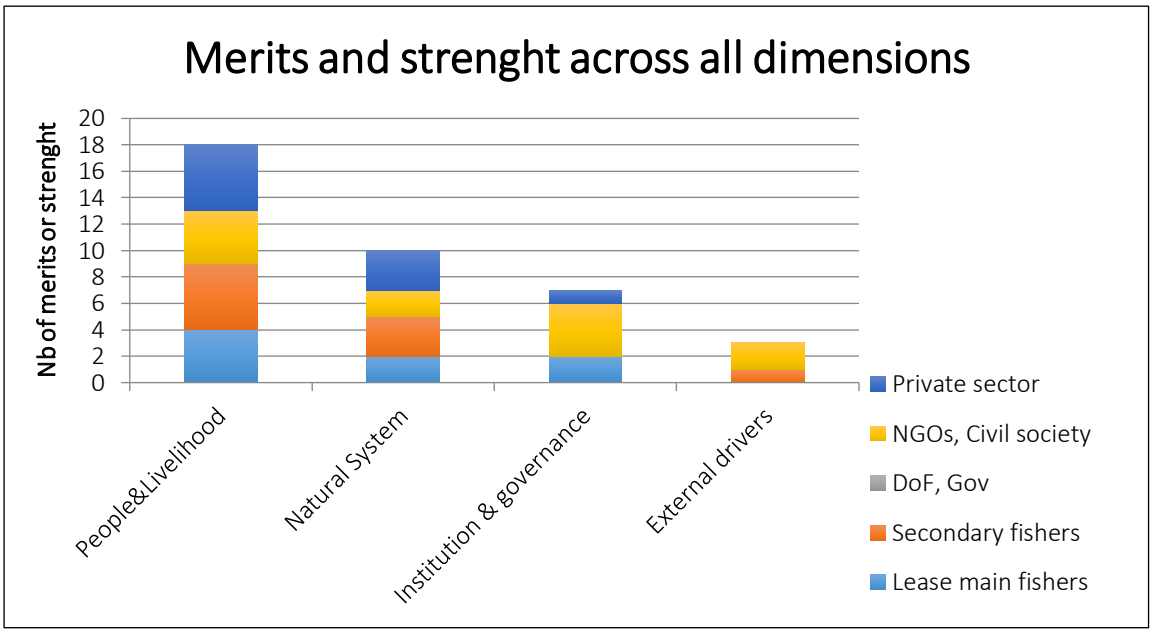
The participants gave suggestions for potential entry points to improve the performance of this lease. Some of the suggestions were (a) a review of the lease price and access rights regulations using a more consultative approach involving local communities, (b) DoF support for awareness raising activities regarding destructive fishing methods, and (c) local support for farming activities that use small, localised water control gates in order to reduce competition between different water users.

6. ANNEX

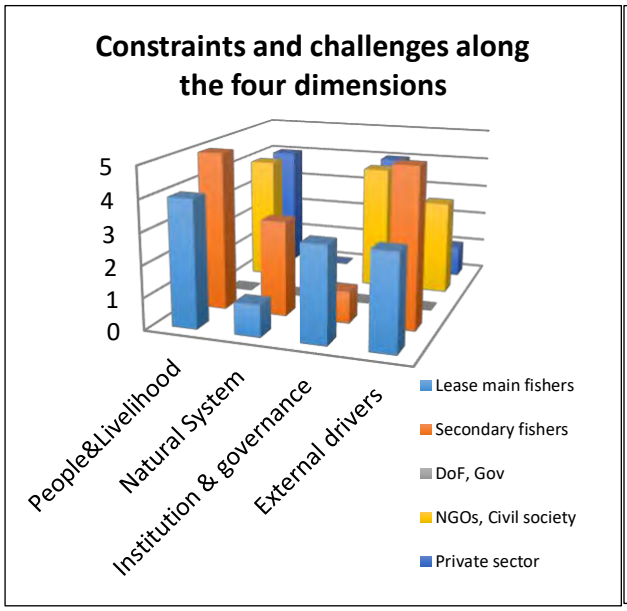
ANNEX 1: Merits and strength along the four dimensions according to the different stakeholders

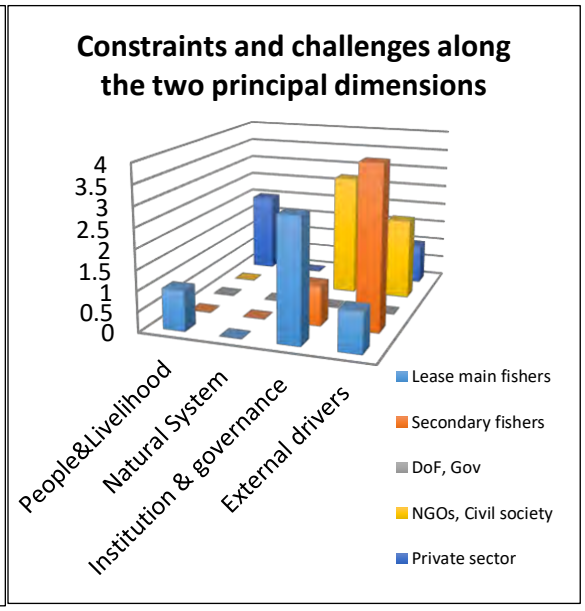


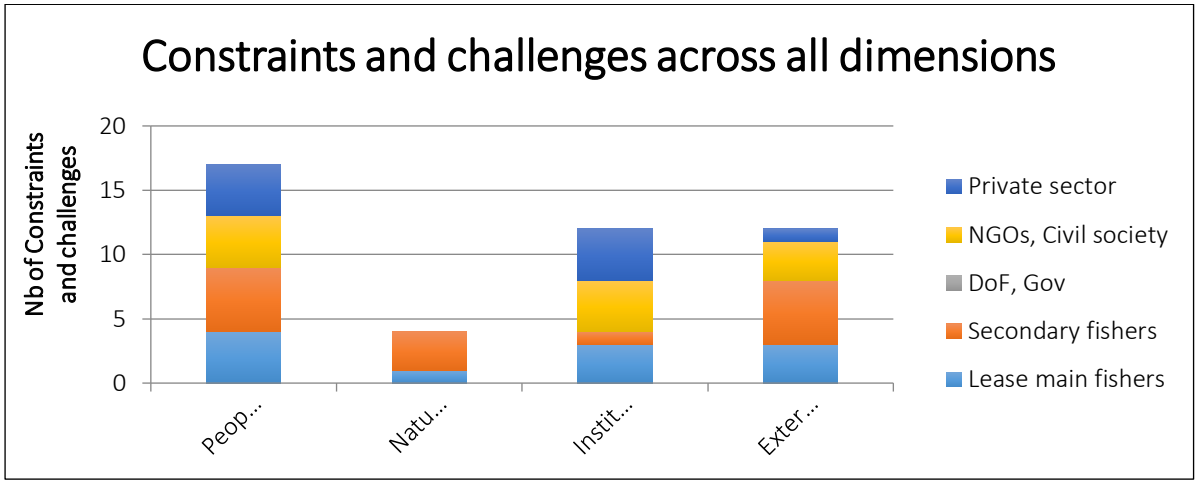




ANNEX 2: Constraints and challenges along the four dimensions according to the different stakeholders







Characterisation of fisheries management systems in AD and CDZ

MYFISH 2

Case Study 7
Report

(Sar Ma Lauk Tender)

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Tables and Figures

Abbreviation

AD	Ayeyarwaddy Delta
CDZ	Central Dry Zone
CSO	Civil Society Organization
DoF	Department of Fisheries
FAD	
FAO	Food and Agriculture Organization
FDA	Fishery Development Association
FG	Fishers' Group
FGD	Focus Group Discussion
HH	Household
KII	Key Informant Interview
LIFT	Livelihoods and Food security Fund
NAG	Network Activities Group
NGO	Non-government Organization
PDAM	Participatory Diagnosis Adaptive Management
RAAIS	Rapid Appraisal of Agricultural Innovation System
RDD	
USD	United State Dollar
WF	WorldFish

Note:

Currency Exchange rate: 1 USD =1,500 Burmese Kyat

Weight Conversion: 1 Viss = 1.6 kilogram

1. Objective of the study

The aim of this case study is to generate an "in-depth" understanding of the fisheries management system in Sarmalauk tender, Maubin, with a focus on identifying major issues and potential entry points for addressing these. Hence the specific objectives are as follows:

- Assess performance of the fisheries management systems based on agro-ecological, social, and institutional environments in Sarmalauk (Car Lan Bay Wal Yar Tar Kyin) tender, in Maubin township, Maubin district; and
- Identify key issues and opportunities for interventions to improve the performance of the fisheries management system in the area.

2. Methodology

This case study documented the fisheries management systems based on its current performance, strengths/merits, and weaknesses/constraints using both quantitative and qualitative indicators. The final output was the identification of entry points both at the local and higher administrative levels to achieve a sustainable capture fishery in the area.

The selected case study was located in Sarmalauk tender, Maubin Township. The tender had been under individual management through an annual auction organized by DoF. The interest in bidding for the tender prior to five years ago was relatively high. The lease holding rights changed hands many different times The last three years, however, saw a decreased interest in the tender, reportedly due to low production levels. Since then, the same person won the auction and controlled the tender. The information and data used in the analysis were both from primary and secondary data sources.

Review of Secondary data

A matrix was developed to compile existing information about the site, fisheries, and type of management in the target area. The information gathered to complete the matrix was sourced from MYFish 1 fishery survey, MYFish 2 Component 2, and other available information from DoF District, Township and Region offices.

The Analytical Framework

The approach for the case study characterisation process was adopted from the Rapid Appraisal of Agricultural Innovation Systems (RAAIS) tool. RAAIS is a diagnostic tool originally developed for the agricultural sector and allows for analysis of issues from broad entry themes towards more specific entry points for productivity, natural resource management, social development, and institutional innovation. The RAAIS tools were combined with another theoretical framework tailored to the identification of fisheries management issues--the Participatory Diagnosis Adaptive Management (PDAM). We combined both frameworks by adapting the four radar issues of PDAM as the four analytical dimensions based on RAIIS results. The four dimensions are elaborated in Table 1, as follows:

Table 1. PDAM Dimension Indicators

Assessment Dimensions	Indicators
People & livelihoods	Living conditions; diversification/income dependence; assets and income poverty
Natural system	Biodiversity; stock status and trends; fishing practices; aquatic ecosystem condition
Institutions & governance	Fishing and development policies; organisational and institutional capabilities; access to markets and financial services; collective action abilities; governance performance and rights; legal frameworks
External drivers	Infrastructure development; conflicts with other sectors or users

Definition of the four Dimensions[1]

People & Livelihoods - this is the socio-economic aspect of the fisheries communities that encompasses household well-being, which include household income, household diversification of livelihoods, household fish consumption, living conditions, norms, culture and household assets. It also can include conflict with other users and resource use

Natural system – a biological classification of yield, biodiversity and sustainability of the fisheries resources and ecosystem, its stock status and trends (total catch, total catch by species, fishing effort, catch by unit effort, and number of species), fishing practices, and aquatic ecosystem conditions, such as connectivity, breeding ground, pollution from upstream, agriculture, industry.

Institutions & governance – the manner in which a power is executed in the management of the fisheries sector. It is the enabling environment aspect in governing the fisheries management to achieve maximum sustainability (legitimacy, membership rules, access rights, management controls, representation rules, sanctions, enabling legislation/policies/legal framework, local support, financial management and services, access to market, organizational and institutional capabilities.

External drivers - outside influences that can impact the fisheries resources and its ecosystem. Various external factors can impact the ability of the fisheries to achieve maximum productivity/biodiversity and sustainability. These external factors might include infrastructure development, macroeconomic instability, climate change and environmental uncertainty, migration, market demand changes, price fluctuation, land use changes, migration.

RAAIS as a participatory diagnostic tool combines multiple methods of data collection, building on existing experiences with rapid appraisal approaches and (participatory) innovation systems analysis. The methods for the RAAIS shall generate both qualitative and quantitative data; facilitate 'insider' and 'outsider' analysis; target different stakeholder groups across different levels with individual, group and multi-stakeholder perceptions on weaknesses/constraints and solutions; and provide sufficient detail on the main weaknesses/constraints under review, the capacity for innovation in the fishery management system, and the functioning of the fishery management system. On the other hand, the innovated framework will be used also to identify the performance, and strength/ merits from the management system under review.

Methodological steps

Based on RAAIS tool, the following main steps were taken to assess the existing fisheries management systems based on the context of each site: (i) identifying strengths/merits, and weaknesses/constraints; (ii) categorizing strengths/merits, and weaknesses/constraints; and (iii) exploring specific and generic entry points for recommendations for the current fisheries management system to achieve equitable and sustainable fisheries. The objectives, sessions and activities of each step are presented in detail in Annex 1. The following research steps were conducted in the selected site to gather a broad range of information from relevant stakeholders and articulate a participatory assessment of existing fisheries management systems. These methodological steps are shown below:

Multi-stakeholder workshops focus mainly on insider analyses of the current fisheries management system and conditions of the system. Five groups of stakeholders identified, categorised, and analysed strength/merits, weaknesses/constraints, and performance of the existing management system to provide specific and general entry theme for innovation in the fishery management system.

1 Definition was taken from the MYFish2 - Characterization Component 2

The DoF and WorldFish in Myanmar led the selection and organisation of stakeholders who participated in the multi-stakeholder workshop. A total of 28 participants, including 4 women, attended the multi-stakeholder workshop activity. Figure 1 shows the percentage of participants of the five stakeholder groups.

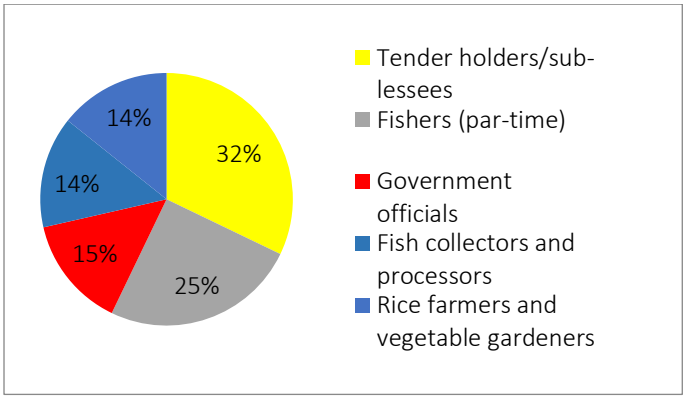

Figure 1. Participants in Multi-stakeholders Workshop at Sarmalauk tender, Maubin

Key Informant Interviews was facilitated through one-on-one conversations between the WorldFish/DoF team members and a key informant. Nine key informants were interviewed, including a fisher who is a former sub-lessee, three fishers, two fish collectors, a paddy farmer, a village tract head, and the head of Maternal and Child Association. The KII was used to get in-depth corroboration of the information gathered during the multi-stakeholders workshop, validate some secondary information, and understand the perspective of relevant individual respondents on the existing fisheries management system in the area.

Focus Group Discussion was done through an earlier visit for preliminary information collection with township fisheries officials and the tender owner and son of village tract head. No focus group discussion was organized as part of the multi-stakeholder workshop and KII due to time constraint as participants informed that they only two hours between 12 pm and 2 pm for the consultation and interviews.

A total of 30 respondents participated in the information/data collection during three days of field work (23 – 25 January 2019) in Sarmalauk tender, Maubin Township. The breakdown of the respondents participating in the data collection is provided in Table 2.

Table 2. Summary of methods and sampling strategies and sample size deployed during the study

Method	Type of analysis		Stakeholders groups targeted – Sample size				
	Stakeholder led	Researcher led	Tender holder/Sub-lessee	Part time fisher	Local government	Paddy farmer and vegetable gardeners	Fish collector/ processor
Multi-stakeholder Workshop	X		9	7	4	4	4
Key informant interviews		X	1	3	1	2*	2
Focus Group Discussion (In preliminary data collection)		X	2		2		

Method	Type of analysis		Stakeholders groups targeted – Sample size				
	Stakeholder led	Researcher led	Tender holder/Sub-lessee	Part time fisher	Local government	Paddy farmer and vegetable gardeners	Fish collector/ processor
Secondary data		X					
Total	28	13	12	10	7	6	6

3. Study site

The Sarmalauk tender is located in Maubin Township, Maubin District. The tender consists of two long channels, each about 15 m wide, extending about 9 miles (14.5 km) Figure 2.

Figure 2. Map of Sarmalauk tender

3.1. Socio-economic characteristics

The Sarmalauk tender extends north-south across eight villages in three village tracts namely: Ah Lan (330 HHs), Wei Dauk (79 HHs), Lay Thar (140 HHs), Mee Tway Chaung (400 HHs), Lae Kaing (400 HHs), Thaung Tann (300 HHs), Da Kun Taing (300 HHs) and Wa Taw (320 HHs). The five main livelihood activities of people in the area are, in order of importance, paddy farming, fishing, selling labour, vegetable gardening and fish farming, with about 70% of households engaged in paddy farming, 30% in selling casual labour, and 5% in fish farming.

3.2. Fisheries System

3.2.1. Natural system and fishing techniques

Old, small natural depressions were enlarged and deepened when the main road connecting Maubin to Yangon was built in 1993-1994. A few years later the channels on both sides of the road, about 15 m wide each, were assigned as a tender and were put up for bidding. The channels receive water from Ayeyarwady river, a little over 1 km to the west and from a floodplain to the east. During the visit in January, both channels of the tender were almost completely dry, with small isolated pools of standing waters along the stretch. Connectivity is interrupted by sedimentation of the channel bed and bunds across the channels. The bunds were built to provide access across the channel to the residential and farming areas on other sides of the road. Some bunds are equipped with small cement rings, mostly not functional, due to building up of sedimentation. Downstream of the channels at the opening to the river, a gate was built to regulate water flow.

The tender is located between two aquatic systems, Ayeyarwady River – about 1300 m to the west and the floodplain – directly adjacent east of the tender. In the wet season, high water levels in the river and in the floodplain, peak in August, makes the systems closely connected. This allows fish to move freely throughout the floodplain system and the tender. In the dry season, the river and the natural depressions in the floodplain provide for two main water bodies in addition to the tender. As a result, the vast majority of local people have access to subsistence or commercial fishing . The tender represents only about 20% of all their fishing effort, as they have the opportunity to fish in the floodplain as well.

Fishing in the tender is largely part-time and small-scale, with only the tender holders and some lessees used surround nets associated with brush parks, set gillnets, and eel traps. Other fishers use various other small gears including the most detrimental methods – electrofishing and poisoning.

Since there is no restriction on fishing in the tender, about 70% of local fishers now apply harmful methods including electrofishing, poisoning, and pumping out water to catch fish. As the system is heavily degraded and less productive, fishers have less interest in bidding for the tender and this may be the reason why illegal fishing practice is largely left uncontrolled.

With surround nets, gill nets, and traps the catch received was reported between 50 and 100 viss (80 – 160 kg) per month during the high fishing season, between November and January, and about 30 viss (50 kg) per month in the low fishing season. Fishers also depend on fishing in the floodplain and the river.

3.2.2. Changes in fisheries management

Myanmar inland fishery management system has seen an important change in 2008 when the government introduced the requirement that tenders are put up for auction annually. As a result, the Sarmalauk tender saw ownership changes annually. Unsurprisingly the auctions were won by local wealthy figures, who subleased parts of the channels or segments to a low number of sub-lessees. It was not clear how many sub-lessees were engaged annually but is reported to vary between three and nine for different years. The tender holders rely on the sub-lessees to operate fishing and to collect fees from local people fish in the area. The lessees negotiated with fishers for different access deals, 1) those who were able to pay access fees upfront and 2) those who could not and had to accept to sell their catch to the sub-lessees in exchange for a soft loan in cash to buy fishing gears.

The tender under local ownership was facing an increasing amount of challenges in its management and, since 2013, has seen a significant increase in both the number and the types of fishing gears and practices, many of which are detrimental. Due to ineffective management the habitat range for fish has become narrower and fishing was noticeably less productive. It was also reported that some sub-lessees lost their interest in managing their respective segments and turned to small-scale subsistence fishing, and pig raising as a secondary source of income. During the 2015-2016 fishing season, a wealthy person from a different township won the auction for the tender. This has led to an unwelcomed stronger enforcement, and a management known to many locals as inequitable.

Inspired by the move for community management elsewhere in the delta and access restriction under management of the tender holder who came from outside of the township, in 2017 a local group of fishers coordinated by the now chief of Alan Village submitted its bid to the DoF. As part of the bidding process the members paid their share to secure the tender at the auction. Since then the holder continues to bid for the tender under the name of the CFG but without collecting contributions from community members as it was done in 2017.

Access to fishing and fee collection have been managed through segmentation. For example, in 2013-2014, the charge for the Alan segment was MMK 150,000. Mee Thway Chaung and other segments were more expensive, being priced at close to MMK 400,000 each. Nowadays, as the production declines and interest in the tender is low, the price of each segment has reduced. For example, the price for Alan segment is now between MMK 90,000 and 100,000. The fees for individual fishers also dropped, to about MMK 20,000 – 30,000 per fisher as opposed to MMK 60,000 – 90,000 four years ago.

Figure 3 shows the trend of the tender bid price. The price had experienced an increasing trend from MMK 414,800 in 2008-2009 to a peak at MMK 776,620 in 2011-2012 then fell back to the lowest at MMK 500,000 in 2013-2014 before it came back to another peak at MMK 900,000 in 2016-2017 when it sharply dropped to MMK 520,000 for the last two years 2017-2018 and 2018-2019.

Some explanation on the current price trend includes three year averaging by DoF to set the new floor price could have been the result for the declining trend after 2011-2012. The initial lack of interest among potential local bidders may be due to the rise in illegal fishing since 2013. The renewed interest by potential bidders from outside of the township had led to a rise in the price to peak in 2016-2017. The relapse of potential bidders losing interest was seen again as the tender was seen as no longer profitable, the inclination by DoF to turn the tender over to CFG management in 2017-2018, and lastly the agreement among potential bidders not to submit their bid until the last call by DoF when the floor price is subsequently reduced to its minimum.

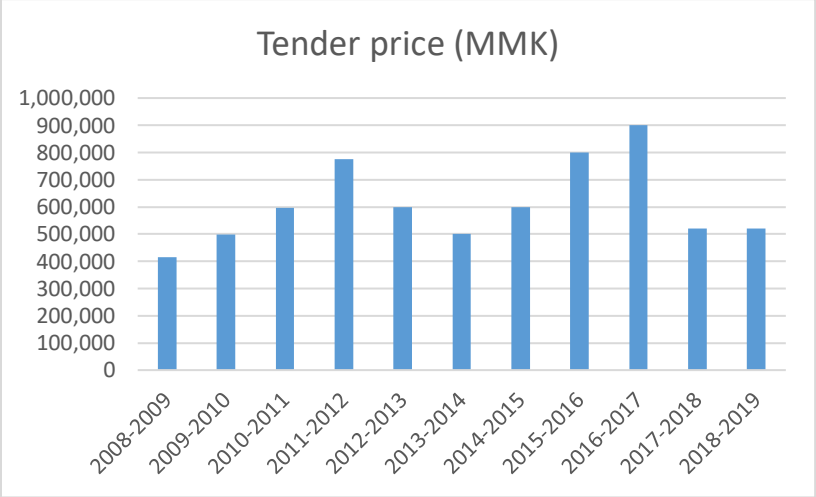

Figure 3. Trend in value of the Tender in Sarmalauk[2]

3.2.3. Current organisation and management

Current management of the tender is partly the legacy of the alleged CFG organization that won the bidding in 2017. Although the management is done by a local individual, people still feel that it is under its CFG management as established in 2017. Rather than collecting share from members as in 2017, the holder secured the tender with the sum collected from sub-lessees who paid upfront for specific segments.

The bidding process for the tender is done in May and the conclusion of fishing in the tender is April the following year. The tender is sub-divided into 3 broad segments, two of which are sub-leased to villages within the three village tracts surrounding the tender. Fishing is open to all during the flood season (Jun-Aug) after which the tender holder and sub-lessees exercise restrictions they set. The tender holder decides the price for segments subject to subleasing, the number of people allowed, and fishing access fees in the segment under his own arrangement. Two fish collectors, like the tender holder himself, from two other village tracts hold two segments. The segment holders also decide on the number of fishers and access price. In some cases, they fish themselves. As the segment holders make a down payment prior to the auction they are free to sell their catch to any customer.

Between five and ten fishers pay a fee to use surround nets with brush parks in each segment at MMK 20,000 – 30,000 per brush park per fishing season. Normally, fishers pay their access fee once in September and then they can fish intermittently[3] for about 7 months (September to March). The tender holder prepares for closing of the tender in April. It is reported this is when some portion of the remaining standing waters are pumped dry. Most catches, dead or alive, are sold at markets in Yangon.

While it has been reported there are fishing restrictions in certain segments and during the fishing period in the dry season, access to fishing is open during the flooded season, between June and August. Although many people follow the rules regarding fishing gears and practices, poaching is reported to occur occasionally. About 70% of household use electrofishing. People also fish during the DoF-designated closed season between May and July. It is reported that apprehending illegal fishers using electrofishing method is a challenge since they arrive and disappear very quickly. Anyhow, no strong action has been taken against perpetrators, only a softer approach of negotiations and written pledges or commitments before village tract head to not commit any violations again has been applied.

In the past 5 years, fishermen fishing during the closed season were fined by government authority during spot checks for illegal fishing. Now there is no control over any kind of illegal fishing, including electrofishing. No awareness on harmful effects of illegal fishing is raised.

4. Results

4.1. Performance of the management system

4.1.1. Current performance

The overall performance both the current and future of the current tender management system is presented in the four dimensions of development affecting the fisheries system. Figure 4 shows that all stakeholders agreed that the 'institution and governance' dimension has the highest performance for the current management system in terms of average of all the factors contributing to this

[2] Source: Township Department of Fisheries

[3] Brush park fishing normally occurs at in interval, and for some only once or twice for the whole fishing season.

dimension. One of the main positive contributing factors is the access by local fishers to loans with low or no interest rates from local fish collectors/ retailers. In addition, the government had also recently provided small loans to all poor households for livelihood development.

The second highest performance is 'livelihood and people'. The responses given are that people enjoy free access to fishing, whether they are legal or illegal and detrimental, as opposed to several years ago when access was restricted. There is no limitation on the number of gears or people that are allowed to fish in the flood season, July-August, as opposed to the general closed season rule imposed by DoF between May and July. This is linked to the fact that the current holding of the tender was the same one that organised the bid in 2017 in name of a local CFG. Allowing people to continue their unrestricted access can be seen as an exchange for the privilege. As the current bid price is low losing operating rights in the tender is not be a big concern to the current holder (Fig. 5).

The natural system continues to degrade as pressure from development and use of the system goes unchecked. The production of the system continues to persist due largely to its natural connection to the large aquatic system of the river and the floodplain. See Table 5 for the key highlights for the four dimensions.

Table 3. Summary of Performance of the current management system

Dimensions	Rank	Key point/highlight
Natural system	2	Natural environment is degrading; fish species and fish stocks are on the decline; no habitat in the tender is protected; and the extent of detrimental fishing, eutrophication and sedimentation due to practices in and nearby the site threaten the productivity and viability of the system.
Livelihood	2	People will be less able to depend on the fisheries in the tender for consumption; in the short-term income may be stable regardless of the decline in fish production due to rising market prices. People will depend more on fish from other water bodies.
Governance	1	There is little to no restriction or enforcement in fishing and everyone tends to enjoy current access. There appears to be misperception that current access and (lack of) management is the norm under CFG. Physical access to markets is good overall and some limited financial services are available.
External drivers	2	Illegal and detrimental fishing is going on unabated; current aquaculture and agriculture development in the floodplain coupled with residential development and waste disposal put increasing pressure on the fisheries system through sedimentation, eutrophication, and pollution.

4.1.2. Expected performance in the next 5 years

Results of the analysis in Figure 4 show a rather pessimistic performance for all four dimensions if no improvement to the current management of and the existing practices in the tender continue. 'External drivers' will go up meaning that more pressure will be exerted on the system. Although 'Institution and governance' remains high it shows some decline due to an expected decline in resource access, and the current lack of regulation enforcement. The other two dimensions are seen

to be at low to medium level because of many factors that may affect and hinder the achievements for a better performance in the next five years. The 'natural system' and 'people and livelihood' dimensions exhibit an expected decline for all contributing elements in particular due to continued habitat degradation and loss of fish stocks on the one hand and decreased reliability on the resource from the tender for food security on the other. The low expectation for the tender (channels) to be normalised and increasing pollution from agriculture and aquaculture set the stage for the perceived scenario.

In summary, 'institution and governance' is seen as the strongest dimension both currently and is still expected to be in the next five years. However, there are concerns regarding the decline in regulation enforcement, particularly by the 'tender holder/sub-lessee', 'fisher' and 'government' groups. The declining trend in 'natural system' and 'livelihood' highlights the immediate need to address the situation of the fisheries in the tender if it is to continue to support local livelihoods and food security.

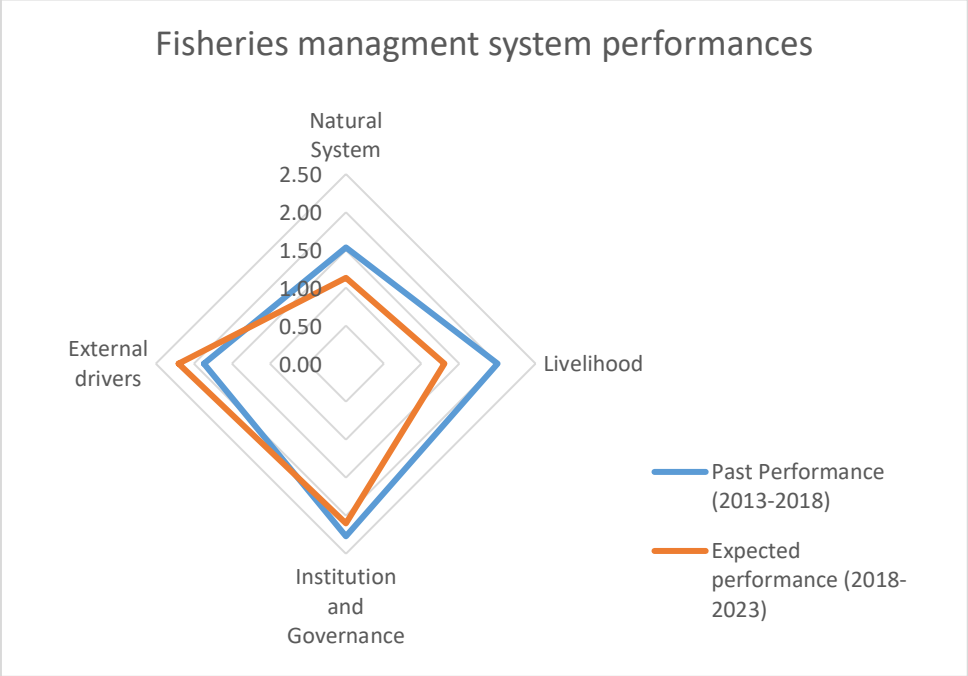

Figure 4. Past and expected performance of the fisheries management system

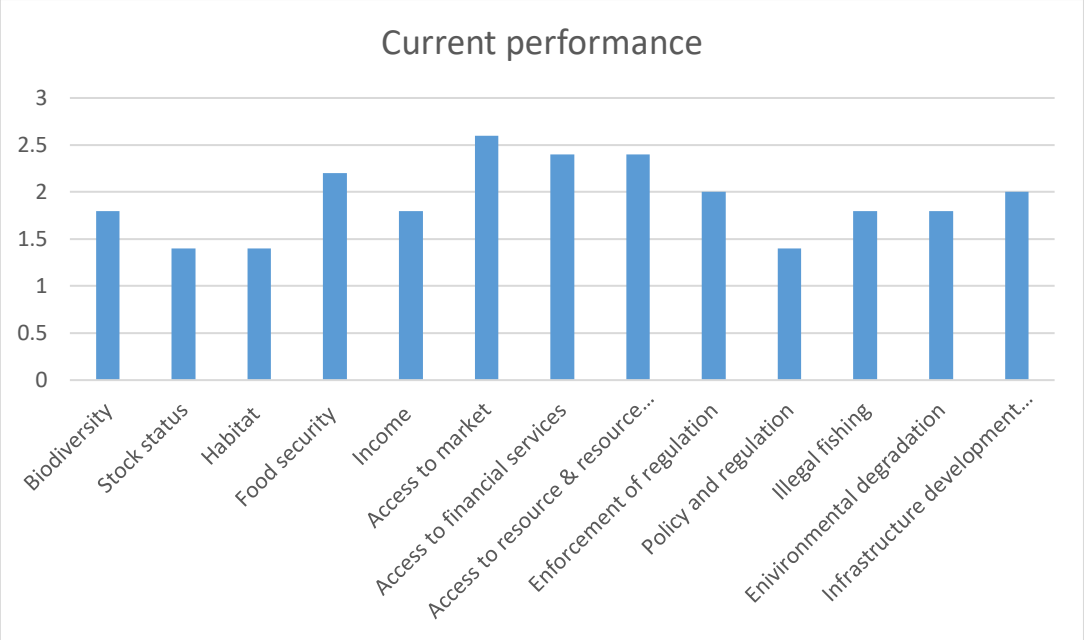

Figure 5. Management Performance: 1 = declining; 2=Stable; 3=Improving

4.1.3. Productivity and income

Overall there is reported decline in catch between 50% and 70% compared to the last 5 years for all gears. For example, fishers reported to have caught 80-90 viss (130 – 145 kg) of Snakehead per fortnight in the peak fishing season -November and December- but now they get only 30-40 viss (50 – 65 kg). Another person reported to have got 300 to 400 viss (500 – 650 kg) per year five years ago but only gets 100 viss per year now. Respondents attributed the decline in catch in particular to detrimental fishing and overfishing such as electrofishing, poison fishing, and pumping out water. Fishing in closed season and collection of snakehead fingerlings for raising in aquaculture ponds were also mentioned as causes for the declining catches. Sedimentation and pollution as a result of expansion of aquaculture ponds and pesticide application in rice field were said to have contributed to the degradation of fish habitats. Direct observation during the visit also identified household waste disposal, home gardening on the channel banks, and construction of bunds across the channels to provide access to residences and farms are among the factors contributing to sedimentation and eutrophication.

The decline in catch is attributable to habitat degradation and illegal fishing. However, there is no report on decrease of the fishing period. Of note is the increase in the occurrence of fishing using detrimental methods, in particular electrofishing, poisoning, and pumping water out. While this would have implications for local consumption and food security, the impacts on income are different as it affects fish prices. For example, it is reported that the price for Gourami, Snakehead, Climbing perch and Featherback was MMK 800-1,000; 3,000; 1,000-1,500, and 2,000 respectively. Now the prices have increased to MMK 1,500-1,800; 5,000-6,500; 2,000-4,000 and 4,000 respectively. What hasn't been noted in the past but has become common now is the presence of trash fish at MMK 1,000/viss.

4.1.4. Benefit sharing and equity

Most respondents reveal that benefits are shared relatively fairly under the current management system. They noted that fish collectors now give out loans with no or low interest rates to small fishers

so they can invest in gears. The fisher group said that small-scale fishers could easily get funding to pay access fees. The fish collector and processor group noted that retailers do not need to make big investments to get fish from fishers and small-scale fishers can easily get small loans from collectors. However, small-scale fishers in KII said fish collectors benefit more as they make additional profits from providing loans to fishers and buying back their catch at MMK 100 kyat below market price. The fishers contended that the tender holder benefited more due to his investment.

4.1.5. Access rights

All groups felt access to fishing is fair as everyone can fish, even during the closed season. The tender holder and sub-lessees claimed there are no restrictions to where people can fish within the tender. All groups and respondents in the KII mentioned that under the previous tender management, in particular when it was managed by a person from outside of the township, restrictions were in place and only local people who were able to pay the fees were allowed to access. Normally fishers can fish anywhere in the tender during the flood season. As the flood draws down, the tender holder and sub-lessees define their respective areas and most fishers are allowed to fish with specific gears at different fees depending on what gears they planned to use.

However, there is also a general agreement among all respondents that illegal fishing is a common practice, especially electrofishing. It appears that everyone enjoys access without caring if it comes at the expense of future catches. Regardless of the fact that fishers are required to pay for access to fish in any segment, the rules are often violated but there is very little effort to curtail it. Respondents informed that this tender is one of a number of areas held by the holder and sub-lessees for fishing. In general, only about 20% of fishing effort takes place in the tender and there is a sense that less interest is paid by men to fish in the tender due to its low productivity.

4.1.6. Conservation

According to respondents, no conservation efforts have been undertaken. No area in the tender is assigned as a no-fishing zone, as only a few small shallow pools remain in the dry season. Even the DoF-imposed closed fishing season between May and July is not observed. Under the past management, DoF was reported to conduct spot checks for infractions to the rules and had apprehended few perpetrators. However, this practice was discontinued now due to limited human resources at DoF. Some said that the rules are being observed since management of the tender changed to CFG-management in 2017. Most of the information received challenged this claim. It was said that under management by the out-of-township holder, it was hard for him to enforce the rules as he did not deploy any staff and that was why DoF intervened. Since 2017 it was claimed that local people helped monitor illegal fishing and reported unusual events to the village chief. This contradicts the information on prevailing illegal fishing received previously.

In summary, the continued decline in productivity of the system, while affecting production and food security of local communities, would not proportionately impact income due to changes in market prices. Although some argued that the tender holder and sub-lessees benefit more, there is a general consensus that the benefits are shared equitably depending on the level of involvement and investment. A general concurrence is that people do normally enjoy access rights to the resource without restriction. The limited resources available are the main restricting factor. There is no general action to curtail illegal fishing, even against the most harmful methods such as electrofishing, no conservation measures are in place, and fishing is allowed during the whole flood season. See table 6 for highlights on key indicators.

Table 4. Summary of performance of each indicator

Indicator	Rank	Key point/highlight

Productivity and income	2	Fish stocks are decreasing, fish prices increased, new commodity – trash fish has a market value. Income from fishing is disproportionately affected.
Benefit sharing & equity	2	Although everybody has access to fish, catches differ based on the type of gear used and so do their benefits.
Access right	3	Everybody has access to the fisheries resources without restriction; the resources themselves are the limited.
Conservation	1	No area assigned for conservation, no effort to rehabilitate or enhance stocks in the tender.

4.1.7. Gender dimension

Women are not reported to be involved in fishing much. Women are rather in fish processing and retailing. Only less than 5% of women were said to be involved and benefit from fishing, while as much as 40% said to be involved in and benefiting from fish processing and retailing. Women are reported to engage in small-scale fishing, for example fishing for small shrimp. They are not reported to be involved in setting the rules governing fishing as this is mostly a man's job and because it is normally set by a limited number of people – the tender holder and sub-lessees. The situation is different in fish collection and retailing as this work is done mostly by women. Women collectors/retailers decide who can receive loans, and who their fish supplier will be. Elder women are reported to frequently work in betel farms, while younger women migrate to cities to work in garment factories.

While there is a Maternal and Child Health Association established to assist in awareness raising on health-related issues, there is no such group established dedicating to fisheries.

4.2. Dimensions of Strengths/merits of the management system

Strength and merits of the current system have been documented and analysed based on the perceptions of different stakeholders'.

Fisher Group

The fisher group considers access to loans from fish collectors as an important factor to keep them fishing in the tender, although it is only a part of their fishing effort – they also fish in nearby leases. An improved access to fishing since 2017 was said to be another positive factor. Under the previous management system only those with financial capability were allowed to fish. Although the system is heavily degraded and less productive, fishing can still be profitable, especially for small shrimp. This contributes to maintaining their income at a certain level due to an increase in prices for aquatic commodities in recent years. The results from the fisher groups can be summarized as follows:

- Fishers have access to loans from fish collectors to whom they sell catch, although at slightly below market price;
- Household income from fishing is relatively stable, due to relatively high production levels of small shrimp, which is the commodity accessible to small fishers, and increases in fish prices.
- No restriction in fishing access, and fishing is even allowed in the flood season, July – August, which overlaps with the closed season imposed by DoF (May - July).

Tender holder and sub-lessee group

Some of the merits mentioned by the second group were consistent with what the fisher group noted– no restrictions on fishing areas and access, and better price for fish and fish products. They noted that fishers can operate anywhere they wish without restriction. Information from other groups confirmed

that this does not occur in brush parks. This group also noted that fishers can sell their catch to any collector/retailer of their choice and this way fishers have the potential to get higher profit margins. This can only be done only if no loan is taken out from any of the collector/ retailer. The last aspect this group mentioned is the reduced price for the tender. The current holding system is a legacy of the 2017 auction when the bid was submitted to DoF under the name of local CFG and as DoF favoured this management arrangement a lower floor price was set. However, information from several KIIs revealed that the lower auction price was a result of lower interest in bidding for the tender due to lower system productivity. No one submitted a bid until the last call made by DoF as the floor price is lowered every time a call is put out. Information from the group can be summarised as follows:

- No restriction in fishing area and time – all areas in the tender are reported to be accessible to fishers, except in the brush parks, and accessible at any time including during the flood season, July – August;
- Fish and fish products receive higher market prices – there is higher demand for fish products, particularly for wild fish; and
- Low auction price for the tender – due to lower interest of bidders, the fact no one submitted a bid prior to the last call made by DoF.

Government official group

A group of local authority officials sees that the system has a strong connection to the other water bodies in the surrounding and thus the tender can be considered an integral part of a larger system. Despite habitat degradation, the tender maintains quite high levels of biodiversity and production, of particular indigenous species. The group argues that the area is in close proximity to Maubin Township and thus advice and supervision are easy to access to address potential conflicts and illegal fishing that may occur. The community has a long track record of good cooperation with local authorities to manage the tender. This group has in common with other groups the idea that the tender is a good source of income, in particular for the poor. However, this statement should be treated with caution as it contradicts some of the information received regarding the status of resources and fishing pressure. The impression for this the group are is summarised as follows:

- Relatively abundant fisheries resources can be harvested and fish biodiversity can replenish itself due to its close connection to the larger aquatic system.
- Good record of cooperation with local people in addressing issues of fisheries management thus providing room for improvement in the fisheries in the future.
- Close proximity to the township provides for easy accessibility for DoF staff. This is a good opportunity to help address illegal fishing or other conflicts.
- Good market prices for fish and fish products and good access to the market; the tender acts as a good source of income, particularly for small-scale fishers.

Fish collector/processor

Good transportation routes and close proximity to markets are identified the main strength of the system. The group observed low transaction and transportation costs, which increases the potential for high profit margins. The second strength under the current management system is broad access for local fishers, unlike in the past when it was restricted to a few fishers only. The retailers see that they do not have to make large upfront investments to be able to engage in this sector. Most fishers accept delays in payments, when their catch is sold at the market by retailers. Another advantage for collectors/retailers is that where loans were made to selected fishers to buy fishing gears, they have the guarantee those fishers' catch will be sold to them at prices slightly below market prices to compensate their investment costs. Unlike in the past, there is now no competition in fish collection so each collector is able to buy a relatively large amount of fish, enough to make profit. The group's views can be summarised as follows:

- Good road and market access reduces transport and transaction costs while fish prices increase.
- Local fishers are allowed to fish without restrictions – the fishers can supply more fish to the collectors.
- No upfront investment is needed to become a fish collector – fishers accept to get payment once their catch is sold at the market; and
- Only few fish collectors in the area – there is no competition in term of purchase prices and also the amount of fish supply.

Paddy farmer/ home gardener

For the 'paddy farmers and home gardeners' they are able to access water from the channel without much constraints. They said that the tender holder and sub-lessees do not harvest everything – referring to water, so the resource can be shared. It is also said that irrigation was the initial intended use of the channels. A good relationship and communication channels with the tender holder represents an important strength under the current management system. It is said it is easy to talk to one person to ask for access to water for farming or to deal with any other issues. Another important strength mentioned is that because the tender holder makes a profit on his fishing investments it is easier for them to negotiate about access to water. The perspective by this group can be summed up as follows:

- Out of stream use of water is not an interest of the tender holder – opportunity for use of the water for irrigation;
- Individual managed system – talking to one person in any negotiation for a deal is much easier than talking to many people;
- Good interpersonal relationship with the tender holder – the main positive factor to negotiate on using water for purposes other than fishing; and
- Fishing remains profitable – it would not be that easy for the tender holder to make any concession if his investment in fishing in the tender was not profitable.

Almost all stakeholder groups agreed that the main strength of the current management system is the unrestricted fishing access for local fishers. This is seen to have different positive effects to different stakeholder groups (fig. 7):

- more fish can be caught thus less complaints against tender holder/ sub-lessees,
- more income generated by the fishers themselves,
- lower chance for conflicts between tender holder/ sub-lessees and local fishers that need to be addressed by the government
- higher fish supply for collectors, retailers and processors,
- less interest by any of the group about in the water itself when they have benefited from the system.

Table 5. Merits and strengths that are common to more than 1 stakeholder group

Merits /Strengths	Common to Groups	Description
Fishing access for small-scale fishers is improved	Fisher group, Tender holder/ sub-lessee, Govt. officials, and Collector/ processor	No restriction in access to fishing in area but also in time, including in the flood season.
Good market price for fish and fish products	Fisher group, Holder/ sub-lessee Govt. official, and collector/processor	Increased market demand and lower supply of fish
Income remains relatively stable	Fisher group, Holder/ sub-lessee Govt. official, and collector/processor	Higher fish price, low transaction and transport costs of fish, acceptable costs for financial services

Good collaboration across different stakeholder groups	Fisher group, Holder/ sub-lessee Govt. official, collector/processor and rice farmer/gardener	All groups understand that they need each other and compromised is made among them.

4.3. Dimension of weaknesses and constraints of the management system

The dimension of constraints has been determined through consultations with five stakeholder groups. Each group was asked about their perceived top five weaknesses of the current management system. Prior to 2017 the tender had been managed and operated by an individual from outside of the township. In 2017 it was awarded to a local CFG group represented by a local fisher who is also the Alan village chief. In the subsequent years he resubmitted a bid and won the auction as an individual. Besides this tender the person also holds a number of leases and also owns a medium-scale home-based fish processing operation. To some local villagers the tender is perceived to be still under CFG but in fact it is not. The following were the responses from all the five groups in the consultation workshop.

Fisher Group

The fisher group expressed a number of constraints in the management system. The first one that was mentioned was a lack of equity in fishing access, were fishers who do not have enough money to pay access fees are not allowed to fish. The second constraint is said to be the relatively high price for the tender compared to its production. They complained that some sub-lessees could not afford to sublease some segments due to their high cost. The next constraint is limited access for small fishers to fish in certain places within the tender because they are already sub-leased to a few rich people. The last constraint is weak coordination and lack of unity to manage the area. Much of the aforementioned weaknesses are likely about the private management system that was in place prior to 2017 when the tender was held by a person from outside the township. These weaknesses can be summarised as follows:

- Lack of equitable access to fish in selected areas in the tender;
- The tender price remains relatively high compared to its productivity so some sub-lessees could not afford it;
- Small fishers did not have access to fish in certain parts of the tender; and
- Weak coordination and lack of unity to manage the tender.

Tender holder/Sub-lessee group

Five main constraints have been identified by this group as chronic problems for the tender. Too many fishers for a small tender is stated as the first and foremost constraint for the area. There is also widespread illegal fishing, including the most harmful methods such as electrofishing, poisoning, and pumping water out. These methods don't leave a single fish to reproduce in the area. Another constraint that was identified is the continued degradation of aquatic habitats due to sedimentation as a result of various non-sustainable activities inside and nearby the tender such as agriculture, fish farming as well as construction of bunds across the channel to provide access to the main road for local residences. Next is the continued expansion of aquaculture ponds. The ponds do not only take up space in the areas adjacent to the tender, their dikes create a disconnect between the tender and the nearby floodplain thus restraining fish movement. All these contribute to the decline in fish stocks, affecting revenue of local fishers and local food security. The constraints mentioned by this group can be summarised as as follows:

- Fishing pressure is too high, limited fisheries resources and too many fishers in such a small tender;
- Pervasive illegal fishing including detrimental methods such as electrofishing;

- Loss of habitat due to sedimentation from various production activities and residential development;
- Increasing aquaculture development that interrupts natural connectivity between the tender and the nearby floodplain and;
- Loss of revenue from fishing in the tender and increasing risk of food insecurity.

Government official group

Local government official group states a lack of opportunity for small-scale fishers to access fishing due to lack of capital to invest in appropriate gears. A continued increase in tender price at auction is another reported constraint. They said that lack of consideration on resource sustainability when fixing the price for bidding has led to high fees for access to fishing. These were said to be some of the reasons why people try to maximise their profits from fishing once access is secured and why many resort to illegal fishing. Too many fishers in a small and degraded fishing ground is another issue that led people to compete with each other and thus conflicts frequently arise and results in a lack of agreement on how to improve or rehabilitate fishery habitats. Less fish is available for consumption, leading to a decrease in food security. As market access is easy much of the high-quality products are sold to large market and nothing, except the low-quality products, remains for consumption locally. Poor access to water for irrigation, due to competing interests between fishing and farming, is another constraint under the current management system. This group's opinions on the weaknesses of the system can be summarised as follows:

- Lack of opportunities for alternative livelihoods for local small-scale fishers;
- Decline in the amount and quality of water that is available, the remaining standing waters were all hyper-euthrophied;
- Inadequate water available to meet competing demands in fishing and farming; and
- Some friction among local fishers who compete for fish in the small tender as not all of them have the same financial capability to afford fishing access.

Fish collector and processor group

The group identified decline in fish biodiversity and catch, lack of financial support from the government and other sectors to develop small and medium businesses, and the lack of alternative livelihood outside of the fishing season as the main constraints. The decline in catch has resulted in reduced income for all stakeholder groups who depend on fisheries resources. There is limited financial support from the government to households to develop alternative livelihoods. There is no support available targeting development of small and medium enterprises. This results in a difficulty for local villagers to create jobs outside of the fisheries sector, in particular to generate income during the closed fishing season.

- General decline in income due to decline in fish catches; and
- Lack of support to develop small and medium enterprises and businesses that can generate income in the closed fishing season and thus there are no alternative livelihoods to fishing.

Paddy farmer and home gardener group

A number of constraints are identified by the group including lack of regulation enforcement by the tender holder. No patrolling is stated as the main reason why illegal fishing is going on unabated. While the group also mentioned increased sedimentation in the tender as another constraint, it also said the lack of maintenance of the channel, inappropriate household waste disposal into the channel, and erosion from home gardens developed on the banks of the channel are the main cause. Another constraint is the holder's inability to manage the tender effectively. The group also questioned if the holder has the intention to manage it effectively or because of his bigger commitment to other leases. Lastly, lack of alternative job opportunities remained an important constraint to addressing effective

management of the tender. This group's considerations on the weaknesses of the current management can be summarised as follows:

- Lack of patrolling and enforcement, which creates opportunities for illegal fishing;
- Continued sedimentation mainly due to inappropriate household waste disposal and lack of channel maintenance;
- Lack of ability or interest to manage the tender effectively; and
- Low income and lack of alternative job opportunities for local villagers.

The overall result of weakness/constraint of the current management system has been categorised according to the four dimensions of the Participatory Diagnosis Adaptive Management (PDAM) Framework. Figure 6 shows how local stakeholder groups perceived weaknesses/ constraints of the current management system. The 'people and livelihood' dimension had the highest score among all dimensions in the PDAM framework. The areas identified as constraints under the current management system were lack of opportunity for livelihood diversification and other employment opportunities, in particular to provide an additional source of income during the closed fishing season. A large section of local people fish, thereby competing for the limited resources in place. The groups noted a decrease in income for fishers due to declining fish stocks, and as most of them are poor they cannot pay access fees. The fishers could not diversify their livelihood or improve their fishing system because of a lack of funds.

The other three dimensions received about the same score, much lower than 'people and livelihood'. According to the stakeholders the current management system is weak on its institutional arrangement, the management is actually led by a single holder supported by a few sub-lessees who make the decisions on access and restriction. The stakeholders noted the lack of patrols and law enforcement by the tender management. Coordination with the management and with other different water users is weak, for example there is no good basis for whether or not water can be allocated for competing interests between fishing and farming. Stakeholders also noted the need for the holder to collaborate with the community if the system is to be effectively managed to achieve sustainable fisheries production. According to the fisher and holder/sub-lessee groups the auction price for the tender remains high when taking the current status of the resource in the tender into account. DoF and other relevant government departments need to control illegal fishing and encroachment in aquatic habitats, particularly linked to aquaculture expansion.

The natural system is heavily degraded and as a result there is decline in fish stocks and catches. For the last 5 years there has been a decline in catch between 50 and 70% decline. The habitats drastically changed due to non-sustainable practices in fishing, farming, waste disposal, and a lack of maintenance. Dike construction to provide access to residences across the channel and expansion of aquaculture ponds are reported to affect connectivity between the tender and the floodplain and as a result fish migration is cut off. Cleaning or dredging the channel is desirable to revive the much-needed environmental functions and improve quality of fish habitats.

External drivers such as expansion of aquaculture development, building of bunds across the channels, gardening on sides of the channels, and inappropriate household waste disposal are the main sources identified by these stakeholder groups to have resulted in sedimentation, pollution, and eutrophication, as well as degradation of fish habitats in the tender and thereby threatening the long-term sustainability of the fisheries system.

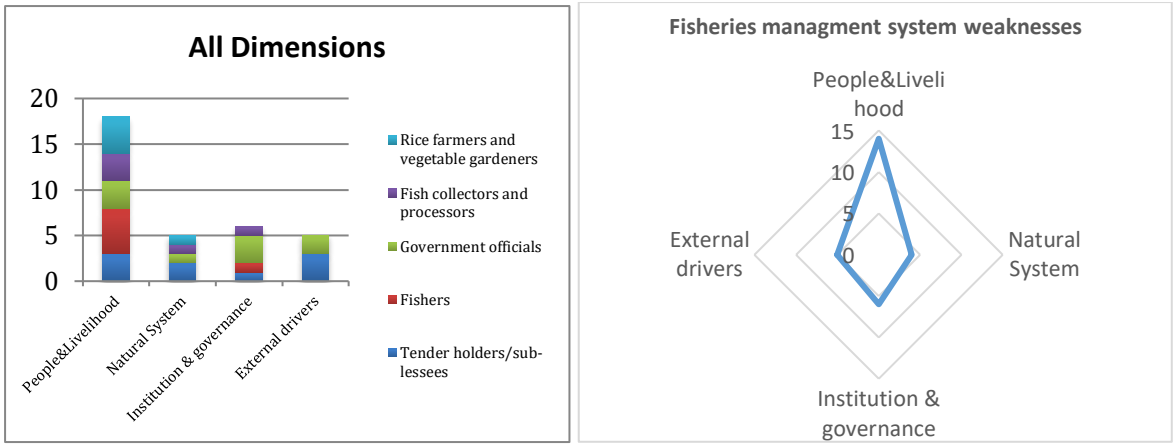

Figure 6. Weaknesses and constraints of the fisheries management system identified by stakeholder group (left) and all groups (right)

All stakeholders agreed to some common external constraints affecting the successful use and management of the lease to its sustainability. They are most concerned with sedimentation as a result from activities both within and outside of the fisheries sectors – non-sustainable fishing practices, aquaculture, gardening, etc. Although a majority of the stakeholders noted many local people enjoyed their access to fishing, some concerns were raised that this would not be sustainable in the long run. At the same time, the poor are not able to pay fishing access fee and could resort to illegal fishing. They also agree on the need to support local people to develop alternative livelihoods, especially during the non-fishing season in order to reduce fishing pressure. See constraints and weaknesses common to groups in consultation in table 8.

Table 6. Constraints that are common to more than 1 stakeholder groups

Constraints and weaknesses	Common to Groups	Description
Sedimentation and pollution in the tender/habitat degradation	Tender holder/sub-lessee; paddy farmer and vegetable gardener;	This continues due to aquaculture expansion, home gardening on the banks of the channels, and household waste disposal
Decline in fish and thereby revenue of small-scale fishers	Tender holder/sub-lessee; Fisher; Government group; Fish collector/ processor; and Paddy farmer and vegetable gardener	Habitat degradation; loss of connection to the larger water body; illegal and detrimental fishing
Weak coordination in the management, and also disagreement in the fishing	Tender/sub-lessee; Fisher; Government official;	Decision is done by a small group of holder/sub-lessees;

4.4. Interaction between constraints

Constraints have been categorised into the four dimensions of the PDAM Framework (i) Livelihood; (ii) Institutions/Governance; (ii) External Drivers; and (iv) Natural system (Figure 7). The current management has impacted livelihood (i) in the sense that although many people go fishing their access is unequal, due to differences in available assets; their income is lost and this presents a food security risk for the community although they continue fishing in other water bodies nearby; there are also limited livelihood diversification opportunities for small-scale fishers who are among the poorest in the area. On the institutional and governance issue (ii) there are little if any policies or regulations that govern local development or fishing. This creates no incentive for effective management of the fisheries or sustainable practices in aquaculture and paddy farming or home gardening and building

access across the channel to their residence. Lack of institutional capacity of the CFG and low awareness of the population in general has led to the false perception that the fisheries now remain under CFG management. For external drivers (iii) all the non-sustainable practices in farming and fishing including waste disposal cause pollution and fragmentation of habitats that have led to decline in fish stock and species which are the issues identified under the natural system (iv). The decline in stocks and number of species creates a feedback loop in the livelihood that people lost their income and interest in managing the tender.

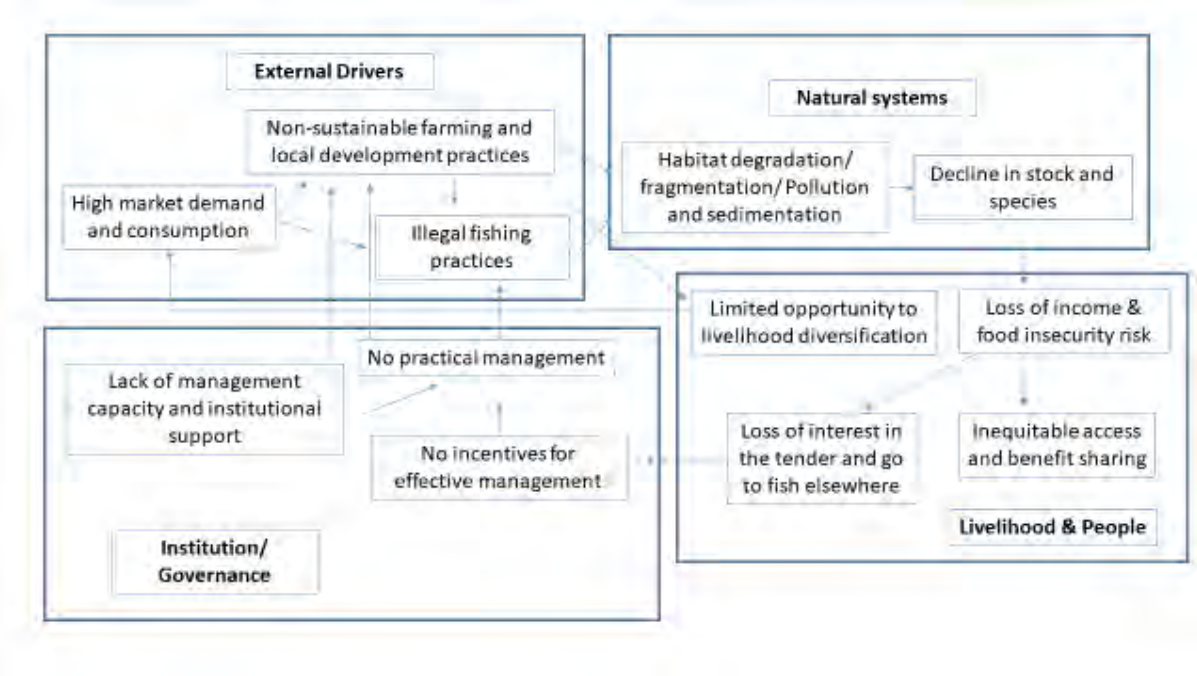

Figure 7. Linkages of constraints

4.5. Entry points for improvement of the management system

Based on the interaction of constraints, the main entry points for improvement of the tender and its management are to address the needed institutional capacity to manage the resources on which the population depends for their livelihood. The new development and expansion of aquaculture should be harmonised with paddy farming and fisheries, rather than competing with them. There is a need to provide incentives for why sustainable fisheries management of the tender shall take place. The tender no longer has value in terms of revenue generation but rather is used for local subsistence. Its management should reflect this change accordingly. Consideration whether to improve the channels of the tender to provide for fisheries as proposed by local stakeholder groups should consider the costs for dredging and maintaining it versus the benefits in terms of value for fisheries and irrigation. As human settlement is increasingly taking space along both sides of the tender, this will pose additional physical threats to the tender and thus requires maintenaning the integrity and function of the channels for fisheries and irrigation functions.

4.5.1. Constraints that can be solved at local and higher level

Most respondents and stakeholder groups thought that the vast majority of the constraints (71%) can be solved at the village or township level (Figure 8). Issues that can be resolved at the local level include too many fishers fishing in the tender, inequity in access to fishing in the area in particular for small-scale fishers, reduced amount of fish available for local consumption, weak local coordination and unity in the area, friction among local fishers due to competition for access, and farmers do not

have access to adequate water for irrigation and limited capacity. According to the stakeholder comments in the workshop and in KII interviews some of these problems could be dealt with at the local level and no policy and enforcement from the higher government is required. In particular home gardening, building bunds across the channel, and waste disposal could be addressed with intervention by the local government. It is important to have rules and strict enforcement in place regarding proper domestic waste management and disposal.

For higher level interventions, the constraints mentioned were a lack of institutional support and incentives for effective resource management and regulation enforcement, fragmentation of habitats due to expansion of aquaculture, heavy sedimentation in and lack of dredging of the tender, and lack of financial support for development of local small enterprises. Addressing the issue of aquaculture expansion, however, is said to require policy intervention from higher level.

Results from the workshop showed different perspectives of the stakeholders on where issues or constraints can be solved. The fishers, fish collectors, and local government officials see more issues that can be solved at the local level, while rice farmers and vegetable gardeners think that more issues will have to be addressed at higher levels.

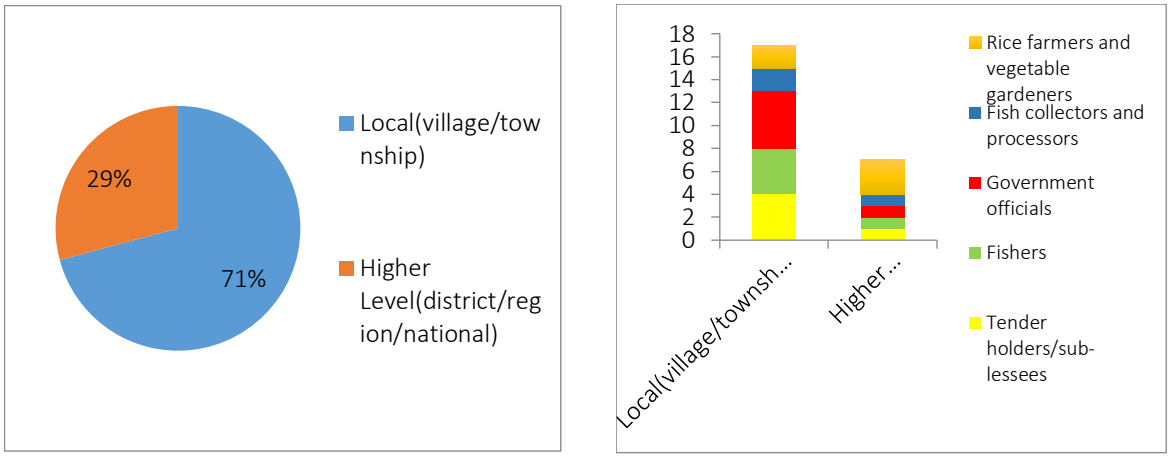

Figure 8. Constraints that can be solved by the stakeholder

4.5.2. Constraints that can be solved by stakeholders

The respondents discussed what stakeholder groups can potentially solve the constraints they identified in the process. Around 52% of all constraints were thought to be solvable by the stakeholder group and 48% would only be solved in collaboration with other stakeholders (Figure 9).

- The tender holder/sub-lessees thought that local fishers can split their efforts to fish in nearby waters to reduce pressure on the tender and this is something they have been doing so far. To buffer the decreased income from fishing in the tender the solution mentioned above combined with sharing more time on crop production was said to be another local strategy. However, this group sees a need for support from other stakeholder groups to address illegal fishing and sedimentation to which local groups like tender holder/sub-lessees can contribute. This group felt that only through collective effort of all stakeholder groups together, in particular with the participation of the government stakeholder, can they address the current expansion of aquaculture.

- The fisher group members felt that they are the largest group but with members from the community. They still have a strong sense of community and address many of the issues if they are better organised. The group also identified village leaders as potential players who can help bring local communities together to address issues such as inequitable access for small-scale fishers and unity. However, the village leader is also the tender holder and also a fish processor, so there might be a conflict of interest.
- The government group sees creating a platform to unify local groups and reconcile different local interests as their role. The local government understands the links it can make with higher authorities to make local concerns heard at higher levels.
- The fish collectors/processors understood that the initiative this group had taken to provide loans to poor fishers and buying their catch helps them not only access finance but also makes a market available at their door step. This group however still wants to see support from outsiders to support development of small local businesses in their area.
- The paddy farmers/home gardeners stated that each stakeholder group can do their respective part to help reduce sedimentation. They argued that sedimentation does not only come from farming practices but also from local housing development and waste disposal and therefore each stakeholder group has a role to play.

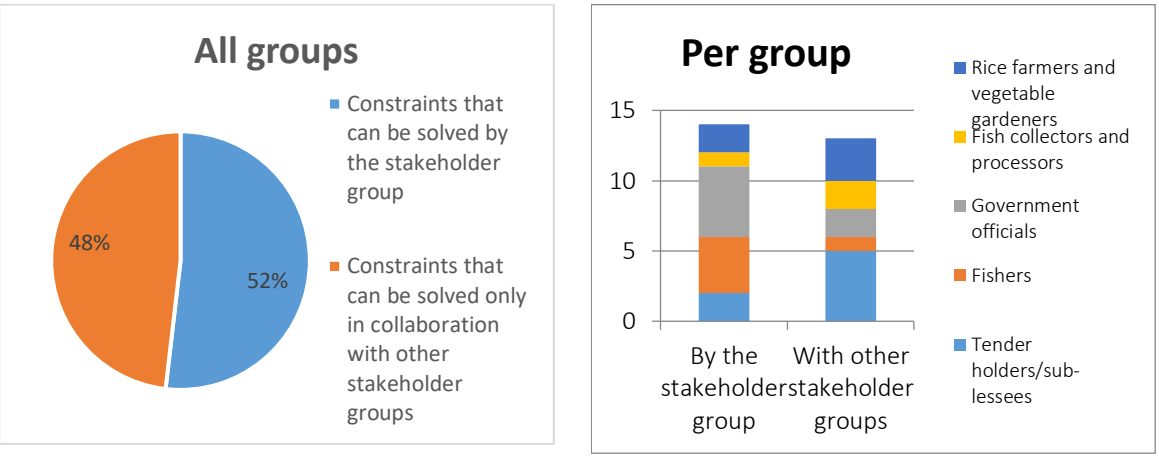

Figure 9. Weakness/constraints per administrative level

5. Discussion

5.1. Specific entry point at the fishery management level

At the local level, the main entry points for local groups should be the following: (i) raising local fishers' awareness about CFG co-management, potential damaging effects from destructive fishing, and the need to protect fisheries resources. (ii) The existing local CFG group should be reinvigorated and their capacity built to manage the fisheries and to enforce rules for the fisheries. (iii) Facilitation should be provided by DoF and/or civil society groups for the CFG to develop rules for a more equitable access to fishing while sustaining the fishery resources by regulating fishing efforts and methods, protecting the fisheries habitats, maintaining water quality, establishing and protecting dry season fish refuges, and other relevant activities. And (iv) the CFG group should be given special access to get hold of the tender at a floor price set by DoF, not in the interest of government revenue generation but rather to provide incentive for the CFG group to manage the fisheries for local subsistence fishing.

5.2. Generic entry points at the higher level

The generic entry points at higher levels should target two areas: (i) those that would create new and strengthen current fishery management for the tender and (ii) ones that support the related sectors to build an enabling environment for better fisheries management.

To strengthen current fishery management there is a need for establishment/strengthening of a network of CFGs in the area so they can learn from and help each other in addressing common problems they face. There is a need to avoid establishing a CFG and then let it fall back. Even if it falls back it should not create a false perception that it remains under CFG management thereby letting local elite capture all the benefits and put the blame for non-sustainable practices on CFG management. A broader fishery management approach should be taken including allocation of access between the three main fisheries domains of the area: the tender, the river nearby, and the lease in the floodplain.

Local authorities at the tender site should also seek to develop policy/regulation to ensure appropriate development of local and residential physical structures does not aggravate the existing problems to the tender, such as erosion and sedimentation and interruption of water flow for the entire length of the tender, and to ensure appropriate household waste disposal. Support should be provided to improve the fish value chain so that fish can be sold at higher prices or kept for household consumption, in particular for the season closed from fishing. A broader support should be geared towards the agricultural sector in which already about 70% engaged in including the development of robust local businesses that can provide for more jobs and livelihood safety net at the local level.

At higher level, there is a need for policies supporting integrated development that can accommodate new sector developments, such as aquaculture in the current environment setting so all sector developments can be harmonised rather than compete with each other. A tool to doing this may be integrated township land use planning vis à vis integrated water resource management. All the proposed entry points are provided for in Table 9 below.

Table 7. Summary of generic and specific entry points

Entry Points	Description	Issue addressed
Generic		
Development of policy that supports integrated development	Aquaculture is seen as an emerging and fast-developing sector to be harmonised in the agriculture-fisheries landscape.	Fragmentation and degradation of natural fish habitats
Government policy to support local residential development that does not degrade the tender environment	Increasing human settlement and household waste disposal present a threat to the viability of the tender.	Local government capacity to manage local sustainable development
Support to enhance fish value chain and local businesses	If access to fishing in the tender is to be effectively regulated alternative livelihoods should be provided including improvement of the fish value chain and food security during the closed fishing season.	Food security, income generation and livelihood diversification

Development of a stronger CFG network across the township to provide for capacity to address common issues facing them more systematically	CFGs will not be strong and able to address fisheries in a large landscape without networking to provide opportunity for learning from and supporting each other.	CFG capacity to operate in a larger landscape
Specific		
Awareness raising with fishers on fisheries co-management	Create an understanding that a CFG is more than just to bid for the tender but working to manage the resource and address access of local fishers	CFG member awareness on co-management of fisheries
Reinvigorating and strengthening fishers group management and law enforcement capacity	Strong institution and leaders will provide more benefits to the members' development and sustainable fisheries.	Capacity building of the FG committee and strengthening of the institution
Support the development of CFG institutional capacity to manage the tender for local subsistence and sustainable fisheries	The tender is no longer productive for generating revenue thus managing it with new objective for sustaining local subsistence with a participatory approach should be promoted	Equitable access to fishing and sustainable fishing practices
Special provision initiated by DoF for regional government to put the tender on special long-term management by CFG with floor price	Same as above	Maintain interest in and resource sustainability of the tender

6. Conclusion

This case study assessed the performance of four dimensions of the fisheries including people & livelihood, institution & governance, natural system, and external drivers. From the assessment it is clear that the natural system, the environment, and productivity of the tender, has degraded significantly and requires immediate attention for its rehabilitation or protection from further degradation. Production has sharply declined in the last five year by around 50 to 70%. Large commercially valuable species have suffered the most. On the people & livelihood dimension, there are mixed feelings about income. Some reported a stable income due to rise in fish prices while reporting lower catches. Small fishers appear to be on the losing side, though. Most local fishers tend to enjoy the current lack of restriction and enforcement, with rampant illegal and destructive fishing methods, further degrading productivity of the tender. This has led to a decreased interest among local fishers to bid for the tender. This was corroborated by the fact a small group of bidders only submitted their bid at the last call by DoF when the floor price was the lowest. There is little or no support to livelihood diversification leaving relatively large parts of the community to depend on the system regardless of its degradation and low productivity. Despite the reduction of the auction price it is still seen as high. There are reports of inequitable access to fishing even though many already have access. On the institution & governance, some progress has been made to place the tender under CFG management, when the local CFG was established and bid for the tender in 2017. Without concrete guidance and capacity building, the group does not function and management of the tender reverted to the old system of individual management, while leaving a legacy of false understanding of

the CFG management. On the external drivers, there are few issues including fast and unregulated development of aquaculture fragmenting fish migration routes and fish habitats.

The current resource base is not sufficient to encourage management of the tender for revenue generation. It is best managed to ensure local subsistence using a local community management approach. This requires to reinvigorate the current CFG group that was once established but without appropriate capacity in place. However, while there is a general policy in support of CFG, it remains not clear how it will go forward and there are few detailed guidelines on what the role of a CFG should be, how it should operate, and for what purpose its mandate is. That an established and dysfunctional CFG leaving a false perception of the group represents a clear lack of awareness among fishers and the general population about CFG management, capacity of the CFG to manage the tender, and a framework for the CFG to be accountable to why it was established, how it operates and what delivery it produces from the government. Coupling with appropriate local residential development policy, empowering this group's capacity and authority to manage the resources at a floor price set by DoF would provide high chances for maintaining sustainability of the tender resources and equitable access by the small local fishers.

Characterisation of Fisheries Management Systems in AD and CDZ

MYFISH 2

Case Study 8

Report

(Pa Zun Tender, Pyapon)

Table of Contents

Abbreviation

AD	Ayeyarwaddy Delta
CDZ	Central Dry Zone
CSO	Civil Society Organization
DoF	Department of Fisheries
FAO	Food and Agriculture Organization
FDA	Fishery Development Association
FG	Fishers' Group
FGD	Focus Group Discussion
HH	Household
KII	Key Informant Interview
NGO	Non-government Organization
PDAM	Participatory Diagnosis Adaptive Management
RAAIS	Rapid Appraisal of Agricultural Innovation System
USD	United State Dollar
WF	WorldFish

Note:

Currency Exchange rate: 1 USD =1,500 Burmese Kyat

Weight Conversion: 1 Viss = 1.6 kilogram

1. Objective of the study

The aim of this case study is to generate an "in-depth" understanding of the Individual Tender fisheries management system in Pyapon, with a focus on identifying major issues and potential entry points for addressing these. Hence the specific objectives are as follows:

- Assess performance of the Individual Tender fisheries management systems based on agro-ecological, social, and institutional environments in Pa Zun tender, Pyapon; and
- Identify key issues and opportunities for interventions to improve the performance of this fisheries management system at the area.

2. Methodology

This case study documents the Individual tender fisheries management systems based on its current performance, strengths/merits, and weaknesses/constraints using both quantitative and qualitative indicators. The final output was the identification of entry points both at the local and higher level for a sustainable capture fishery in the area. This case study was selected in Chaung Wa Village, Pyapon Township. The site was an individual tender management system for many years to date. The information and data used in the analysis were both from primary and secondary data sources.

Review of Secondary data

A matrix was developed to compile existing information about the site, fisheries, and type of management in the target area. The information gathered to complete the matrix was sourced from census, FAO assessment, MYFish 1 fishery survey, MYFish 2 Component 2, and other available information from DoF at the District, Township, and Region levels.

The Analytical Framework

The approach for the case study characterisation process was adopted from the Rapid Appraisal of Agricultural Innovation Systems (RAAIS) tool. RAAIS is a diagnostic tool originally developed for the agricultural sector that allowed for analysis of issues from broad entry theme towards more specific entry points for productivity, natural resource management, social development, and institutional innovation. The RAAIS tools were combined with another theoretical framework tailored to the identification of fisheries management issues--the Participatory Diagnosis Adaptive Management (PDAM) (Table 1). The two frameworks were combined, adopted, and graphed into the radar issues of PDAM as the four analytical dimensions based on RAIIS results. The four dimensions are elaborated, as follows:

Table 1. List of Dimension Indicators

Assessment Dimensions	Indicators
People & livelihoods	Living conditions; diversification/income dependence; assets and income poverty
Natural system	Biodiversity; stock status and trends; fishing practices; aquatic ecosystem conditions
Institutions & governance	Fishing and development policies; organizational and institutional capabilities; access to markets and financial services; collective action abilities; governance performance and rights; legal frameworks
External drivers	Infrastructure development; conflicts with other sectors or users

Definition of the four Dimensions[1]

People & Livelihoods - this is the socio-economic aspect of the fishing communities and it encompasses household well-being, which include household income, diversification of household livelihoods, household fish consumption, living conditions, norms and culture, and household assets. It also can include conflict with other users and resource use

Natural system – a biological classification of yield, biodiversity and sustainability of the fisheries resources and ecosystem, its stock status and trends (total catch, total catch by species, fishing effort, catch by unit effort, and number of species), fishing practices, and aquatic ecosystem condition, such as connectivity, breeding ground, pollution from upstream, agriculture, industry.

Institutions & governance – the manner in which a power is executed in the management of the fisheries sector. It is the enabling environment aspect in governing the fisheries management in order to reach maximum sustainability (legitimacy, membership rules, access rights, management controls, representation rules, sanctions, enabling legislation/policies/legal framework, local support, financial management and services, access to market, organizational and institutional capabilities.

External drivers - outside influences that can impact the fisheries resources and its ecosystem. Various external factors can impact the ability of the fisheries to achieve its maximum productivity/biodiversity and sustainability. These external factors might include infrastructure development, macroeconomic instability, climate change and environmental uncertainty, migration, market demand changes, price fluctuation, land use changes, migration.

RAAIS as a participatory diagnostic tool combines multiple methods of data collection, building on existing experiences with rapid appraisal approaches and (participatory) innovation systems analysis. The methods for the RAAIS shall generate both qualitative and quantitative data; facilitate 'insider' and 'outsider' analysis; targets different stakeholder groups across different levels with individual, group and multi-stakeholder perceptions on weaknesses/constraints and solutions; and provide sufficient detail on the main weaknesses/constraints under review, capacity for innovation in fisheries management system and the functioning of the fishery management system. On the other hand, the innovated framework will be used also to identify the performance, and strength/ merits of the management system under review.

Methodological steps

Based on RAAIS tool, the following main steps were taken to assess the existing fisheries management systems based on the context of each site: (i) identifying strengths/merits, and weaknesses/constraints; (ii) categorizing strengths/merits, and weaknesses/constraints; and (iii) exploring specific and generic entry points for recommendations for the current fisheries management system to achieve equitable and sustainable fisheries. The objectives, sessions and activities of each stage are presented in detail in Annex 1. The steps were conducted in the selected site to gather a broad range of information from relevant stakeholders and articulate a participatory assessment of existing fisheries management systems. These methodological steps are shown below:

Multi-stakeholder workshops focus mainly on insider analyses of the current fisheries management system and conditions of the system. Four groups of stakeholders identified, categorized and analyzed strength/merits, weaknesses/constraints, and performance of the existing management system to provide specific and general entry theme for innovation in the fishery management system.

[1] Definition was taken from the MYFish2 - Characterization Component 2

The DoF and WorldFish in Myanmar led the selection and organisation of stakeholders who participated in the multi-stakeholder workshop. A total of 21 participants, including ten women, attended the multi-stakeholder workshop. Figure 1 shows the percentage of participants of the four stakeholder groups. The Fisher Group had the highest representation, at 52% of the total participants.

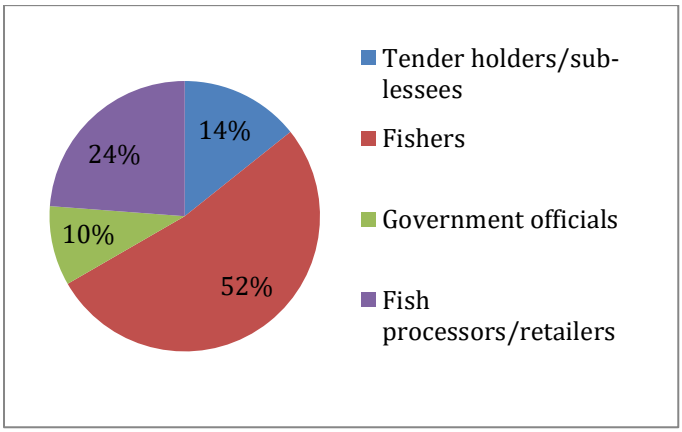

Figure 1. Participants of multi- stakeholder groups' workshop in Chaung Wa, Pyapon Township

Key Informant Interviews were facilitated through one-on-one conversations between the WF/DoF team members and a key informant. Three key informants were interviewed, including a Village Head, a tender holder, fishers and a fish collector/retailer. The KIIs were used to gain extra in-depth information based on what was gathered during the multi-stakeholders workshop, to validate secondary information, and to understand the perspective of relevant individual respondents on the existing fisheries management system in the area.

A total of 28 respondents participated in the information/data collection during three days of field work (28 – 29 January 2019) at Chaung Wa Village, Pyapon Township. The Fisher Group had the highest representation of respondents participating in data collection (Table 1).

Table 2. Summary of methods and sampling strategies and sample size deployed during the study

Method	Type of analysis		Stakeholders groups targeted – Sample size			
	Stakeholder-led	Researcher-led	Tender holder/ Sub-lessee Group	Fisher Group	Government officials	Fish processor/ retailers
Multi-stakeholder Workshop	X		3	11	2	5
Key informant interviews		X	1	4	1	1
Secondary data		X				
Total	21	7				

3. Study site

There are four villages located next to the tender including Hmwe Be, Aye Thar Yar, A Phaung (where live the current tender holder), and Da Min Siek. However, the villagers are not allowed to fish in the tender as they either fish in the main channel of Pyapon River or fish somewhere else away from the tender. The tender is divided into 3 segments, two of them are sub-leased to two other fishers in the local villages as sub-lessees.

Location of Pa Zun Tender

3.1. Socio-economic characteristics

Four villages of Pyapon Township have fishers who depend on fishing in the tender and nearby waters. They are Hmwe Be, Aye Thar Yar, A Phaung and Damin Siek. The village where the consultation took place has a primary school and a strip of concept road linked to Pyapon township at about ??? km away.

3.2. Fisheries System

3.2.1. Natural system and fishing techniques

The Pa Zun tender lies in the intertidal coastal area of Pyapon River. It is a strip of intertidal land along the eastern shore of Pyapon River, between Pa Zun Chuk Sat Yone and Chaung Wa. It is located in the delta of Pyapon River. The salinity of the water ranges between brackish and saline between the wet and dry season. The area is auctioned as a tender on an annual basis. The auction starts on 1st April and the tender holding period lasts till end of March the following year. Fishing here follows the moon cycle and no closed season is imposed by the government. Fishing in the tender starts about one week prior to the full moon and continues for another week following the full moon.

According to DoF in Pyapon, the high fishing season, starts in October but high catches are observed between November and December and the low fishing season is January - February. Fish catches in high season range between 5 and 15 viss (8 – 24 kg) a day. In low season catches range between 2 and 6 viss (9 kg) a day. The only gear allowed to be used in the tender is fence net. The main species caught include *Wallago attu*, Seabass, and freshwater prawn – the high value species - mostly sold in Yangon. *Mystus* is the main species that is caught and sold locally. No fishing with fence net takes place between March – September as the tide is too high to operate the gear. The last four years had seen a drastic decline in catches of *Wallago* followed by freshwater prawn.
The main species caught with a fence net are freshwater prawn, seabass and *Wallago attu*. However, the catch is reportedly on the decline. For example, the tender holder reported a decline of prawn catch from 20 – 25 viss (30 – 40 kg) per day in 2013 to only 8 – 10 viss (13 – 16 kg) per day in 2018. Similarly, for *Wallago attu*, it was 2-3 viss (3 – 5 kg) but now only 1-1.5 viss (1.5 – 2.5 kg). A retailer reported a similar trend when she sold between 6 and 7 viss (9 – 10.5 kg.) per day during peak fishing season two years ago but now only 3 to 4 viss (4.5 – 6 kg).

3.2.2. Changes in fisheries management

There was no reported change in fisheries management for the tender. The tender fisheries are put up for auction annually. Bidding starts in early April and the holding of the tender end at the end of March the following year. Theoretically, the floor price is set by DoF with a 10% increase in relation to the auction price for the previous year. Figure 2 shows the trend in auction price for the last 10 years. A sharp increase in price can be seen in 2011-2012. This might have been the result of the change in fisheries legislation and the decentralisation of authority to the district level. The district-level office then reassessed the auction floor price. The highest price is seen in 2012-2013 at almost MMK 4.6 million followed by a sharp decline to about half that price. There is no explanation for that however. Information from anecdotal sources reveals that bidders collaborated and did not submit their bid until the last call by DoF when the floor price is reduced to its minimum.

Two different tender holders were reported over the last ten years or so. The former holder between 2013 and 2017 was an individual from Pyapon then he was replaced with a local person from the village next to the tender. It appears that there are only few people who managed to bid for the tender and an arrangement to win in a bidding process tends to have been laid out behind the scenes among those interested in it. The change of tender holder in 2017 illustrates how agreements were made beforehand behind the scenes. No formal contract in writing is reported as people knew each other and everything was agreed to verbally.

Between 2013 and 2015 the previous owner allowed fishing in the tender with specific fees for different gears, but in 2016 as the new government was elected the fishers refused to pay the fees and the owner stopped this access arrangement. Since then the access rules were very strict with an exclusive use by the holder and sub-lessees during the high fishing season (October to February) with a peak between November and December and a lower productive fishing between January and February.

The current tender holder has over 10 years of experience fishing in the tender. Between 2008 and 2015 he was a sub-lessee for Damin Siek segment. For 2015 - 2016 he paid MMK 1.6 million to be able to fish with a fence net and other gears in the segment. He later asked the then tender holder to allow him to bid for the whole tender. The holder agreed but at the condition that he bid for the tender under the then holder's name. As part of the agreement the holder also asked him to sub-lease a

segment to one of sub-lessees then. He then won the auction and got hold of the tender in 2017 and continues until now.

It was reported during the survey that since there are only a few people bidding for the tender and, due to agreements amongst them, interested fishers do not normally submit their bid until the last call when the floor price is set to the minimum.

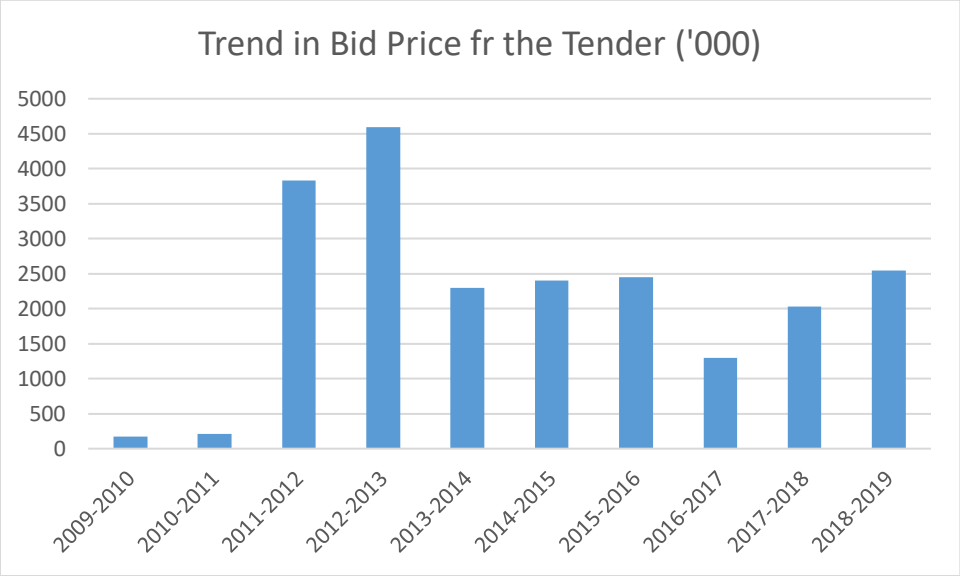

Figure 2. Trend value of the Pa Zun Tender

3.2.3. Current organization and management

The tender is divided into 3 segments as follows: 1) Pyap to Achar Gyi village (nearly 2.5 miles), 2) Achar Gyi to Apaung Village (nearly 2.5 miles) and 3) Apaung to Damin Siek village (4 miles). A segment holder normally employs 4 to 6 fishers, each pair uses a boat to fish in the respective segment. Each segment is patrolled by the workers of the respective segment. As the tender holder and sub-lessees only manage the tender, the waters outside of the tender are not under their responsibility. As such illegal fishing is reportedly widespread. Between October and February only the tender holder and sub-lessees fish in the tender. The rest of the year the tender is open access for all villagers. The tender holder and sub-lessees use fence nets and the others used traps and pull nets along the beach during the period of open access fishing.

The price for the three segments is as follows: MMK 0.7 million for Pyap – Achar Gyi segment; MMK 0.5 million for Achar Gyi – Apaung; and 0.8 million for Apaung – Damin Siek. The special arrangement for the Damin Siek segment is that the sub-lessee pays the fee and sells the catch to the current holder. The current tender holder contended that he does not make a profit from subleasing segments of the tender. Since he also collects and trades fish and fish products, he can profit between at least MMK 35,000 and 40,000 a day by selling fish in Yangon.

The auction for the tender starts in April. The fishing season starts in October and concludes in March, just before the next bidding process starts. There is no closed season imposed by DoF but fishing between May and July is not productive as the water level is high and fence net fishing is not possible. Other gears used in the tender include traps, push nets, drift gillnets, and seine nets. These gears operate in the water next to the tender but also in the tender when fence nets are not being operated.

A person intending to fish in a segment of the tender will have to ask the segment holder prior to the auction. To have higher chance for success in bargaining for access rights the potential fisher would have to come to terms that their catch will be sold to the segment holder at an agreed price.

A fisher in one of the KIIs noted that 4-5 years ago fishers were required and encouraged to release gravid and fingerlings back into the water to preserve fish stocks. Three years ago rules became stricter. Illegal fishing in the tender area surged starting last year as conventional fishing is becoming less effective to catch enough fish.

All applicable rules are developed by DoF. Fishers are required to register licenses for their boats and other equipment at the local DoF. Fishers were restricted from fishing from June to August to allow fish for spawning, however it was not mentioned by local informants during the interview and in the multi-stakeholder workshop if such rules exist and are applied to the area. No protected areas are designated in the tender. To be able to fish in the tender, an arrangement and agreement with the holder has to be made beforehand.

The tender holder is reported to patrol for illegal fishers using poison along the shore. Using drift gillnets is not allowed in the tender area but sometimes poachers do fish with drift gillnets. The tender holder and sub-lessees also work as fish collectors and usually lend money, gears or boats to fishers in exchange for the exclusive right to buy their catch.

While the tender holder and sub-lessees fish using a fence net between October and February, others fish using drift gillnets on the main channel during high tide. Paddy farming takes place on land along the coast and along the creeks flowing into the main channel. One of the issues is that paddy farmers close the creeks to catch fish when fish are supposed to return to the main channel of Pyapon River to be caught in the tender. Another issue is that large-scale fishers violate the rules set by DoF and fish in shallow waters just outside of the tender, leading to an overlapping fishing ground with the small-scale fishers.

4. Results

4.1. Performance of the system

4.1.1. Overall performance

The overall performance of the current fisheries management system was determined based on the perceptions of four stakeholder groups who participated in the multi-stakeholder workshop activity. The PDAM framework was used to assess the performance based on the four dimensions: natural system, people and livelihood, governance/institutions and external drivers. The performance score of each indicator was divided into three with 3 being the highest score. Stakeholders' responses showed that 'institution/governance' had the highest score as shown in Figure 3 & 4. The score given here should be treated with caution as different stakeholder groups may not mean the same thing in their deliberation. For example, while the government and fish processor/retailer groups have a broad perspective of the fisheries for the area as a whole, the tender holder/sub-lessee group focuses its assessment on the fisheries within the tender proper for many aspects and the other way around for fisher groups whose members mostly fish outside of the tender.

The dimension with highest average score was livelihood. High scores were given by the fisher and government official groups in particular. The medium scores were given by the tender holder/sub-lessees and the average score was given by the fish processor/retailers group. The second highest score was for the 'institution and governance' dimension for almost all stakeholder groups. However,

the fisher group did not share the same sentiments, which will be explained in more detail below for each dimension. The 'external factors' and 'natural system' dimensions received equally low scores. What stood out for the performance under the past and current management systems among the different stakeholder groups was the fact that the fish processor/retailer group gave average low scores for two dimensions – natural system and livelihood the dimension-, while those dimensions received the highest score from the fisher group. While the government official group gave the lowest average score for 'external factors', the fisher group scored 'institution and governance' the lowest – below average.

In terms of expected performance for the next five years, all stakeholders had a negative perception for most indicators. Overall, all stakeholder groups, except government officials, agree that the livelihood dimension will decline in the future. The average score for all stakeholder groups for 'institution & governance' in the future remains unchanged. Surprisingly the fisher group expects an improvement for that dimension, while the tender holder/sub-lessee group the government group expect a declining in the performance for this dimension in the next five years. As the average scores of all groups were high for 'external driver'. The scores for 'natural system' decreased to below average. Both give a sign of caution about the sustainability of the system.

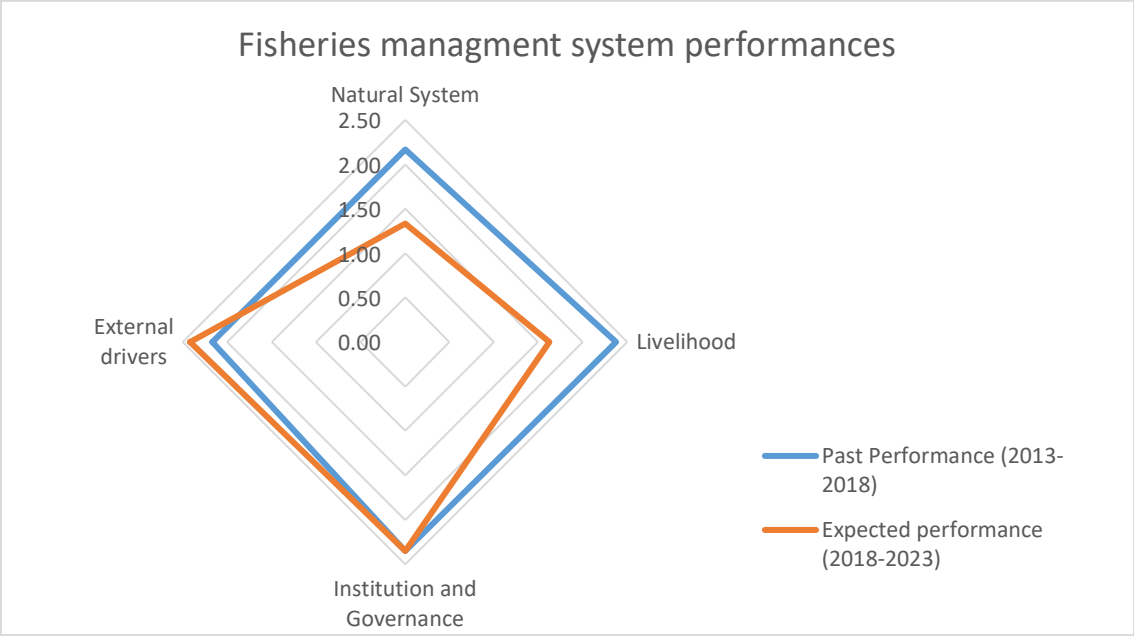

Figure 3. Current and expected performance of the fisheries management system

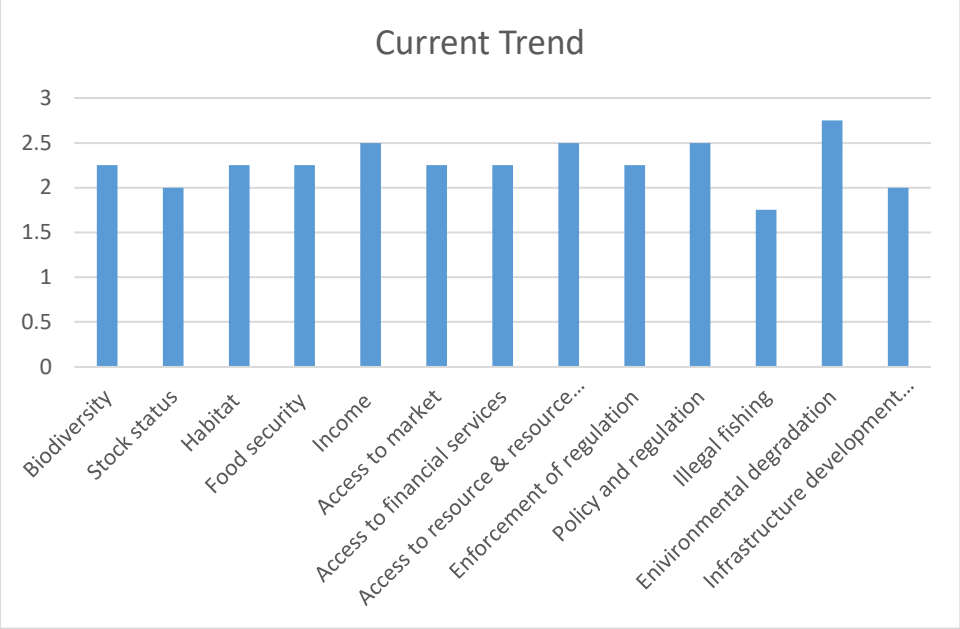

Figure 4. Current Management Performance Indicators

Natural system

The respondents assessed the natural system's performance based on biodiversity, stock and habitat status. Almost all stakeholder groups, except the fishers, gave the system at low score. All groups noted the decline in fish biodiversity and fish stocks mainly due to habitat loss, fragmentation and degradation, and illegal fishing. The fisher group, however gave all aspects under the dimension a high score, because until recently fishing pressure had not been very high. The tender holder & sub-lessee group saw expansion and intensification of paddy farming as part of the reason for their low score. They also mentioned escaped aquaculture fish could contribute to sustaining fish stocks. Although the government group noted a 20% decline in fish size, a 50 per cent decline in fish catches, and that 70% of fish migration routes are blocked due to paddy irrigation, it still gave high to highest scores to aspects under this dimension. The fish processor & retailer group rated aspects under this dimension between low and average, in particular due to reported decline in commercially valuable species such as seabass, tank goby, and *Wallago attu*. The group also noted challenges from habitat modification, especially along the shore due to paddy farming developments as an important justification why the group gave low scores to the factors under this dimension.

Informants noted the degradation and fragmentation of habitats was due to development of paddy farms and building of sea dikes along the shore. Much of mangroves were cleared prior to the Typhoon Nargis but some of the forests have been regenerated since. Other practices that are harmful to fish biodiversity and fish stocks are intensification of rice farming and application of pesticides, and harmful fishing practices such as the use of poison.

Livelihood

There are some contradicting responses from different stakeholder groups; however, two issues common to all of them were that less fish are caught and fish prices have increased over the last five years. Although the tender holder/lessee group had an opinion that fish prices were increasing overall and this was linked to lower catches. The fisher group noted that there remain plenty of small fish and can be bought at low prices. The fisher group also said that local people were now trying to diversify

their livelihood. The government group attributed the 20% decline in fish consumption overall to lower catches. The fish processor/retailers claimed that people can catch fish from other sources and this will lead to relative stabilisation of local fish consumption.

As for income, the holder/sub-lessee group stated that despite lower catches higher fish prices helped maintain a stable level of income. For example, the tender holder said that income did not change because even though fish catches declined, prices were good. Additionally, the transport costs have reduced because less fish needs to be taken to the market. He said that sending three cool boxes filled with fish to Yangon in the past would earn even less than what he earns for 1 cool box today. The government and fish processor/retailer groups, however, disagreed and stated that the effect is felt differently by different stakeholders. The large-scale fishers like the tender holder/sub-lessees may not have seen a decline in income as they deal mostly with high-value fish, unlike small-scale fishers and retailers who main earnings come from small shrimp and fish. A fisher from Aphaung village said that her household income hasn't changed, but added that the decline in her income from fishing is now compensated with income from livestock farming.

Institution and Governance

Performance of institution and governance was assessed based on access, enforcement, and policy and regulations. The overall score for this dimension was high, in particular due to positive impressions by the tender holder/sub-lessee for all aspects and partly by the government stakeholders for three aspects – access to resources & resource sharing, enforcement of regulation, and policy and regulation. The fisher group rated this dimension the lowest.

All stakeholders, except the fishers, agreed that with lower catch it means the supply is kept at check while rising demand makes it easier for fish products to access market. The negative impression by fishers may be associated with the fact that they are mostly small-scale operators and their products don't meet market requirements. A similar sentiment is felt by these stakeholder groups for access to financial services. Stakeholders appreciate the financial services available to them, whether they are from non-government or local private money lenders, at affordable prices. The fish processor/retailer group saw an increasing role played by NGOs in provision of financial services. Although the fisher group didn't seem to appreciate their current access to financial service as it was scored low, the prospects for this factor look good, as access is expected to be broadened in the next five years.

For access to resources & benefit sharing, the tender holder/sub-lessee and government groups appear to agree that it is fair. Both groups scored this factor high and the explanation that was given is they all have something to give and to take. All are said to be able to have access to fishing in the tender provided that they satisfy a set of conditions, including paying the fees, using certain gears, and respecting the fishing periods. The tender is open to all at times when fence nets aren't operated and this is seen as an important aspect of good resource sharing. The fisher and fish processor/retailers, although scoring this factor lower – average, appreciated that all stakeholders involved in fishing in the tender and associate water bodies have a good understanding of each other and they agreement can be reached if they want to access fishing or fish-related businesses in the area.

The tender holder/sub-lessee noted no problem with regards to regulation enforcement as people normally respect the boundaries of the tender, except when the fence net are no longer operated and fishing in the tender is open to all. The government group gave the same high score, but acknowledged the fact there is weak law enforcement, in particular in waters adjacent to the tender. Certain

complicated issues were reported to take place, such as an overlap in fishing grounds between large- and small-scale fishers, and fishing using harmful methods. This group noted weak awareness among local people of the provisions under the fisheries law. In the past, DoF had extended its effort to patrol the area and apprehended and fine illegal fishers. Due to limitations in the number of staff number and available resources, it could not be sustained. This has led illegal fishing being left unchecked. The fisher group agreed with the DoF that awareness has been poor but recently people have become more aware.

On policy and regulation, the government group noted that new legislation for freshwater fisheries was put in place in 2012, wherein a closed season and gear restrictions were provided. Nothing was said about the coastal fisheries. The fisher group expressed doubts whether the policies and regulations adopted by the government to promote sustainable fisheries would be applicable and have had any effect at the ground level as concerns by local people may not be considered.

External drivers

The performance of external drivers was assessed based on the issues of illegal fishing, environmental degradation, and infrastructure development affecting the environment. All stakeholders mentioned that illegal fishing activities in the tender area have been widespread and are increasing. The tender holder/sub-lessee and fisher groups agreed that people did not use harmful fishing practices in the past but it has become widespread now. The government group acknowledges that it is hard to control illegal fishing, in particular when using poison as they mostly operate at night.

All groups agreed that environmental degradation is of concern and need to be addressed. The increased use and inappropriate disposal of plastics, use of highly toxic chemicals in farming, destructive fishing by large fishing vessels, and cutting down mangroves for firewood production were mentioned as the main causes.

There were no reports of infrastructure development in the area, however operation of irrigation canals for paddy production and sea dikes have been noted to impact fish habitats and inhibit free movement of fish in their range. During the KIIs, the tender holder and sub-lessees complained about some fishers to whom they gave loans did not honour the conditions of their agreement and sold their catch to different fish collectors who offered higher prices (Table 3).

Table 3. Summary of Performance of the current management system

Dimensions	Rank	Key point/highlight
Natural system	4	Biodiversity, fish stock and habitats are degrading because of habitat loss, fragmentation and degradation, as well as illegal fishing due to non-sustainable agriculture practices, construction of sea dikes, and harmful fishing practices.
Livelihood	1	Lower catches resulted in less fish for local consumption overall but plenty small fish and shrimp are still reported. The decline is mostly in high-value fish species leading to a rise in fish price. There are mixed implications between those earn who sell low or those who sell high value fish. The high value fish get higher prices so no big differences in income were reported.
Institution & Governance	2	Overall, there is fairly good access to both markets and limited financial services. Resource access and sharing is mostly seen as fair because all fishers claimed they understand each other and

		they can still negotiate with holder/sub-lessee if they intend to fish in the tender. It is seen that enforcement of the rules within tender is fairly strong but there is no monitoring of enforcement of the rules for the larger part of waters outside of the tender. No specific regulation is in place to address illegal fishing and non-sustainable farming and sustainable use of resources in the coastal area.
External drivers	3	Prominent issues include illegal fishing, environmental degradation, and infrastructure affecting the environment. Unregulated fishing in the open water just outside of the tender including fish poisoning and large-scale fishing in the shallow waters continue to pose threats to the resources in the tender.

4.1.2. Productivity and income

Tender owner and fish collectors said that higher fish price keeps their income stable despite lower production. The tender holder, for example, said he earned at least MMK 35,000- 40,000 per day by trading fish at Yangon's wholesale market. He added that in the past he would send three boxes of fish to Yangon a day and now he only sends one. The transportation costs for one box are lower so his profit margins are higher.

Small fishers and retailers did not share the same story. In a KII interview a fish retailer said that in the past she sold 6-7 viss per day in peak fishing season and now she onlys sells 3-4 viss. She blames degradation of fish habitat and overfishing as the main causes of decline and ultimately her lower income. Now she has to diversify her income source by selling snacks to school children to top up her income. She only earns between MMK 2,000 – 3,000 per day from selling fish in the village. Her husband works on an offshore fishing vessel and gets paid MMK 250,000 per month.

One of the interviewed fishers estimated a 50% decrease in overall fish stocks. She said her catch was 2 -5 viss/day five years ago and now it is only 0.5-3 viss. Larger fishing boats are blamed for not only the decline in fish stocks but also for damaging small-scale fishers' fishing gears as they operate in overlapping fishing grounds. While one fisher blamed the fish habitat loss on destructive fishing practices such as fishing with Nga Ponna Pite, trammel net, others pointed to fish poisoning as the main cause.

4.1.3. Benefit sharing and equity

Some fishers tend to be satisfied with the current access regime and the benefit they can generate from such access. They said that overall the system is fair and ensures equitable benefits. Fishers operate with a sense of compassion towards each other. All fishers can access and benefit from fishing in the area so long as the rules are followed. Women and poor people are also able to benefit as women are active fishers and poor people are given fair access to the tender.

Another fisher praises the tender holder for facilitating access for all fishers to fishing, either inside or outside of the tender. For example, they provide free or low-interest loans so that the poor can also buy gears and fish. Sometimes the poor are given time flexibility so they are able to catch more fish. He said local people also find jobs as causal labourer during the fishing season such as preparing fishing nets and drying shrimp and fish.

However, another fisher thinks it is not equitable because rich people, such as the tender holder, influence and dictate fish prices for the fish that is bought from small fishers. This way the rich get the most out of the system. The fisher argues that most fishers cannot pay back their loan within a year.

He himself couldn’t pay back the loan he owed to the loan provider. He said that poor people are not able to pay the license fee, and thus are not allowed to fish in the tender.

A sub-lessee who also works as retailer complained that it is unfair because some fishers access fishing at certain times of the year in his segment without paying. He also added that some fishers do not honour their agreement to supply him with catch and instead sold their catch to other retailers when they were offered higher prices.

4.1.4. Access rights

Fishers said many fishing gears are used in the tender area, such as fence net, trap, cast net, surround net with brush parks, and pole and line fishing. After prior negotiation and agreement, people are allowed to fish in the tender as long as they pay the fees. For a brush park, the fee is said to be MMK 15,000. Access is granted to all fishers and the poor who cannot afford to pay immediately are given a loan so they can invest in gear. During a KII interview, a fisher said that anyone from adjacent villages can fish in the tender as long as they pay the access fees. The fisher believes that the system is fair and straightforward.

Another fisher complained that the tender holder and sub-lessees use a big fence net in their segment but other fishers are not allowed to use the same gear. Cast nets and surrounding nets with brush parks are allowed in one segment. In the past when fish were plenty, people could be seen fishing everywhere. Now there is a bigger fisher population but fish stocks are declining so some fishers use illegal fishing practices to support their livelihood. Some fishers who cannot pay for the fishing fees are still able to access fishing through an arrangement in which they agree to repay their loan in fish at agreed prices.

One sub-lessee didn't allow other fishers to fish in his area with fence net. However, most fishers now use diverse gears to catch fish, without paying fees, along the river outside of the tender and in the tender when fence nets aren’t being operated. She thinks it is too open because the tender holder cannot control the fishers who are using the other gears such as, trap, seine net (Chone Wai Pike) without paying fee. Besides, fishing with poison is also reported and this is done mostly at night. Most of the fishers catch fish in every season.

No awareness raising with fishers is reported by the government or NGOs. The holder provides loans to sub-lessees or fishers who sell their catch back at an agreed price. She preferred the individual system, she doesn't understand about the community system but she thinks if the government gave all fishers access to managing the tender collectively, conflicts may occur among them.

4.1.5. Conservation

No conservation area is designated in the tender or adjacent waters. Fishers are advised to report any illegal fishing to the tender holder and village head who will respond. However, to date no reports of illegal fishing has been acted upon. As a result, illegal fishing has been increasing over time. The respondents attributed a significant decline in fisher revenue to illegal fishing – poison- and electrofishing. Some people are reported to have cut mangroves for firewood or to be used in seine net fishing. No mangroves were replanted along the shore of the river. No awareness on the need for protection of the habitat or fish was done by DoF. Some of the species that were reported to be disappearing or to be less abundant include pangasius, Iridescent Shark; Ngar Htwe , Ngar Gyaung, Ngar Myin, *Glossogobius giuris* (Tank goby), and *Trichogaster pectoralis*. Species reported to have become less abundant are *Lates calcarifer* (Ka ka tit), Orecromis spp. (Tilapia), *Wallago attu* (Nga bat), *Channa striata* (Nga Yant), *Macrognathus zebrinus* (Nga mwe toe), Scatophagus Spp: (Nga

gyar ma), *Cyclocheilichthys apogon* (Nga khone ma), *Macrobranchium rosenbergii* (Pazun htoke), *Tenualosa ilisha* (Nga tha lauk), *Johnius belangerii* (Nga Poke Thin) and *Polynemus paradiseus* (Nga Pone Nar). Fish species that were reported to be caught regularly are *Mystus vittatus* (Nga Zin Yine). (Table 4).

Table 4. Summary of performance of each indicator

Indicator	Rank	Key point/highlight
Productivity and income	2	Although fish stocks are decreasing the price of wild fish is increasing. It provides a good income, in particular for the tender holder and sub-lessees. The fishers and retailers do not see themselves benefit from the increased fish prices.
Benefit sharing & equity	3	The sense whether benefit is fairly shared and equitable diverges. The tender holder and sub-lessees are seen to profit the most from the tender.
Access right	4	Only a few selected fishers are allowed to fish in the tender. Access to fishing is open during the flooding season when fence net fishing by holder and sub-lessees is stopped. Illegal fishing is widespread in the whole area, in particular in the waters adjacent to the tender.
Conservation	1	No conservation measures are in place. There is no closed fishing season and no fish fingerlings are being restocked.

4.1.6. Gender dimension

The tender holder and sub-lessee are all men and the decision regarding access to and fee are set by them. Similarly, all large-scale fishers are all men. Women and the poor were reported to be also active in fishing. Fishing is the main livelihood activity along with rice farming. However, there are more men than women engaged in fishing and those women mainly do small-scale fishing. Two parts of the fish value chain where women were prominent are fish collection and processing. Women were reported to benefit from providing causal labour during the fishing season for jobs such as preparing and mending fish nets, and processing dried shrimp and fish.

4.2. Dimensions of Strength and merits of the system

The strengths/merits of the current fisheries management system were assessed using the four dimensions of the PDAM framework. As can be seen in Figure 5 the assessment reveals that almost all of the strengths and merits were under the people and livelihood dimension, mainly mentioned by fishers and retailers. The tender holder & sub-lessee group identified somewhat high strengths and merits in people and livelihood but also in institution & governance. However, the average score for all groups together shows a much lower score for three dimensions – natural system, institution & government, and external factors.

The reasons behind much stronger merits for people & livelihood were due to the fact that many people have access to fishing and this contributed to local livelihood despite the widespread illegal fishing that was reported. The much lower score for the other three dimensions was due in part to limited institutional arrangements to manage the tender and associated waters, the decline in species and in fish catches, and lastly the impacts from illegal fishing and development along the shore (e.g. poison fishing, sea dike construction, and agricultural production).

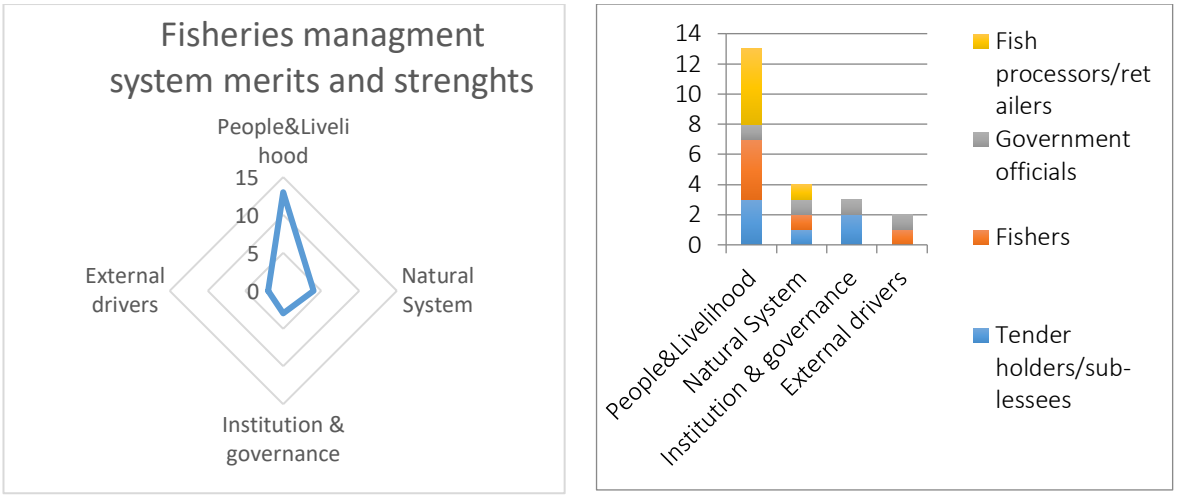

Figure 5. Strength and merits of the current management system

Tender holder & sub-lessees

Five main strengths identified by the group were better road connectivity, income, a more streamlined application process for bidding, relatively abundant fish and prawns, and a practical loan system adopted by fish collectors. This group stated that improved infrastructure in particular road and telecommunication has enabled a more reliable, cohesive, and strengthened capacity to manage the tender. The relatively abundant fish in the wider area in which the tender is situated provides access to fishing year-round in order to generate income. It is easier for contenders to bid for the tender at lower prices due to a more streamlined process by DoF. The group assumed that the paddy fields adjacent to the area may have provided spawning and feeding habitats for selected fish and prawns. Local fish collectors provided loans to local fishers at low interest rates and with arrangements that payments are made in catch. This allowed all local people to have access to fishing.

Fisher Group

As the price for the tender was low, the access fees charged by sub-lessees to fishers were also low. It was also identified as a potential reason why the holder and sub-lessees allow them to fish in the tender during the flooded season. As more people were able to fish, fish supply was high, which allowed fish collectors and retailers to buy fish at relatively low prices. This is said to have a feedback effect on the poor to be able to buy fish for consumption on local markets at low prices. This was also assumed to occur because of the relatively good system they have in place for accessing loans from fish collectors who accept that payment is made in fish at previously agreed prices. As the holder was a person from the local community there is a level of understanding and concessions were made to local poor fishers and thus there were less complaints made against the current holder of the tender.

Government official group

The government group identified the main strength of the individual tender as being the easy communication and relation with the holder to manage the tender. Speaking strictly of the tender the group appreciates the holder for following DoF's rules and regulations to control fishing in the tender, in terms of which gears were allowed. The group appreciated the holder for building a good relationship with local villagers and for allowing local people to fish and managing that relationship effectively through the segment holders. The relationship was said to help facilitate control of illegal

fishing in the tender. The tender was said to provide job opportunities to local villagers, not only in fishing but also in fish processing and related livelihood activities.

Fish processor & retailer group

The processors & retailers stated the current tender management allowed more fishers to fish. This was said to provide a good fish supply, with diverse fish species. This allowed consumers to make their own choices, in particular between October and January. Due to high supplies, everyone involved in the fresh fish value chain, particularly consumers, had access to fish at low prices in and around their village. The agreement between fishers and retailers to get paid only after the catch is sold opens a very good opportunity for retailers to do the business without having to invest a large capital in their business. Although fishing is not full-time here, only 12 days a month, this was seen as a good opportunity for people who have other livelihood activities to supplement their income. Nearby villages did not have fish retailers, therefore retailers from this area can cover a large geographic area. (Table 5).

Table 5. Merits and strengths common to more than 1 stakeholder groups

Merits/Strengths	Common to Groups	Description
Wider access to fishing for local villagers	Tender holder/ sub-lessee, Fisher group, retailers/processors	Limited expenses for the auction, low fishing fees charged by tender holder, lower prior investment needed, and open access in flooding season allow many villagers to fish in the tender. A larger fishing ground is just in the adjacent area.
Good loan system in place	Tender holder/ sub-lessee, fisher group, retailers/processors	Inter-dependence between fishers and retailers to get loans and fish without having to make upfront investment is win-win for all.
Good communication and relationship between holder and local villagers	Tender holder/ sub-lessee, Fisher group, Government, retailers/processors	The current tender holder is a local person who allows local fishers to access his area in the flood season and allows special treatment for the poor.
High demand for fish and fish products	Tender holder/ sub-lessee, fisher group, retailers/processors	There is high demand for fish products locally and in the city. Locally the price is low, but the advantage there are no retailers at nearby villages and the price and demand in big city are high.

4.3. Dimension of issues - weaknesses and constraints

Most of the identified constraints and weaknesses of the current fisheries management fall under the livelihood dimension of the framework. Prevalent illegal fishing including electrofishing and fish poisoning was reported by almost all groups. This is understood by the stakeholders to have strong implication on livelihoods rather than it being an issue under external factors. Since the tender is simply a narrow strip along the shore, the impression was more about the associated waters. It is there where there were complaints on fishing grounds overlapping between large-scale and small-scale fishers. Large-scale fishers used large mobile gears to run over the small-scale fishing gears causing damages and losses to the latter. No compensation can be claimed against the large-scale fishers who caused the damage.

Although high market demand for fish was reported as a merit and strength in the previous section this wasn't always the case. When fish catches were delivered late during the day, the fish had to be kept for the following day before it could be sold and this caused a decline in quality. The fish collectors/ retailors complained that they didn't earn enough in the flood season when the fence net weren't operated. The tender proper was said to offer opportunities for income generation only for a few people, whether in fishing, fish collection or processing.

On institution & governance there were no reports of monitoring or law enforcement by DoF like before and this was blamed as the cause for the widespread illegal fishing. While collaboration among local fishers, tender holder, and local villagers was noted as a strength it is also noted as a weakness. Not all fishers and local villagers reported illegal fishing activities to the tender holder or local authorities. This was partly due to confusion about when and where restrictions would be in place. There seemed to be strong law enforcement in the tender during the fence net fishing and then no restrictions in the flood season. For the open waters next to the tender illegal fishing is reported as being the norm, in any season.

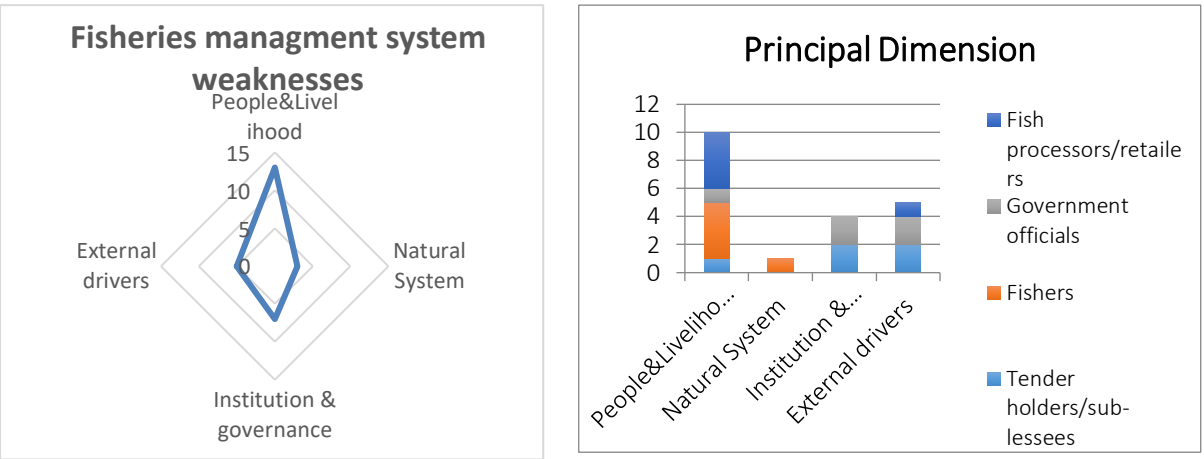

Figure 6. Constraints and weaknesses of the current fisheries management system

Tender holder and sub-lessees

The main issues that were identified were prevalent illegal fishing, increasing competition for the tender, lack of support in deterring illegal fishing from DoF, and the continued degradation of the natural system. Poison fishing and electrofishing have been reported to occur in particular in the open waters next to the tender but also in the tender outside of the fence net fishing season. Poaching was reported to occur mainly at night in particular in areas where fence nets are operated. It was reported to be hard to trace as this equipment is easily concealed and the method is very effective and efficient in getting fish in a very short time.

While there were reports on lower administration costs for auctions as the bidding process is more streamlined there were also reports of more competition and higher floor prices for the tender due to increasing number of interested bidders. This information somewhat contradicted that from other sources and the records on auction prices. There were reports of spot checks in the past by DoF and illegal fishers were reported to be fined by DoF officials. No such field activities are being carried out

by DoF now due to reported limited manpower and resources available to the department. The group identified sedimentation and climate change impacts to have been altering the natural system and affecting the yield for the tender in addition to direct anthropogenic impacts.

Fisher group

The main constraint reported by fishers was the decline in fish catch and species diversity. Increasing fishing effort in general, both offshore and inshore exerted increasing pressure on fish populations. This meant that bigger fish with longer reproduction cycles, and higher commercial value were overfished. This was noted to be a result partly of inappropriate disposal of plastic waste. There were overlaps in fishing grounds and power imbalances between large-scale and small-scale fishers. Although open waters next to the tender are open to fishing for everyone, large-scale gears should not be operated in these shallow waters. People do it anyway because there was a lack of enforcement and there was no mechanism in place to bring both parties to a negotiation table and no compensation was paid for the damages caused to small-scale fishers.

Another issue was the degradation of fish habitats both in the inter-tidal zone and elsewhere in open waters. Large-scale fishing operations in shallow waters damage bottom habitats. Cutting and clearing of mangrove forests occur in certain places, for fuelwood and for local development such as sea dikes, irrigation channel and rice paddy. People were better informed about the role mangroves can play after this area was hit by typhoon Nargis in 2008. Small fishers are normally the poorest sector of the society and they find it hard to afford more costly fishing gears. They are practically the most disadvantaged group.

Government officials

Local government officials saw a number of constraints in the fisheries including a decline in catch overall, the nature of current illegal fishing making it hard to curtail, weak collaboration among fishers and local villagers, and limited job opportunity available to small fishers.

Similar to the previous stakeholder group this group mentioned the volume of catch was declining, particularly for large species with high commercial value. This was reported to be linked to sophisticated illegal fishing methods and practices, and the lack of effective law enforcement. The group acknowledged that current illegal practices need closer collaboration from all relevant stakeholder groups if they are to be effectively curtailed. The tender holder alone can hardly protect the tender area, let alone the much larger open waters nearby where many fishing activities take place. Other challenges were the weak collaboration among stakeholder groups, the involvement of local villages in illegal fishing activities, and the lack of reporting by local villagers to the appropriate authorities. The current fishing methods, more sophisticated and effective, were hard to detect, particularly when operated at night. Trammel net is one of the very effective methods, but also harmful to fish population as it catches fish of all species and size. This method was seen to be used together with side fence nets within the tender. Electrofishing and poisoning are even more destructive. These methods can be operated with very few people in a very short time, and are hard to notice.

Fish processors & retailers

The fish processors & retailers noticed a decline in fish stocks due to overfishing offshore and illegal fishing along the Pyapon River using poison. This group argued that investments in fish collection requires relatively high capital, at least MMK 0.5 million so not many people can do it. Even when there is a high market demand for fish, the fishing cycle is not always good for collectors & retailers.

When catch is delivered late during the day fish will have to be kept for the following day before it can be sold leading to a degradation in and reduced sale prices. Fence net fishing depends very much on the tidal cycle. During any month of the fishing season low tide lasts only 6 or 7 days when fishing is productive. Fish retailers cannot depend on collecting and retailing fish as their sole livelihood. In addition, no fish is collected between April and August as no fence net fishing is undertaken. It is a long gap in time, during which fish collectors have to engage in alternative activities in order to survive.

In summary the constraints common across stakeholders are presented in Table 6. They were a decline in fish catch that affects income and livelihood of both fishers and retailers, and the weak law enforcement by all relevant stakeholder groups. The group of tender holder & sub-lessees reported more severe competition for the tender. However, information from DoF shows a declining auction price of the tender. Although the three non-government groups noted low marginal profits and high investment cost, it appears, according to one the interviewed tender holders, that the rise in fish prices led to higher profits than in the past. There was also anecdotal evidence that the contenders in the auction tend to know each other and they agreed not to submit their bid until the last call is made by DoF when the floor price is set to the minimum price.

Table 6. Constraints common to more than 1 stakeholder groups

Constraints and weaknesses	Common to Groups	Description
Decline in fish catch	Tender holder & sub-lessee, government officials and fish collectors	Fish stocks are decreasing because of overfishing, destructive fishing practices, and habitat degradation
Weak law enforcement	Tender holder & sub-lessee, fishers and government officials	This was due to limited resources and manpower for DoF. The large numbers of fishers also led to conflicts between large- and small-scale fishers, and to the current prevalence of illegal fishing practices.
High investment needed compared to marginal profits	Tender holder & sub-lessee, fishers and fish collectors	This is due to stronger competition for the tender, higher fish prices were only reported for large fish species, high costs of fishing gears, and fish collection and retailing is not viable as a full time occupation.

4.4. Interaction between constraints

Constraints have been categorised under the four dimensions of the PDAM framework: (i) Livelihood; (ii) institutional/Governance; (iii) External Drivers; and (iv) Natural system (Figure 7). Results of the workshop indicated that most issues are related to livelihood (i) small-scale fishers and retailers have derived less profits from the fishery. Investment costs for fishing have increased, in particular for small-scale fishers and thus there are limited opportunities for diversification in the sector. Too many people continued to depend on the sector, whether they are fishing or collecting and reailing fish. For the 'institutional and governance' dimension (ii), there was an issue that regulations were only enforced within the tender, representing only a part of a much larger body of water. This created a situation that discouraged control of illegal fishing activities. Overfishing and destructive practices had been identified as the main problem within the area, and high market demand for fish both in the nearby communities and in big city continued to drive increasing fishing pressure (iii). The natural system (iv) was faced habitat loss, degradation and fragmentation due to paddy farming, cutting

mangroves for charcoal, and construction of sea dikes. These factors and non-sustainable fishing practices contributed to fish stock decline, in particular for large, high-value species.

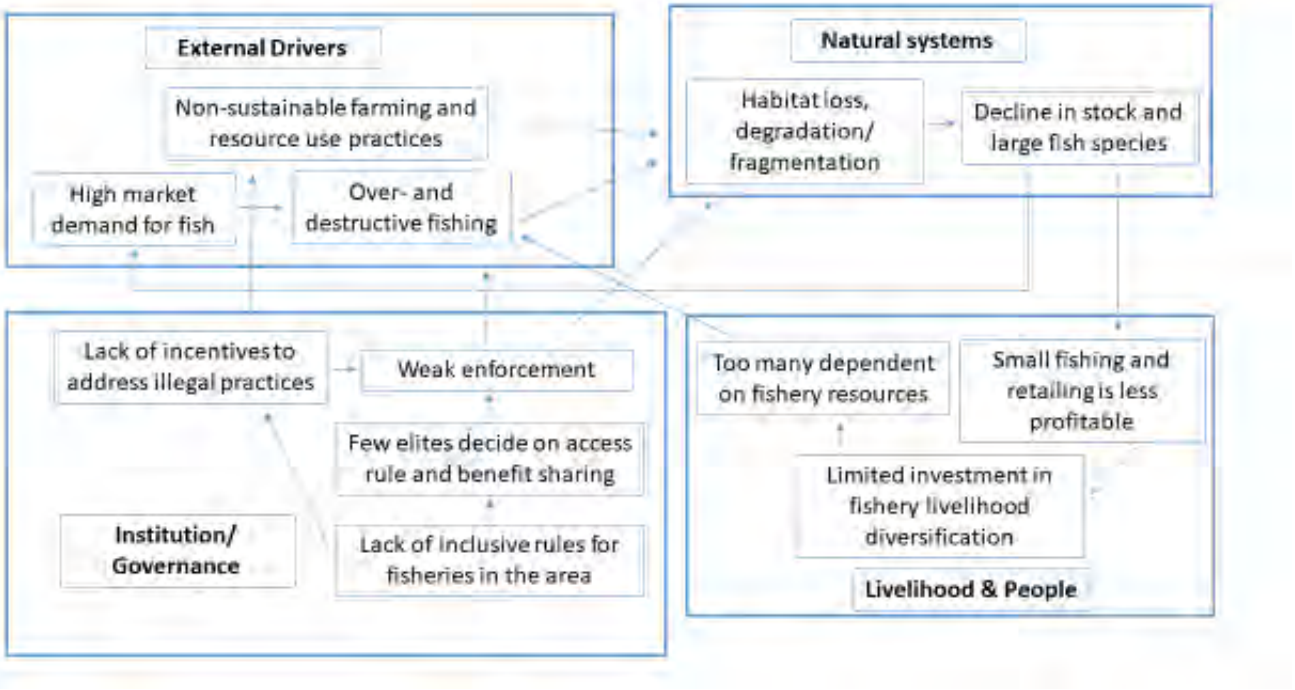

Figure 7. Framework of interaction between constraints

4.5. Entry points for improvement of the management system

According to the interaction of constraints the main entry points for improvement of the governance should be provision of policy support for inclusive management of the tender and nearby waters so that management of the tender doesn't operate in isolation. The current management system was appreciated by local fishers and since no CFG has ever been established in the past the current tender holding system could be expanded and used to manage fisheries in larger area. However, rules should be agreed upon in a participatory manner to promote voluntary compliance and reduce violations, while also promoting a more equitable access to fishing and benefit sharing and protection of fisheries resources. Proceeds coming out of the tender should be partly reinvested for better resource protection and improvement of local livelihoods.

4.5.1. Constraints that can be solved at local and higher level

The respondents thought that as high as 70% of the constraints they identified can be solved at the village or township level (Figure 8). These include: illegal fishing activities (electro and poison); poaching; issue of decreasing catches; difficult access to the fishing area by small-scale fishers due to high investment costs for fishing gears; overlap of fishing grounds between large- and small-scale fishers, and lack of compensation for the damage caused to small fishers; weak collaboration of fishers and local communities; low market demand for fish in times when fish are caught late in the day.

For higher level interventions, the constraints mentioned include policy support for sustainable practices in agriculture, shoreline development; improving capacity and authority to enforce regulations; technical support from the government for livelihood diversification, and improvement of the fish value chain; and financial support to small-scale fishers.

For some issues or constraints, a number of different stakeholder groups had the same perspective on how it can be solved, however for other issues stakeholder groups disagree on which level the solutions are found. For example, stakeholders had the same opinions about the need for higher-level policies to address development of paddy fields and dikes along the shoreline. However, the tender holder and sub-lessee group found it hard to control illegal fishing without support from higher level government institutions due to the nature and prevalence of illegal fishing activities, in particular during the off season from fence net fishing and in the adjacent waters in general. The fisher group and others had different opinions on how to manage rules and enforcement at the local level.

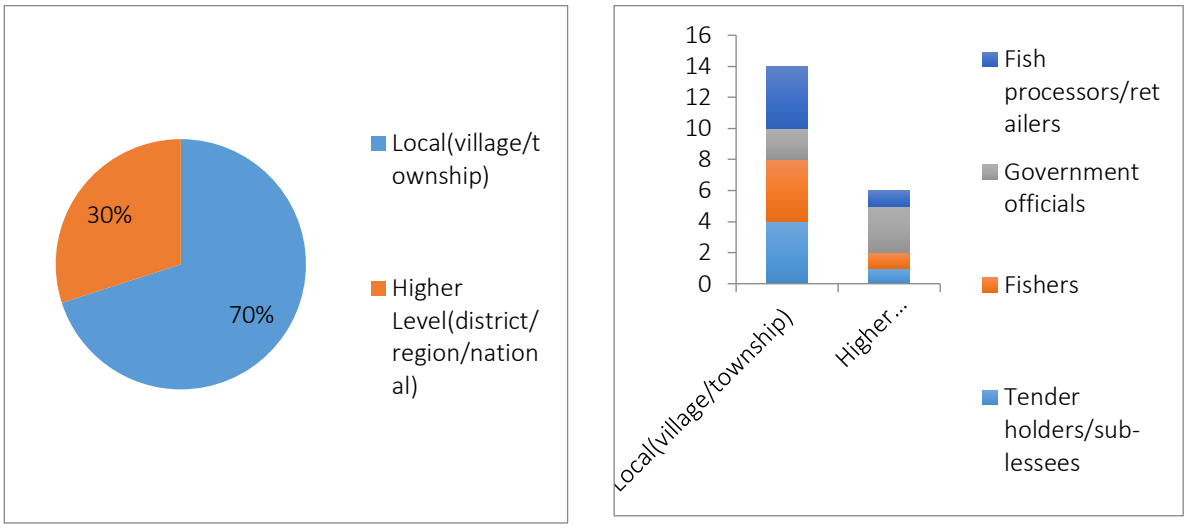

Figure 8. Administrative level where constraints can be solved

4.5.2. Constraints that can be solved by stakeholders

The respondents assessed which stakeholders were best suited to address specific weaknesses/constraints identified during the discussion. More than half (57%) of all weaknesses/constraints are thought to be solvable through cooperation of different stakeholders at the local level, while 43% could be solved by joining with other stakeholders rather then by their group alone (Figure 9).

- The tender holder/sub-lessees thought that illegal fishing activities, poaching and enforcement of regulations can be solved through collaboration with others. The group thinks it can address issue of high competition for the tender at high price through collaboration with other stakeholders.
- The fishers' group thinks that they can address the issue of lower catches and poor fish diversity by themselves by deploying appropriate gears at different times, but mentioned that the group needs to collaborate with other to address the issue of overlapping fishing grounds, compensation for damages caused by large-scale fishers, and loss or degradation of fish habitats.
- The local government group agreed with the tender holder group that the current pattern of illegal fishing is difficult to control by the tender holder alone and required collaboration from other groups. The group stated it can take lead in facilitating collaboration of different local stakeholders.
- The retailers and collectors, thought that the issues can be solved either within their group or through collaboration with other stakeholders. The constraints that can be addressed within

the group are: improve access of small-scale fishers to loans, improve fishers' access to markets; lower demand for fish products when fish are caught late in the day; and, flexibility for a limited number of fishers having access to the tender.

Results of the workshop reflected the knowledge, attitudes, and decisions of each stakeholder group. It was observed that fishers had limited knowledge about how to respond to the questions in the consultation process, their negotiating power with fish collectors when applying for loans and selling their fish to make repayment. The opportunity to access loans from the fish collector or allowing fishers to settle repayments through fish sales were appreciated by fishers. However, fishers also complained that by doing this the collectors make higher profits, which was deemed unfair to them. Overall, fishers tend to appreciate the broader access to fishing activities, but at the same time they complained that there are too many fishers and many of them used illegal fishing practices.

The fishers had no knowledge of fisheries policies or the practice of CFG management and they praised the current individual management system although they acknowledged the widespread illegal fishing and declining production trend.

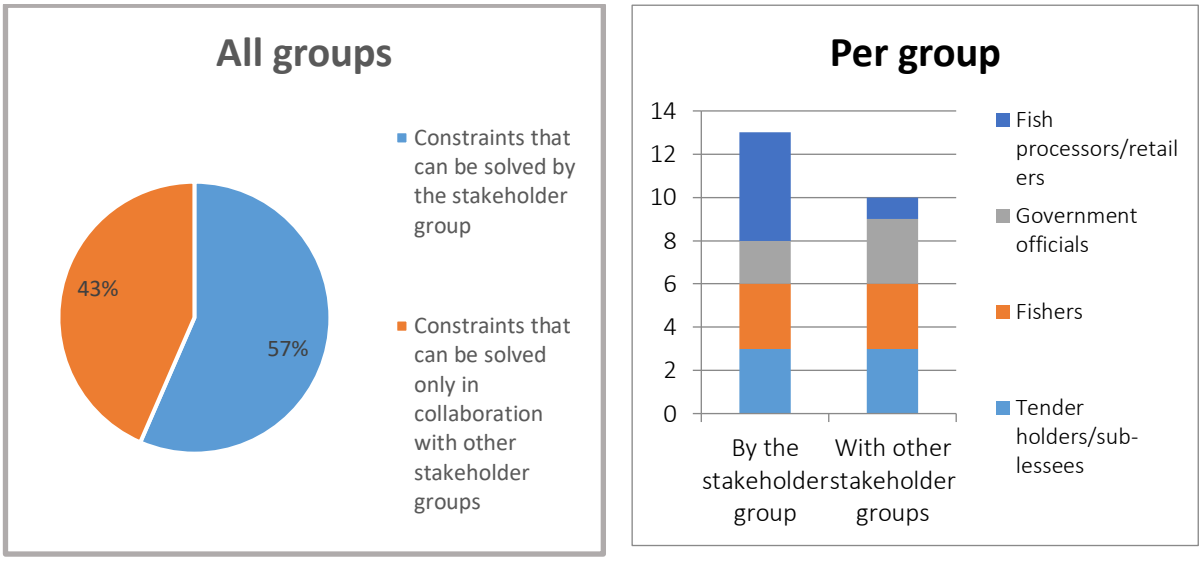

Figure 9. Stakeholders that can solved the constraints

5. Discussion

5.1. Specific entry point at the Fishery management level

Government to provide for a management approach that builds on the current tender holding as a tool to manage fisheries in wider waters of the area. The current tender is only a narrow strip of habitats along the shore managed and fished only during a certain period of the year, resulting certain periods of the year and certain areas largely under illegal and in fact unregulated fishing. To be effective in managing fishing in the larger area frequent staff deployment by DoF would be needed. The resource required for such an operation would be larger than the revenue generated by the tender. Weighing off the cost of losing fishery resources due to illegal and unregulated fishing, the cost of enforcement by DoF, and revenue from the tender, it is proposed that it would be wiser to apply the current tender system to a wider area under the form of contractual arrangements.

Building a participatory fishery management with current tender management system. For the area, there is neither past experience with a participatory approach to fishery management nor have any community fisher groups been established. Some fishers strongly support the current management system, citing positive responses by the tender holder and sub-lessees to plights of the poor small-

scale fishers and their ability to manage the tender. By requiring the current tender management to adhere to participatory planning and decision-making principles, and making the management accountable to both the local community and the DoF it should be possible to safeguard fisheries in the area beyond the tender.

Rationalising existing loans provided by fish collector/retailer so that poor fishers can also access them. There is a fairly effective scheme in practice between fish collectors and small fishers in taking out loans and repaying them. However, this scheme is not uniformly applied by these groups as the transaction can be more or less strict depending on personal or historical relationships. There are also cases in which fishers were said to have broken the agreed terms for repayment by selling their catch to a different collector who offered them a better deal. Rationalising and formalising the scheme would not only give a fairer and more secure deal to both parties and but improve access to loans for more small-scale fishers.

Diversifying livelihood opportunities for local fishers. Most local villagers engage both in paddy faming and fishing as their main livelihood occupations. Few local fishers are engaged as wage labourers for certain fisheries-related tasks. Although paddy farming absorbs a significant amount of wage labour (between 50% and 70% of households), many found themselves without work to maintain their income. It is therefore important to look into opportunities to diversify local livelihoods as this would keep them busy and discourage them from fishing illegally. Part of the initiative is to look into promoting the fish value chain in particular during the season when it is difficult to sell fresh fish as it arrives late in the day.

5.2. Generic entry point at the higher level

Government provision of a policy for integrated development among competing interests, e.g., fishing and agriculture. Degradation of mangrove habitats was attributed by stakeholders to the paddy field development, construction of sea walls and harvesting of mangroves for firewood. A policy should be in place to prevent further land use development along shore that may result in more mangrove losses. Provision of the policy would be important to ensure sustainable development and preventing the shore from eroding but also to provide safeguards against saltwater intrusion and typhoons, like the one in 2008.

Awareness campaigns to rehabilitate/replant mangroves for fisheries and storm protection. Increasing human settlement was reported along the shore. Awareness campaigns on rehabilitating or replanting mangrove forests will not only help restore mangrove habitats for fish but also provide a barrier against coastal erosion and storms.

Rationalising between roles for revenue generation and a function to safeguard for fisheries in the area surrounding the tender. Fisheries are one of the most important sources of revenue to the national economy but in order for the revenue stream to be sustainable there is a need to protect fisheries from overfishing and destructive practices. Considerations will have to be made and policy needs to be developed looking into using the tender approach to safeguarding coastal fisheries in general. (Table 7).

Table 7. Summary of generic and specific entry points

Entry Points	Description	Issue addressed
Generic		
Rationalise between role of revenue generation and of safeguarding fisheries in	It will not be sustainable to manage and protect only the tender while not regulating and enforcing rules in the larger coastal area. Deploying DoF staff	Provision of a coastal fisheries policy to engage tender holders in safeguarding fishing areas.

the area surrounding the tender	may not be efficient. Engaging the current tender holders to enforce the coastal fishery regulations.	
Awareness campaigns to rehabilitate/replant mangrove as fish habitat and for storm protection.	Raising awareness will be essential to engage local villagers to protect and rehabilitate mangroves that provide fish habitats and act as a barrier against coastal erosion and storms.	Awareness raising campaign on mangrove protection and rehabilitation
Government provision of a policy for integrated development among competing interest, e.g., fishing and agriculture	The current paddy field area, irrigation infrastructure, and sea dikes would expand, thus a policy to harmonise different sectors through an integrated land use planning approach is needed.	Provision of integrated coastal development policy
Specific		
Government to provide for a management approach that builds on the current tender holding as a tool to manage fisheries in the wider area	A policy should be in place to provide for capacity strengthening of the current tender system to enable protection of fisheries in the wider area.	Policy instrument that enables the current system to protect fisheries in a wider area
Building in participatory fishery management within current tender management system	Capacity building including technical and institutional capacity, to enable the tender holder, sub-lessees and a group of local fishers to patrol and enforce fishery regulations	Relevant capacity development provided to relevant stakeholder groups
Rationalise existing loan system provided by fish collector/retailer so poor fishers also have access.	Consultation and formalisation of current loan scheme to enable a fairer and wider access in order to include poor small-scale fishers	A guideline provided to formalising current loan system
Diversifying livelihood opportunities for local fishers.	Financial resources and vocational training provided to realise the potential in the area.	Interest-free loans and vocational training provided.

6. Conclusion

Pa Zun tender is managed by a local individual who had many years of experience as a sub-lessee in one of the segments of the tender. The tender is divided into three segments, two of them are sub-leased to other local fishers and one segment is under direct management by the holder. The main fishing gear used is a fence net. The main species caught with this gear are are freshwater prawn, seabass, and *Wallago attu*. It was reported catches have declined threefold in the last 3 to 5 years.

This assessment affirms a definitive performance in terms of income provision income and limited job opportunities in the fisheries sector. A shift from an outsider to a local person managing the lease has been reported to lead to improved access among local fishers. This was seen by some as improved access and equity in resource sharing and benefit from the fisheries. The equity markedly favoured the tender holder and sub-lessees. The holder claimed to have benefited more from increased fish prices but small-scale fishers and retailers argued they suffered a loss of income as they do not deal with commercially valuable species. In addition, fishers also argued that holders and sub-lessees earn from payments made by fishers and collectors, by buying their fish below market price and through

repayment of loans provided to fishers. While fishers affirmed a good performance in terms of access to the tender/resources and markets, they are disadvantaged compared to the tender holder/sub-lessees because of these conditions imposed on access and where to sell their catch.

There are also the issues of increasing numbers of fishers and increasing illegal fishing by non-selected fishers which results in lower incomes for the other fishers and collectors. Some fishers complained they could not repay their loan in one year due declining income. The small-scale fishers suffered losses or damages to their gears without receiving compensation as they fished outside the tender where large scale fishing gears are also operated. There were reports of collaboration among the candidates for the auction. They agreed to not submit a bid until the last call when the price is set the lowest.

The natural system has deteriorated as evidenced by lower catches and lower biodiversity. The factors contributing to this were the agriculture and irrigation sectors. Loss and fragmentation of habitats due to dike construction and mangrove cutting were reported to affect fish spawning areas and water flows.

The individual tender system has some merits, mainly in ensuring livelihood to the fishers operating in the tender. However, this was in contrast to the absolute control by the tender holder on fisher-selection, payment for access, fish price, and the lack of empowerment of fishers, as seen in their inability to bid themselves as they lacked capital and were not engaged in resource management. The responses tended to show low performances in law enforcement and conservation. The main constraints were the decreasing catch and price control by tender holder. On a deeper view, the system favoured mainly the tender holder and his sub-lessees who dominate the system. The broader segment of stakeholders among fishers, retailers/collectors, women, and local communities as a whole were disadvantaged despite the fact that some flexibility was provided by the tender holder and sub-lessees to poor small-scale fishers.

The issue of illegal fishing is mainly due to a lack of regulation and enforcement, in particular in the waters next to the tender. Even if improvements would be made to the tender management it wouldn't make much sense if the larger fisheries area is not included management in place.

To ensure a meaningful management of the fisheries the tender management should apply fisheries management in the adjacent waters. The current system should aim to include and empower local fishers in order to work together to regulate and enforce regulations over the larger area beyond the tender.

Characterisation of Fisheries Management Systems in AD and CDZ

MYFISH 2

Case Study 9 Report

(Community managed Lease)

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AD	Ayeyarwady Delta
CDZ	Central Dry Zone
CSO	Civil Society Organization
DoF	Department of Fisheries
FAO	Food and Agriculture Organization
FDA	Fishery Development Association
FG	Fishers' Group
FGD	Focus Group Discussion
HH	Household
KII	Key Informant Interview
NGO	Non-government Organization
PDAM	Participatory Diagnosis Adaptive Management
RAAIS	Rapid Appraisal of Agricultural Innovation System
USD	United State Dollar
WF	WorldFish

Note:

Currency Exchange rate: 1 USD =1,346 Burmese Kyat

Weight Conversion: 1 Viss = 1.6 kilogram

1. Objective of the study

The aim of this case study is to generate an "in-depth" understanding of the individually managed lease system in Kyauk Se Township (Central Dry Zone), with a focus on identifying major issues and potential entry points to address them. Hence the specific objectives are as follows:

- Assess the performance of the Individual Lease system based on agro-ecological, social, and institutional environments in Sun Ye Village tract, Kyauk Se; and
- Identify key issues and opportunities for interventions to improve the performance of this fisheries management system in the area.

2. Methodology

This case study documented the individually managed lease fisheries management systems based on its current performance, strengths/merits, and weaknesses/constraints using both quantitative and qualitative indicators. The final output was the identification of entry points both at the local and higher levels to achieve a sustainable capture fishery in the area. The selected case study was located in Ah paung Village tract, Pyapon Township. The site is under an individual lease management system since 2008, and has had the same owner since 2013. The information and data used in the analysis were collected both from primary and secondary data sources.

Review of Secondary data

A matrix was developed to compile existing information about the site, fisheries and type of management in the target area. The information gathered to complete the matrix was sourced from census, FAO assessment, MYFish 1 fishery survey, MYFish 2 Component 2 and other available information from DoF District, Township and Region.

The Analytical Framework

The proposed analytical framework is adapted from the Rapid Appraisal of Agricultural Innovation Systems (RAAIS). RAAIS is a diagnostic tool originally developed for the agricultural sector and allowing the analysis of agricultural issues from broad entry theme towards more specific entry points for productivity, natural resource management, social development, and institution al innovation. We propose to combine RAAIS with another theoretical framework tailored to the identification of fisheries management issues: the Participatory Diagnosis Adaptive Management (PDAM). We combine these two frameworks by adopting the four radar issues of PDAM as the four analytical dimensions to be investigated by RAIIS. These dimensions are elaborated in Box 1 bellow.

Box 1: PDMA dimensions – Definitions and Indicators

People & Livelihoods: the socio-economic aspects of the fisheries communities that encompass household wellbeing, which include household income, household diversification of livelihoods, household fish consumption, living conditions, norms, culture and household assets. It also can include conflict with other users and resource use.
Indicators: Living conditions; diversification/income dependence; assets and income poverty.

Natural system: the biological classification of yield, biodiversity and sustainability of the fisheries resources and ecosystem, its stock status and trends (total catch, total catch by species, fishing effort, catch by unit effort, and number of species), fishing practices, and aquatic ecosystem condition, such as connectivity, breeding ground, pollution from upstream, agriculture, industry.
Indicators: Biodiversity; stock status and trends; fishing practices; aquatic ecosystem condition.

Institution s & governance: the manner in which a power is executed in the management of the fisheries sector. It is the enabling environment aspect in governing the fisheries management to its sustainability (legitimacy, membership rules, access rights, management controls, representation rules, sanctions, enabling legislation/policies/legal framework, local support, financial management and services, access to market, organizational and institution al capabilities.
Indicators: Fishing and development policies; organizational and institution al capabilities; access to markets and financial services; collective action abilities; governance performance and rights; legal frameworks.

External drivers: Outside influences that can impact the fisheries resources and its ecosystem. Various external factors can impact the ability of the fisheries to achieve its productivity/biodiversity and sustainability. These external factors might include infrastructure development, macroeconomic instability, climate change and environmental uncertainty, migration, market demand changes, price fluctuation, land use changes, migration.
Indicators: Infrastructure development; conflicts with other sectors or users.

The resulting framework relies on multiple methods of data collection, building on existing experiences with rapid appraisal approaches and (participatory) innovation systems analysis. Our investigation generate both qualitative and quantitative data; facilitates 'insider' and 'outsider' analysis; targets different stakeholder groups across different levels with individual, group and multi-stakeholder perceptions on weaknesses/constraints and solutions; and provide sufficient detail on the main weaknesses/constraints under review, the innovation capacity in the fishery management system and the functioning of the fishery management system.

Methodological steps

Based on RAAIS tool, the following main stages were conducted to assess the existing fisheries management systems based on the context of each site: (i) identifying strengths/merits, and weaknesses/constraints; (ii) categorizing strengths/merits, and weaknesses/constraints; and (iii) exploring specific and generic entry points for recommendations for the current fisheries management system for equitable and sustainable fisheries. The objectives, sessions and activities of each stage are presented in detail in Annex 4. The following research steps were conducted in Sun Ye Village over the course of 2 days to gather a broad range of information from relevant stakeholders. The participatory assessment of the fisheries management system was facilitated by a research team of 7 members (incl. 3 WorldFish staff and 4 DoF staff).

The multi-stakeholder workshop represented the first step of the research and focused mainly on 'insider' analyses of the fisheries management system. A total of 19 stakeholders were invited and convened in four groups (figure 1), namely Lease main fishers (i.e. person in charge of the lease management, member of the CFG committee), Secondary fishers (i.e. common fishers operating in the lease either full- or part-time), Government and institutions (i.e. village head, village tract head, DOF officers) and Private sector (i.e. Farmers, aquaculture farmers, retailers, collectors, lotus fibre processors). Those stakeholder groups where represented equally, and one quarter of participants were women. The workshop offered an opportunity for each group to assess the overall performance of the fisheries management system and identify associated strengths and constraints. As such, this first step provided entry points for the next two steps of the study.

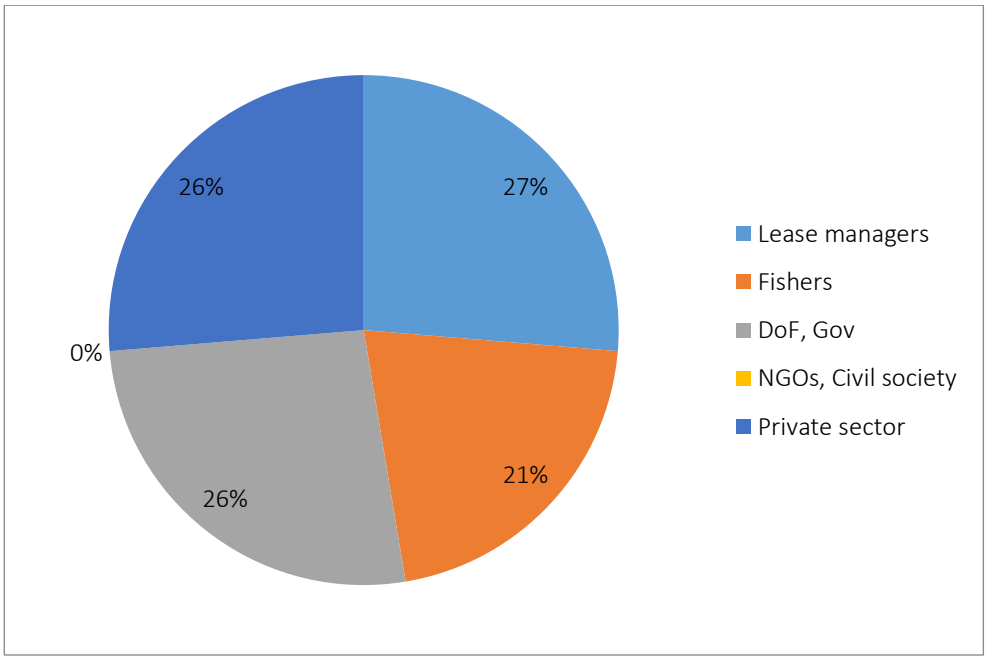


Figure 1: Participants proportion

The workshop was followed by targeting Key Informant Interviews (KIIs), and Focus Group Discussions (FGDs). These consisted of conversations with respectively one and multiple stakeholders of importance as identified during the workshop. These were used to gain in-depth insight on the information gathered during the multi-stakeholder workshop and understand the perspectives of and dynamics between different groups on the existing fisheries management system in the area. Three KIIs and two FGDs were held in total. The KIIs and the FGDs were held with stakeholders who had participated in the multi-stakeholder workshop (i.e. Lease manager, Private sector), and extended to 'outsiders' (i.e. fish retailers, fish collector, and small business owners). All discussions revolved around the strengths and constraints identified by the different stakeholder groups during the workshop.

Workshop group (Photo© Romain Langeard)

All together, a total of 22 respondents contributed to the information gathering during three days of field data collection (4 – 5 February 2019) at Sun Ye village, Kyauk Se Township. Each group presented a similar number of respondents participating in data collection, the absence of CSOs and NGOs explains the non-participation of this stakeholder in the case study. A detailed list stakeholders participating in the different methodological steps is provided in Table 1.

Methodological steps	Stakeholders groups targeted – Sample size					
	Lease managers	fishers	Government Officials	NGOs/CSOs	Private sector	TOTAL
Multi-stakeholder Worksop	5	4	5		5	19
Key Informant Interview	1				1	2
Focus Group Discussion		1				1
Secondary data	N/A	N/A	N/A	N/A	N/A	
TOTAL	6	5	5	0	6	22

Table 1: Summary of data collection methods and participants

3. Study site

3.1. Background information

Figure 2: Map of the Ah Paung Lease

The study site is located within Kyauk Se village track, at 45 km South of Mandalay. The lease area is a lake of 1460 Acre of 2800 meters East/West on 2400 meters North/South. It is directly connected to a large river upstream and an extended area of agricultural farming downstream, which explains why it is mostly used as a water reservoir for farming activities. There are 6 main villages on the shore, of which three villages are involve in fishing activities: Inn Kone village, Kyok Kone village, and Sun Ye village.

Area (km2)	6 km2 (1460 Acre)
Demographic	Inn Kone: pop=1050, HH=180, Fishers=120, Lotus plucker =60 Kyok Kone: pop=800, HH=180, Fishers=7, Lotus pluckers=12 Sun Ye South: pop=1076, HH=220, Fishers=3 Sun Ye North: pop=666, HH=120 Ywar Thit: pop=916, HH=200 Kado: pop=2021, HH=370
# of fishers	130
# of others	70 Lotus pickers, 98% of farmers out of over 6000 population
Start Date of this lease management	1988
Date of this kind of management (individual or community based)	2017
Lease price	No more auctions, last auction in 2007 at 1036600 ks
Peak fishing season	October to November for fishing, March to November for lotus picking.
Low fishing season	December to January

Table 2: Lease general information

3.2. Fisheries System

3.2.1. Natural system and fishing techniques

The Sun Ye lease is a large lake connected to a large river upstream, surrounded by agricultural farms especially in the North and South - and mountains in the northwest and east. One of the peculiarities of this lease is its large size, and its abundant production of lotus across the whole lake. Its high productivity is even more unique since it is located in the CDZ at about 1h (45 km) from Mandalay city. It is important to note the presence of water control gates, proof of its primary use as a water reservoir for the surrounding farms.

This lease is accessible from Mandalay by the main road Mandalay – Kyauk Se, and then by a small road going east before reaching Kyauk Se city. The area is mostly devoted to farming activities with some industrial infrastructure along the smaller road. The lease has a high diversity of aquatic plants - … Lotus … - and a average depth of … meters.

Picture

The high season for fishing is from October to November – with average catches around 1 viss/day/fisherman – and the low season is from December to January – with average catches of 0.2 Viss/day/fisherman. Fishing activities in both seasons are mainly carried out with the gill nets, and small fish and shrimp traps. Longlines are used but less commonly, only by 10 fishers. The mains species targeted are tilapia, fetherback, snakehead, small shrimp and other small fish species. In terms of revenue, the CFG collect around 40 Viss/day in the high season and 14 Viss/day in the low season which represents around 1/3rd to 1/4th of total catches, amounting to 16 650 000 ks per year. Based on this calculation, the average revenue of a fisherman will be around 277 500 ks/year. The 80 lotus pickers are mostly women and their high season is from March to November. Their income is estimated at 3 ticale/day at 2600 ks/tical, meaning they earn around 7800 ks/day. The fishing seasons are not submitted to any closure period and the fishing period are based solely on the productivity of the lease depending on the natural conditions, mostly to the water level. Low water levels drastically reduce the productivity of the lease in terms of fish abundance.

3.2.2. Former fisheries management and changes over the time

This lease has been put in place in 1988 by the formal government, has been taken back by the ministry of Science & Technology in 2007, and was put under a collaborative management between the Science & Technology department and a private company in 2012, and then finally moved under the current community management system in 2017. The changes to the management system in place are summarised in table 3.

Year	Actor in charge of the management	Management main lines

1988 - 2007	Individual owner	At this time, the lease was auctioned by the DOF to an individual owner. The access to the lease was open, but all catches had to be sold to the lease owner (buying at a low price and resold locally at a higher price)
2007 - 2012	Department of Science & Technology	The Department of Science & Technology took control for experimental purposes, but the management system and access rights stayed the same in addition to restocking activities.
2012 - 2017	Department of Science & Technology with individual owner	The management stayed the same, political pressure seems to have pushed this sharing management. In 2016, during the NLD election, some members of the party collaborated with the lease owner (private owner) and started the idea of a "village fund" to support development in the area.
2017 - present	Community management	In 2017, the department of Science & Technology decided to transfer the lease (in addition to 2000 acre of unexploited forest) under the DOF, but the DOF did not want to handle the lease management (no more auctions had taken place since many years) and transferred it to the Department of General Administration, who then handed it over to the CFG committee which is elected at the township level. The elected CFG leader is the previous individual owner who has a lot of experience in lease management. He has been freely elected by local actors and is now following the community management directive from the administration and allows open access for fishers and distribution of benefits through the "village fund". The CFG expects the government institutions to decide who will be in charge of the lease.

Table 3: Past evolutions and events

The major evolutions in the management of the lease do not lay in its access rules – it always has been working as an open access fishing area – but in the benefit sharing and the removal of the auction system in 2007 (see table 3). It is important to note that under the new management system, the number of fishermen increased drastically (from 30 fishers five years ago to over 120 now). This seems to be due to the increased benefits derived from fishing under the current arrangement.

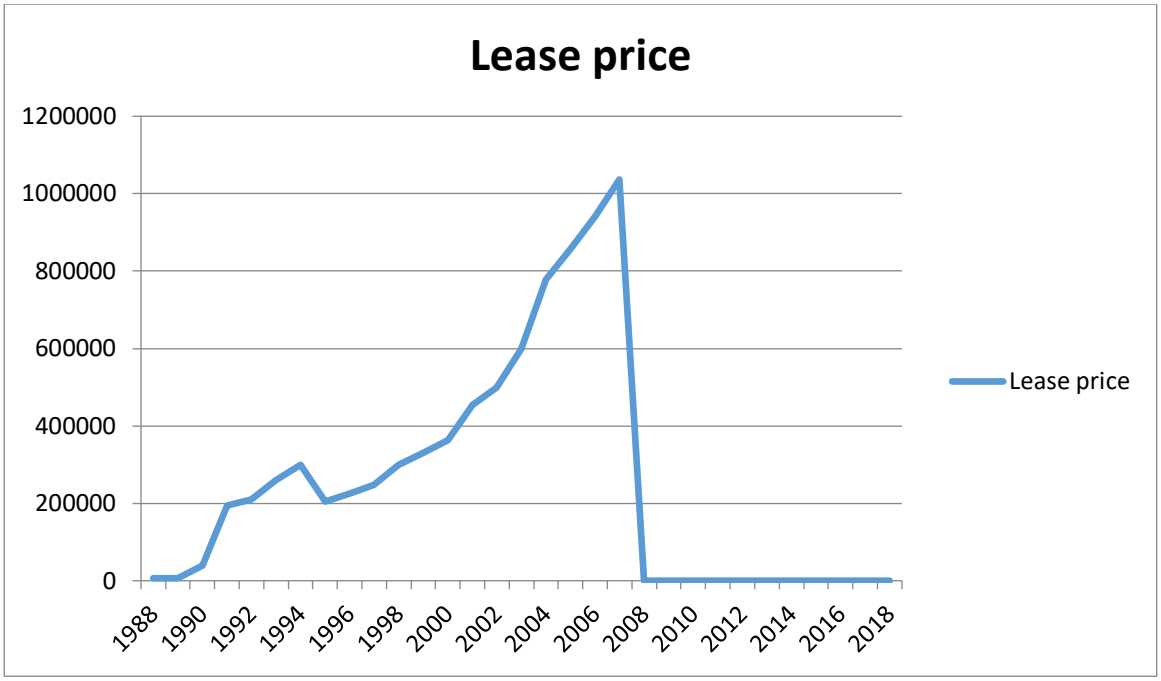


Figure 3: Price evolution

The institutions and people in charge were initially treating this lease as a source of profit (for individual businesses or for the government) until it was placed under community management, as a result of political pressure, to ensure benefits are shared within the local community. This is probably the reason why it is complicated now to find out which institution will be in charge of it as there no more auctions to be managed.

There was a switch from restricted sales opportunities - exclusively to the lease owner or institution in charge - toward a partial selling obligation to the institution in charge, and a real repartition of benefits to benefit the development of local villages. This is mostly due establishment of a "village fund" under the CFG management, and strict control of landing sites.

Regarding the lease productivity, it seems to be relatively stable. There has been a small reduction in the past years due to the reduction of stocking activities – around three time less than before– under the CFG management compared to the previous management. In the past five years, the abundance of some species like *Wallago attu*, small gourami, and shrimp decreased, while the abundance of tilapia increased strongly increased and stabilised total fish stocks.

The local market price evolved to reflect global changes in the value of fish products over the past 5 years, as illustrated in Table 4.

Species	5 years ago (ks per viss)	In 2018 (ks per viss)
Rohu	1000	3000-3500
Tilapia	1000	3000-3500
Snakehead	2000	4000-5000
Small shrimp	1500	3000-4000

Table 4: Local market price evolution in the past five years

3.2.3. Current organization and management

Since 2007, the management of the lease has placed under a CFG committee at township and village level. The previous manager of the lease (under the individual and then the consecutive government management systems) has been elected as the CFG leader alongside the 12 other committee members from the 6 villages in the area.

This CFG committee manages the lease on behalf of the institution in charge – currently not identified since 2007 – and fixes the rules and regulations. The main roles of this committee are to ensure compliance with the rules by local actors, to put in place management measures like the fishing period, reduction of illegal fishing activities, and manage "village fund" activities.

The majority of fish are sold locally in and around Kyauk Se market, one part by the CFG and the other part by fishermen through two retailer groups of four individuals who takes turns selling fish.

Access management

The lease is open to anyone who wants to fish as long as they pay the DOF the necessary license fees and comply to the local regulations.

The CFG is monitoring catches at the authorised landing sites, where each fisherman has to sell between 1/3 to ¼ of their catches -most of the time they sell the less valuable small fish rather than larger ones. The rest of the catch is then sold or consumed by the fishers directly.

The CFG purchases the fish at a low price (half the market price) and resells it at the current market prices. The profit they make is re-invested to cover management expenditures: three daily patrols, mostly at night, to control illegal fishing activities, and the "village fund". This fund supports the local development such as funding construction of school buildings, football pitches, operating ambulances and upgrading roads.

The only restrictions lay in a daily-defined fishing times in two sessions, one in the morning from 5:30am to 11am and one in the afternoon from 2:30pm to 6pm. This is mostly due to the necessity to have CFG members monitoring catches at the landing sites. The only closed period is during the water festival, once again due to the absence of CFG members making the monitoring of catches at the landing site complicated.

Beside this, all the usual local regulations are in place: destructive fishing methods are forbidden under community management – like electrofishing and use of poison – and conservation of spawning grounds.

Meetings take place monthly place to inform the local community – not only fishermen but all villagers – about the latest activities, productivity of the lease and the latest and planned activities for the "village fund". It is important to note that, even if there is no equal representation of genders within the CFG, women are actively involved in the dialogue.

Illegal fishing

It is globally accepted that the open access status of this lease and the arrangement for benefit distribution are the main factors that keep prevalence of illegal fishing level low in the area.

The major illegal activities conducted in the lease are fishing outside of the authorised time slots (mostly at night time, accordingly to interviewed stakeholders, and not by local villagers), illegal landing of fish catches (in order to avoid the mandatory sale of part of it to the CFG at a low price), illegal fishing practices (some electric fishing, poisoning in the small creeks and harpooning).

It seems that the illegal fishing activities increased slightly under the current management system compared to the previous one. The main reason mentioned by local actors is the lack regulations enforcement. Before, the lease management could count on the government support and had much more night patrols, but now the cost has to be fully supported by the CFG. Those illegal activities don't seem to threaten the productivity of the lease, but they impact the CFG benefits -and thereby also the "village fund"- and the management capacity.

Opinion on the management

The large majority of local actors thinks the current management allows a very fair sharing of benefits and would like to keep it this way. Indeed, the benefits have not only benefited the fishing community but all villagers through to the "village fund". It supported a monastery, school, ambulances, football pitches, and road repairs. On the fishers' side, it is clear that the benefits increased since the new management authorised individual sale, making fishing more attractive and pushing some individuals to invest more in it.

Few points have been raised regarding potential improvement and concerned mostly reducing illegal fishing activities and ensuring sustainability of the natural system. It is agreed that the actual management has less power than the previous actors to control the illegal activities. Additionally it was pointed out that some individuals who fish illegally because of limited access to loans, so they cannot afford legal fishing gears. The "Village fund" doesn't have sufficient capital to provide loans at beneficial rates. Hence the population has to turn toward other organisations with higher interest rates (around 1,5% for Sahtapana, Mya Kyun Thar, World vision, Hamen associations).

In addition, several management measures could be put in place to support the sustainability of the lease. The major concerns raised are related to decreasing water levels in the lease and water use by the agricultural sector, the natural sedimentation and proliferation of algae, and the low capacity of the CFG for restocking measures. It seems to the local actors that a better collaboration with the local institution in place could help address these concerns. It would be possible to receive support from the DOF for restocking –they already help with it, but much less than before- and in controlling sedimentation/algae. Also, involvement of MOALI in facilitating dialogue with the agricultural sector on water use in intensive agricultural activities could be a good entry point.

External conflicts

The degree of external conflicts seems very low in the lease, the only tension points that could be identified are illegal fishing activities and water use by other sectors in the surrounding area. Illegal fishing activities seem to be conducted mostly by villagers who are outside the lease area, which are not involved in the CFG and the "Village fund".

The major livelihoods in the area are agricultural and farming activities. Only around 2% of the surrounding population is involved in fishing full-time. Historically, this lease has been used as a water reservoir for farming activities, but it seems that the intensification of the sector is starting to have an impact on the water level and therefore the productivity of the lease. Some The use of water control gates, under the management of the agricultural sector and the MOALI, seems to crystallize those tensions.

4. Results

4.1. Strengths and merits of the management system

During the workshop, participants were asked to elaborate on what they identified as the most important positive changes brought on by the new management system. Below a summary of these views are presented by stakeholder group before proposing a summary of the strengths that are common across stakeholder groups.

Lease managers

The lease managers group was composed of the CFG leader – who was the person previously in charge under old management systems and other local leaders elected at village and township level. They agreed that the major strengths of the current management system lies in its high contribution to local livelihoods. This seems to be possible thanks to a fair and respected management in place, real measure of benefits sharing (trough the village fund for example), and stock conservation practices. It is globally acknowledged that the equity of access and benefits sharing is key to respecting the management measures and sustaining high levels of productivity.

Fishers

According to this group, the major strengths of this management system are its general equity, in access as well as in benefit sharing. Under this management system, fishing became a reliable source of income for the local population year-round (this probably explains the increasing number of full-time fishers over the past few years). This lease has a high productivity, a continuous access to fish products, and potential for livelihood diversification (e.g. lotus or algae cultivation, tourism).

Government officials:

The government and officials' group was represented by DOF officers and local village leaders. Regarding the major merits of this management system they align with the others groups and believe that the decentralised management under the CFG allowed an increase of equity and

local income. In addition to this, the open access regulation allows reduce destructive fishing practices which in turn preserves natural resources. Additionally, repartition of the benefits from the village fund raised the accessibility of the area and allowed business development, having direct benefits on the local population.

NGOs and CSOs

This group was not represented in the area and was not mentioned by any of the interviewed stakeholders.

Private sector:

This group, composed mostly of fish collectors and lotus pickers, stated the main strengths are good market access, and a healthy natural system with little pollution and good water circulation. In addition to this, they agree with the others group and consider the equitable sharing of benefits a main strength, as it contributes to local food security.

Merits and strength	Groups	Description
Management equity	Lease managers, Fishers, government officials, Private sector	The lease management system is perceived as highly equitable in terms of access and benefit sharing by all the stakeholders interviewed. This is mostly due to the inclusive approach of the CFG management with an open access area and redistribution of the benefits collected from the fishermen through the "village fund". The management committee is an elected body and the decisions are taken jointly with the local communities, there is a real transparency in the process which encourages compliance with the regulations put in place.
Livelihood support	Lease managers, Fishers, government officials, Private sector	The lease management with its collection system is ensuring sustainable revenue for the fishermen. The fact that there are no closure periods is making fishing a very reliable source of income, especially for retailers who can guarantee a continuous supply to larger export markets. In addition to this, the conservation practices regarding aquatic vegetation allows for a diversification of activities towards lotus picking or tourism.
Lease natural sustainability	Lease managers, Fishers, government officials, Private sector	It is agreed among stakeholders that the natural environment of this lease is in good health. The high water level provides good productivity during the rainy season. The CFG does restocking once a year which stabilises fish global stocks, and good water circulation free of pollution is beneficial to both the fishing and the farming communities, thereby reducing potential conflicts.
Benefits falls out in the area	Lease managers, government officials	Another merit mentioned by several actors regarding this lease management is its capacity of bring positive results for the surrounding area (and not only for the fishing community). With the "village fund" funded by the CFG profits, the whole population in the area benefit from of the high productivity of the lease. Construction of a school has reduced out-migration, repairing the roads favours local businesses, and purchasing an ambulance increased the quality of locally available healthcare.

Table 5: Main merits and strength of this management system

4.2. Weaknesses and constraints of the management system

Similarly, participants were asked to identify the most important constraints and challenges brought on by the new management system. A summary of the assessment made by each stakeholder group is presented below before proposing a summary of those challenges that are common across stakeholder groups.

Lease managers

This group identified the major weaknesses of the system to be a lack of CFG strength. Even if the CFG committee is composed of several elected members across the different communities (17 members), their involvement in the lease management is very weak (only 5 members seem active). Another point is the weak funding of the CFG which doesn't enable enough supporting services like loans or a large restocking scheme. The last point that was mentioned in the discussion was the pollution of the lease with plastic coming from small businesses and tourist activities in the surroundings and the lacking awareness raising activities on this topic by the CFG. Another important constraint identified by this group is the fluctuation of the water level in the lease, especially in summer, which impacts the productivity of the lease. An overall decrease in water level is locally seen as a bad thing.

Fishers

The Fishers group agree with the Lease managers that the stocking activity conducted by the CFG is not sufficient, and that the water level fluctuation due to pumping water for surrounding farming activities are major weaknesses of the system. In addition to this, it is mentioned that sedimentation and water turbidity is increasing, which then reduces natural productivity. The last point raised as a major weakness was the lack of conservation practices, like protected areas or species size regulations. Indeed, besides the fixed daily fishing slots (mostly for a tax collection purpose rather than for a conservation one) and the ban on destructive fishing methods, the CFG did not put in place more measures.

Government officials:

On the government and official institutions' side, concerns regarding the reduction in water level due to sedimentation are shared with other stakeholder groups. According to this group, sedimentation is caused by a lack of digging activities by the CFG (while the CFG reports that they are waiting for assistance from the government). The other major weaknesses identified by this group are linked to the CFG management, which seems not to be involved enough in controlling both pollution in the lease and the high numbers of fishers (access is not restrictive enough), and less frequent restocking than before (Five million fingerlings now as compared to 25 million before). The reason for the low restocking seems to be due to a lack of funding on the CFG side.

NGOs and CSOs

This group was not present in the area and was not mentioned by any of the stakeholders interviewed.

Private sector:

This group stated the main constraint is the lack of contribution by fishers to the CFG fund ("village fund") by wrongly weighting their catches and illegal fishing activities (fishing outside of the allotted times). The lotus pickers side mentioned the main constraint in their sector is the fact that lotus harvesting isn't possible during the rainy season, due to the seasonal availability of lotus plants.

Constraints & challenges	Groups	Description
Water level and quality reduction	Lease managers, Fishers, Government	This constraint was mentioned as being the major weakness of this system. This seems to be due to several factors, natural ones such as the sedimentation or climate change, but also due to management factors like a lack of digging actions and pumping water for farming activities.
CFG capacities	Lease managers, Fishers, Government, Private sector	Rather than the CFG management system, it is the CFG's capacity which is the main challenge. It is seen in the low involvement in lease management by some of the committee, which lowers the overall CFG capacity to regulate illegal fishing. Some actors like the government feel access to the lease is not restrictive enough, while the private sector feels the fishers do not contribute adequately to the CFG fund. The CFG's inability to provide local loans due to a lack of funds was mentioned as a weakness by several groups. In addition to those challenges it was mentioned that the CFG might not communicate enough with local actors.
Low restocking capacity	Lease managers, Fishers, Government	This challenge is linked to the previous one, the restocking level conducted by the CFG seems to be too low to maintain the productivity in the lease. Under the previous management system where restocking was done five times as much, but the CFG does not have the financial capacity to do so.
Plastic pollution	Lease managers, Government	Both lease managers and the government group are concerned that plastic pollution around the lease is increasing and damages the natural system. The government would like the CFG to put in place some trash collecting system across the villages, while the CFG feels it doesn't have sufficient funds to conduct local awareness raising campaigns.
Lotus fibre seasonality	Private sector	This was mentioned only by the lotus fibre collectors, but it seems to be an important challenge to the sector. The seasonal availability of lotus plants doesn't allow for fibre collection all year long.

Table 6: Constraints & challenges of this management system

4.3. Performances of the management system

Participants were invited to reflect on the performances of the management systems along the four dimensions of the PDAM (see Box 1), considering on one hand the current performance (i.e. evolution of key indicators over the past 5 years) and on the other hand

future performance under current management conditions (i.e. inferring on the trend of these key indicators over the next 5 years). The results of this assessment are presented and discussed below (also in ANNEX 1 and ANNEX 2).

4.3.1. View by stakeholders

Lease main fishers

This group was composed of the CFG leader, some CFG committee members, and some local leaders like village heads and village tract heads. Overall, they scored the current performance of the management system medium across the different dimensions, with a better performance in ***people & livelihood***. They expect that the performance will remain stable for the ***people & livelihood dimension***, to reduce slightly for the ***Natural system*** and to improve slightly for the ***External drivers*** and improve significantly for the ***Institution & governance*** dimensions. (Figure 4).

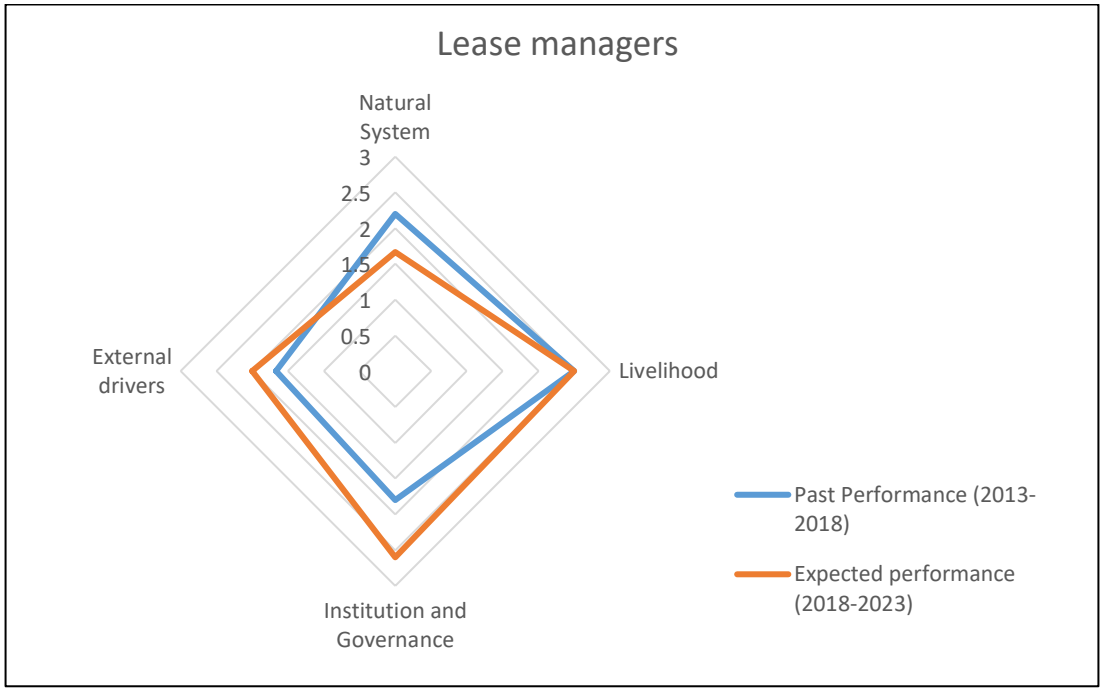


Figure 4: Performances view by the Lease managers group

The expected decrease in the performance under the ***Natural system*** dimension seems to be due to the expected reduction in productivity and the incapability of the CFG to halt the decreasing water level (the natural causes are outside the scope of the local community, but water use by other sectors could be a working topic with support from the government acting as facilitator between the fishing community and the farming sector). The ***people & livelihood*** performances increased in the years under CFG management, especially thanks to a broader access to the lease and a more equitable benefits sharing for fishers, who are now able to sell more than 75% of their catch to whom they please. This is expected to remain the same under the CFG management in the coming years. Due to the more open access arrangement,

increased market access and possibilities, and a spillover of benefits into the whole community the ***Institution & governance*** system performance increased under the CFG and is expected to keep increasing in the coming years. The only concerns lies in the weak CFG capacity to enforce regulations. Finally, the ***External drivers*** dimension's performance increased under CFG management, and is expected to get better as a result of the upcoming awareness raising campaign against plastic waste, and infrastructure development through the "village fund". Only the low financial power of the CFG gives rise to low expectations regarding control of illegal fishing activities.

Secondary fishers

This group was composed of different actors who fish in the lease. They scored the performance of the past management system as low for the ***Natural system*** and ***External drivers*** dimensions, medium for the ***People & livelihood*** dimension, and good for the ***Institution & governance*** dimension. They expect the performance under the ***people & livelihood*** dimension increase significantly good in the future, and performances for the other dimensions to remain the same, albeit with a slight improvement for the ***Natural system*** dimension. (Figure 5).

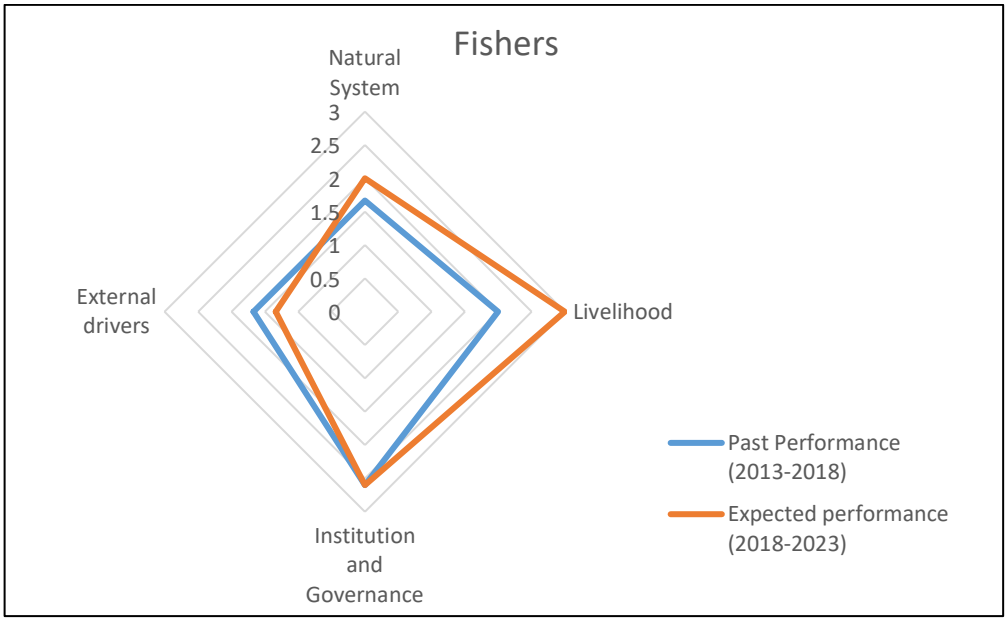


Figure 5: Performances view by the Fishers group

The mediocre performance of the ***Natural system*** dimension seems to be linked to the small decrease in productivity over the past few years, which is related to the observed decrease in water level. This is compensated by a good conservation of fish habitats (with proliferation of seaweed and lotus). The expected increase in the performance is driven by the potential involvement of the Government in the lease management to support to the CFG with restocking and regulation activities, but it hasn't been decided yet. The current medium score and expected high score for ***People & livelihood*** is related to improved benefit sharing and better fish prices under CFG management. It is expected to keep increasing, even more when the Government would get involved in restocking activities once again. The stability if

performance for the ***Institution & governance*** dimension seems related to a good overall performance in market access and resource access, and expected improvements in regulation enforcement and access to financial services. The only dimension that is expected to have a decrease in performance is the ***External drivers***, which is due to increasing impacts of climate change (reducing the size of the lease) and low CFG capacity to control illegal fishing.

Government and local institutions:

On the government side – group composed of DOF officers, village heads and village tract heads – the stated the system is performing well for the ***Institution & governance*** and the ***People & livelihood*** dimensions. On the other side, the performances for the ***Natural system*** and ***External drivers*** dimensions were scored low (Figure 6).

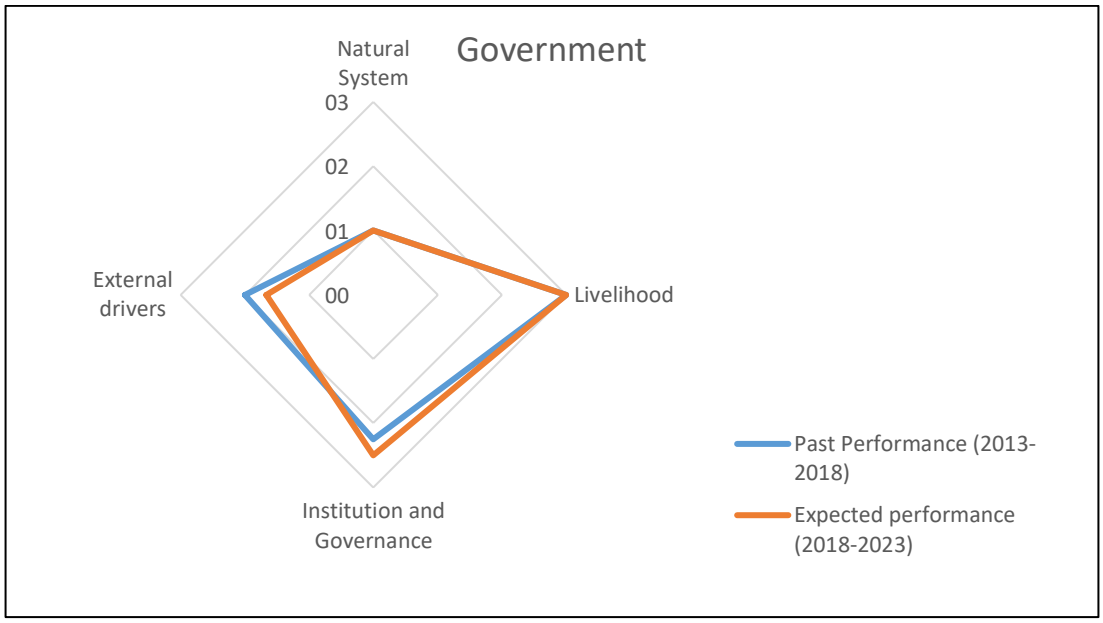


Figure 6: Performances view by the Government group

The particularity of this group's expectations is that they think the performances will remain the same in the future for all dimensions except ***External drivers***, for which they expect a slight decrease. This decrease seems to be related to the difficulty for the CFG to control illegal fishing practices compared to the previous management systems where more funding was available. The very high scores – past and expected –for the ***People & livelihood*** dimension are related to stable income and food access. The good performances of the ***Institution & governance*** dimension seem to be linked to the increase in resource sharing and access, which compensates for the decrease of this new system's capacity in enforcing regulations and policies. The very low score for the ***Natural system*** dimension seems to be related to decline in fish resources combined with sedimentation, which in turn lowers the water level. It seems that the government group considers the CFG to be responsible for the dredging activities required to maintain a good water level.

Private sector:

This group – composed of retailers and lotus collectors – is the most optimistic regarding the performance of this management system. They consider the four dimensions to be performing well or very well, and expect them to perform even better in the coming years (Figure 7).

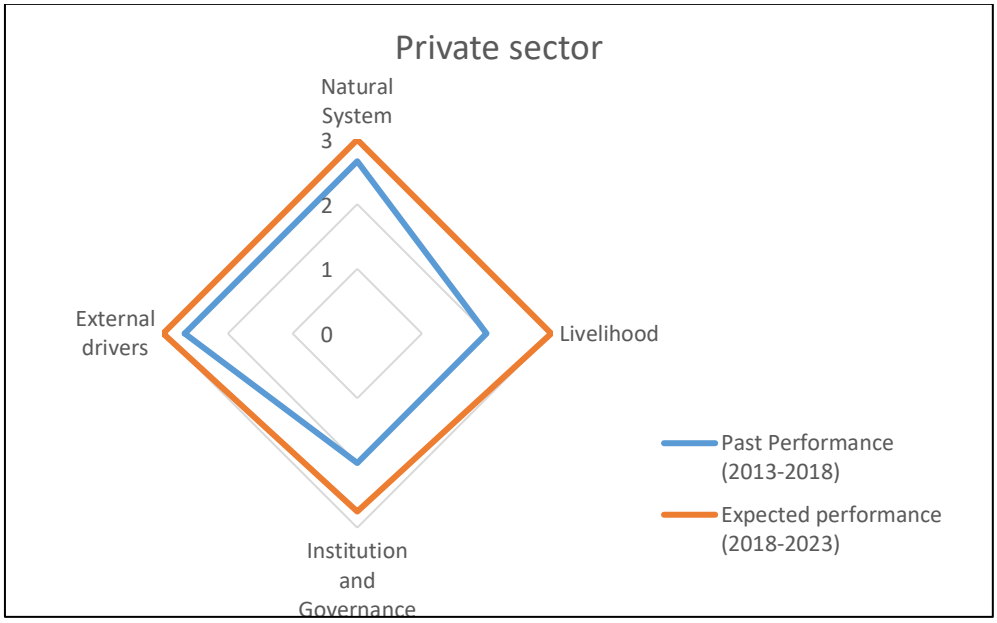


Figure 7: Performances view by the Private sector group

The ***Natural system*** dimension performance seems to be related to the high productivity and biodiversity of the lease. In addition to this, the increasing tilapia population will raise lease productivity in the future. The past good and expected increased performance for the ***Institution & governance*** dimension lies in the potential increase in access to financial services through develpment of local infrastructure, continued improvement in resources conservation through the participatory CFG approach, and a fair distribution of resources and benefits. The ***People & livelihood*** good and expected great performances are driven by a constant increase in incomes, and food security. Regarding the performance for the ***External drivers*** dimension , even if regulations regarding illegal fishing regulation are weaker under the new management system, this group believes that the fairness of resources sharing will lead to a decrease in illegal fishing activities coupled with an increase in income. In addition, improvement in local infrastructure development and environmental conservation will compensate for lower performances.

NGOs and CSOs

This type of actors were not present in the area, and there were no Civil society activities connected to the lease mentioned during our study.

4.3.2. View shared across the stakeholder groups

Performance of the current management system was determined primarily on the perceptions of four types of stakeholders who participated in the multi-stakeholder workshops. The PDAM framework was used to assess the performance based on the four dimensions: ***Natural system***, ***People & livelihood***, ***Governance & institution s*** and ***External drivers*** (Figure 8).

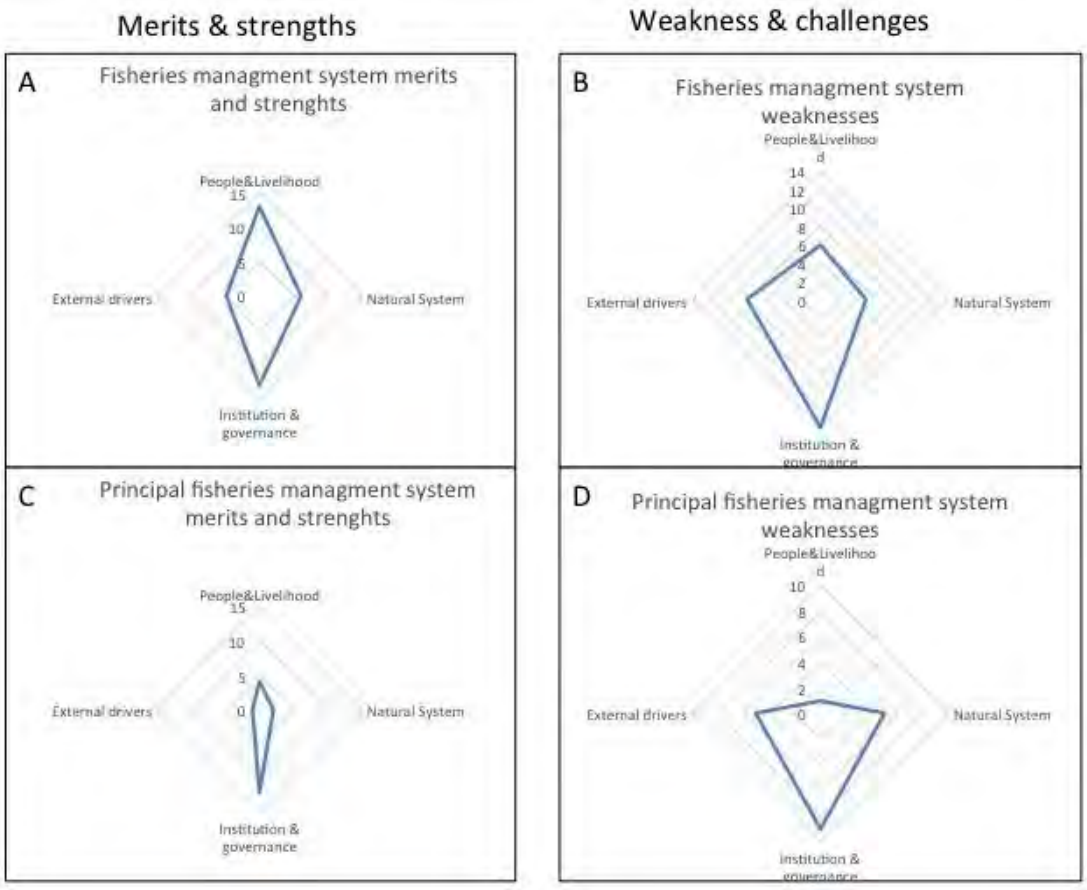


Figure 8: Metris and strengths compare to the constraints and challenges

It is clear that the according to the different stakeholders' main merits & strengths are found under the ***people & livelihood*** and ***Institutional & governance*** dimensions (Figure 8: A and C), while the weaknesses & challenges are found under the ***Institutional & governance, Natural system*** and ***External drivers*** dimensions (Figure 8: B and D)

This ambivalence for the scores attributed to the ***Institution & governance*** dimension can be explained by the fact that –according to the local actors –the CFG management system has less financial resources and therefore is less able to control the lease, reduce illegal fishing, and enforce the regulation as well as the previous management. This is linked to the weaknesses seen in the ***External drivers*** and ***Natural system*** dimensions. At the same time, it is this same management that strengthens the ***People & livelihood*** dimension through a fair benefits and lease access system.

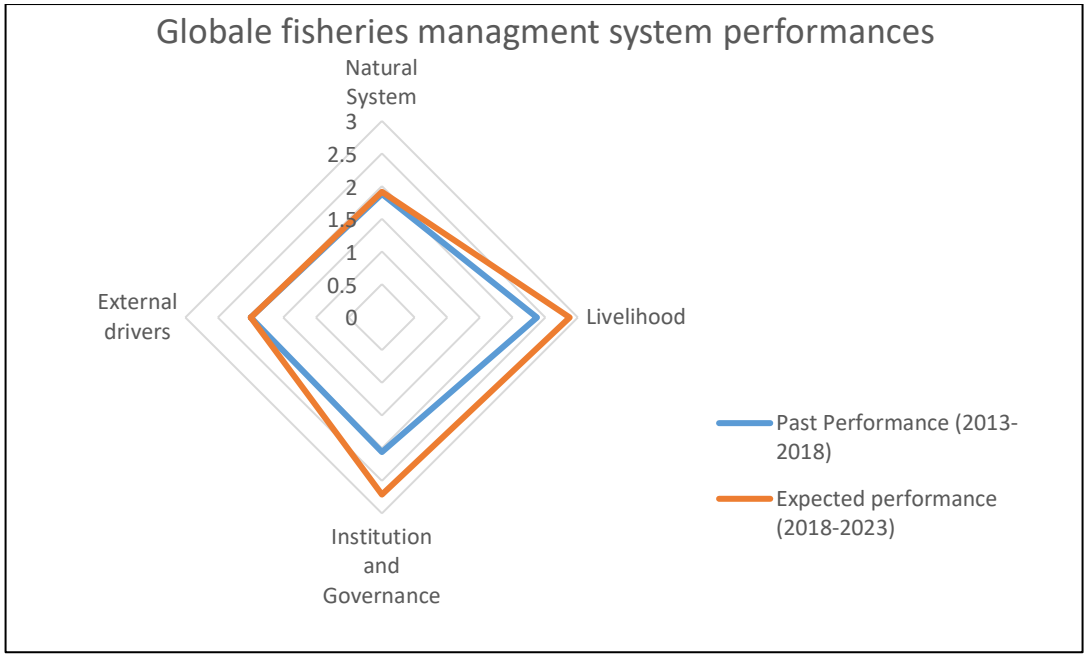


Figure 9: Summary of the strength shared across the stakeholder groups and the four dimensions

Overall, participants consistently reported a past and expected medium good performance of the system for the ***Natural system*** and ***External drivers*** dimensions (Figure 9). The positive side of it seems to be the good natural productivity of the lease, boosted by the fast growth of the tilapia population, strong management of external pressures like illegal fishing, and an abundant water supply reducing inter-sectorial conflicts. The expected stagnation of performance of those two components could be linked to a decreased control of illegal fishing control despite positive expectations for local infrastructure development. On the other hand, the overall participant's perception of the ***People & livelihood*** and ***Institution & governance*** performances are good, and are expected to improve in the future. This is related to the expected improvement of income and food security under the new management system, and the expected overall improvement in all performance indicators under the ***Institution & governance*** dimension. Observed performances regarding market access, access to financial services and resources are expected to increase, as well as the capacity for policy and regulation enforcement (Figure 10).

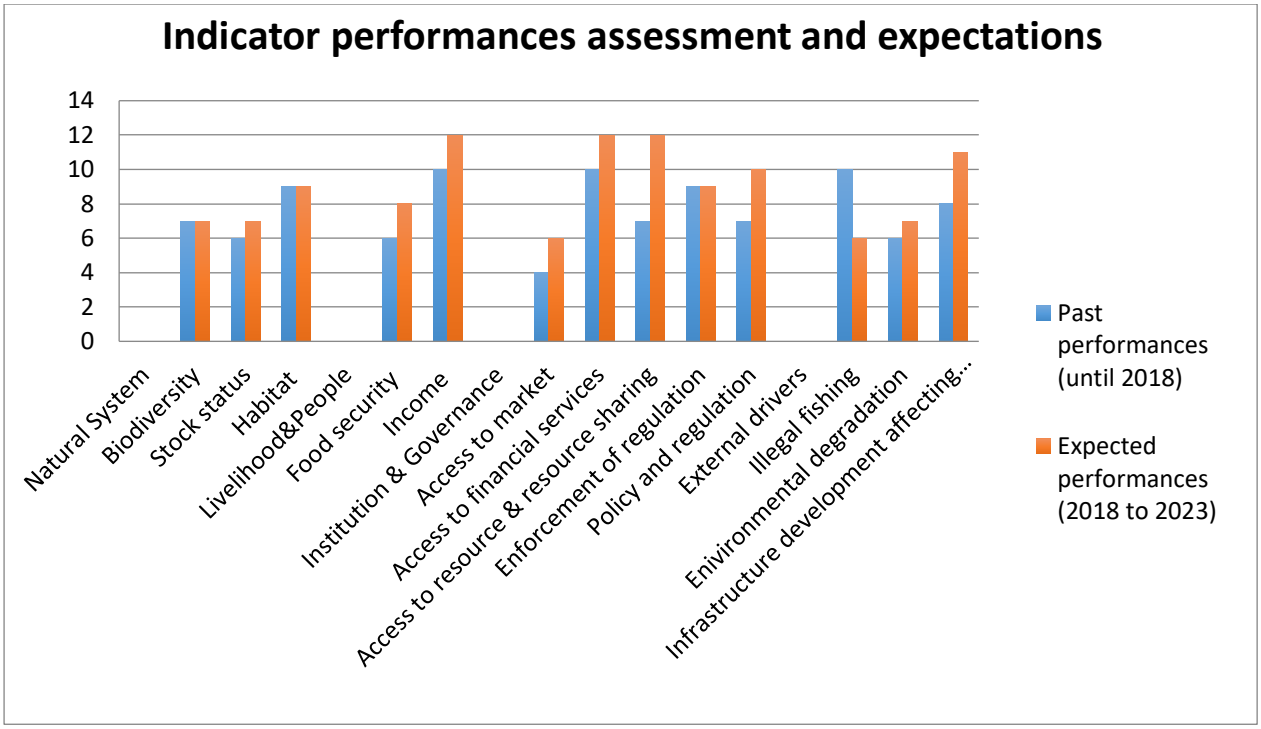


Figure 10: Indicator performances shared by stakeholder groups

5. Discussion

The case of Sun Ye lease is particular, firstly because it is located in the CDZ where there is little community-based management, and it comes out of a long period of successive changes in management systems. These transitions enable the elimination of the auction system that is omnipresent everywhere in the country for fishing leases and tenders. It is important to note that fishing activities are less important than farming in this area, which the historical use of this water resource as a reservoir rather than as a fishing ground. The status as water reservoir turned out to be an advantage for fishing activities through the installation of water control gates retaining water which would otherwise flow away at the end of the rainy season, but also has its drawbacks related to intensification of water use. In any case, this lease has a high productivity and biodiversity, while also providing diverse business opportunities related to aquatic products and tourism. Historically, this lease had been under individual management through an auction system, followed by governmental or shared management after auctions were abolished, and then recently it was placed under community management. Under the previous management system, profits were made by the lease managers through fishing gear fees, restricting access, and exclusivity on fish sales. The new management saw the establishment of a CFG and a "Village fund", which have the objective to re-invest their profits in the area. The access to the lease is open, the regulations are decided by an elected committee.

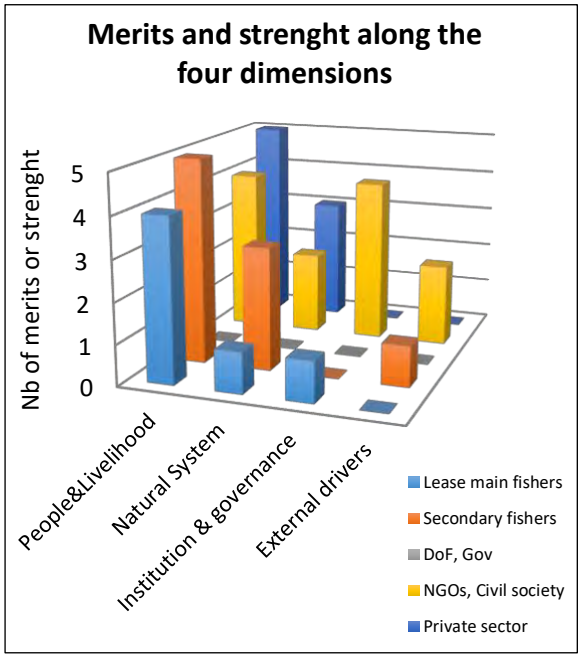
Under the new CFG management system, one of the major strengths is its high equity compared to previous systems. With open access to the lease, and equitable sharing of fish catches between fishers and the CFG, the impact of this new governance significantly increased the support for local livelihoods. The income and food security improved, and the increasing number of fishermen is the proof that fisheries sector provides profitable and reliable job opportunities. The broader spillovers have had a positive impact on the local population's market access, education and healthcare services, and the accessibility of the surrounding villages.

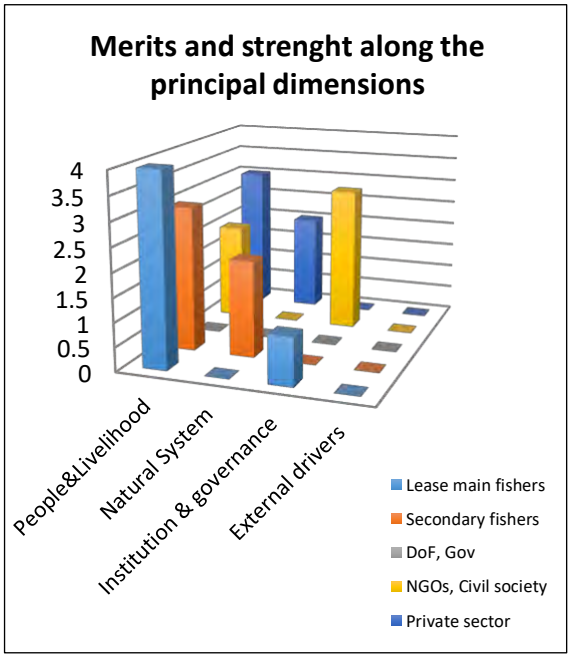
In this system, the major challenges mentioned by the actors were twofold. Some are related to natural and external factors; the others are related to the CFG's lack of financial capacity. Recently a decrease in water level was observed, together with an increase in sedimentation and algae proliferation. If lotus picking would become prolific – in not for its fibre than for its touristic attraction – although it can be used as a spawning ground for fish, it would lead to a decrease in fishing area. The seasonality of this activity makes it of secondary importance in terms of livelihood support. The intensification of the farming activities in the area puts increased pressure on the water supply. Additionally, there has been a constant increase in plastic pollution in the lease surroundings and no real measures preventing it have been taken.. A lack of financial means has led to lower restocking capacity as well as a less effective management of the illegal fishing activities than before. Fishing at night has been cited as the main reason for the lack of finance, because it doesn't provide input for the "village fund". The low involvement of several of the CFG committee members in lease management was cited as another concern.

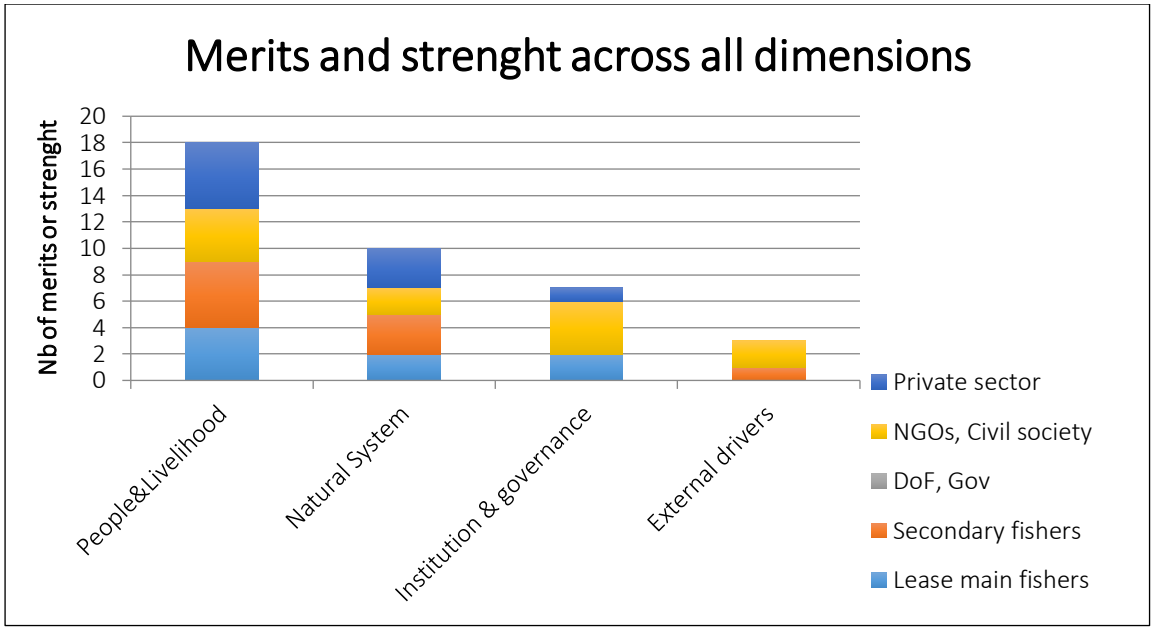
Regarding the actions that are needed to address those challenges, stakeholder feel slightly more can be done at the local level (village, township) than at higher levels (district, region, national). The Lease managers think that each level can address half of the weaknesses, for example illegal fishing activities or pollution can be handled locally, while the negotiations with the farming sector regarding water use should be done with support from higher levels. The government however, (including higher level DOF staff) think more work is to be done at the village level rather than at higher administrative levels. The fishers' group think that stronger support from higher levels is needed, especially regarding fish stocking, and the private sector states that all challenges should be be solved at the local level (ANNEX 3). This situation might be the result of the fact that this lease, since under the CFG management, has not supported by any government institution and doesn't fall under any department's responsibility. A stronger dialogue between the fishing and the farming sector and financial support for restocking supported could be interesting starting points, when combined with better management by the CFG regarding illegal fishing and pollution. This management system is supported from the local population due to its perceived equity, its good environmental conditions and it is expected could achieve even better performances with more local involvement and government support.

6. ANNEX

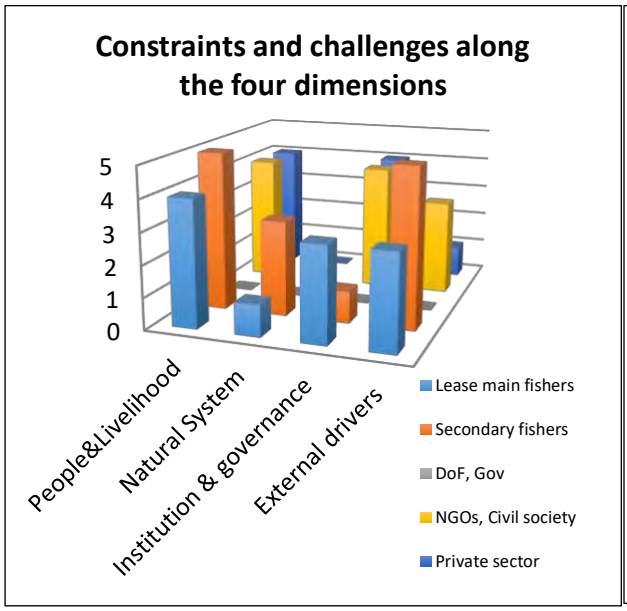
ANNEX 1: Merits and strength along the four dimensions according to the different stakeholders

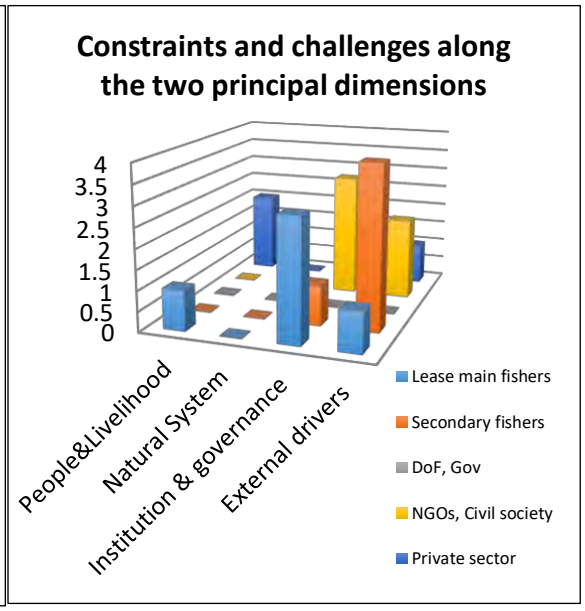


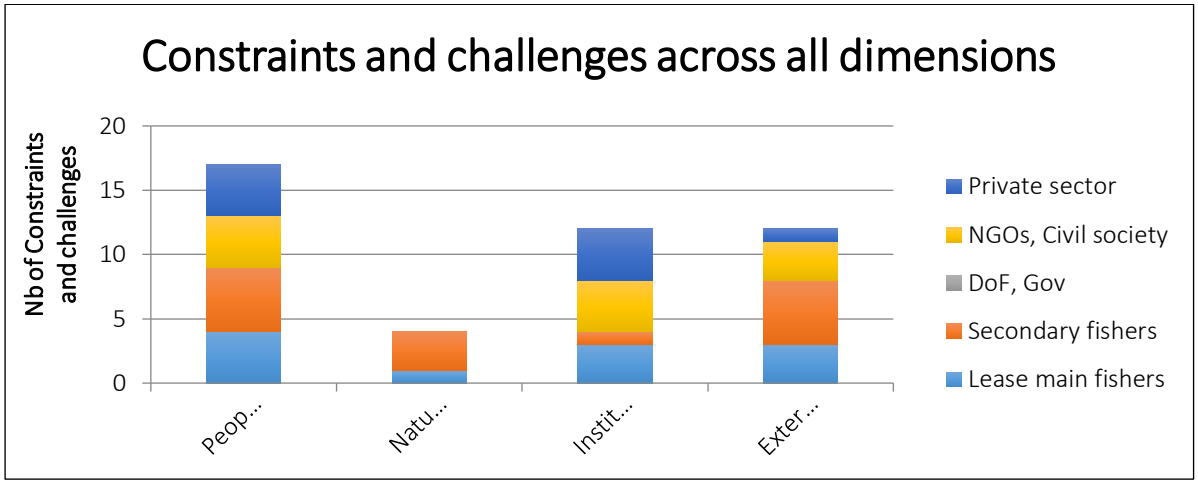




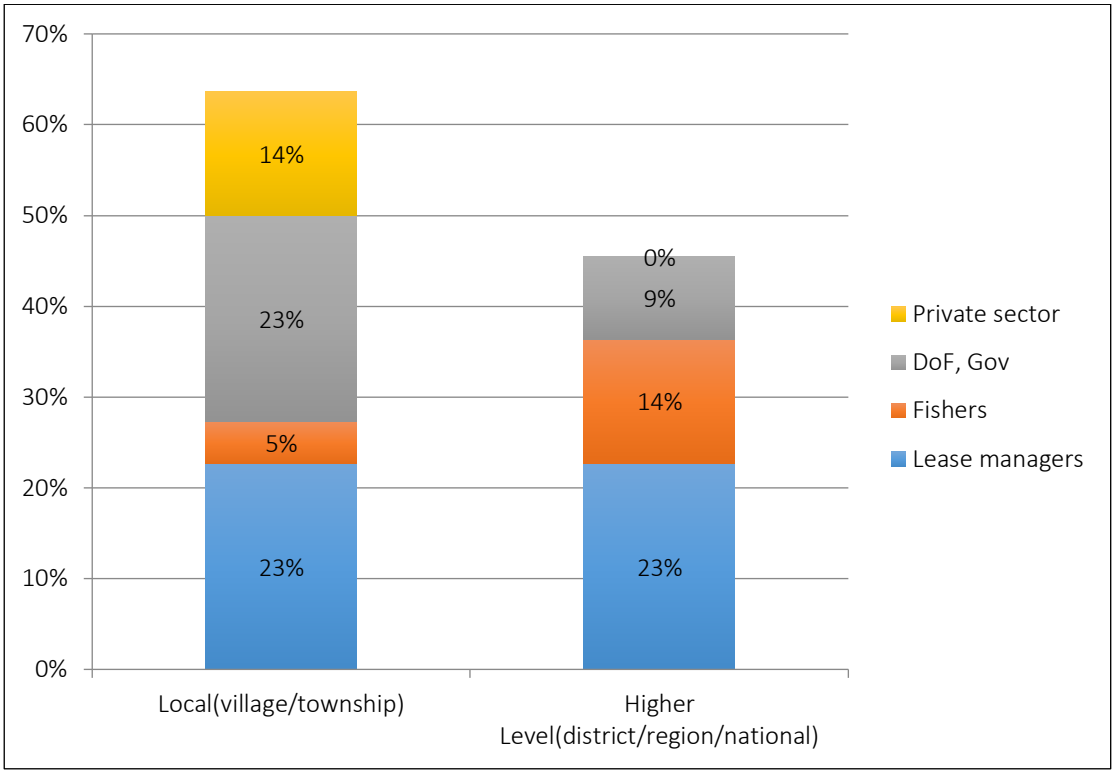
ANNEX 2: Constraints and challenges along the four dimensions according to the different stakeholders

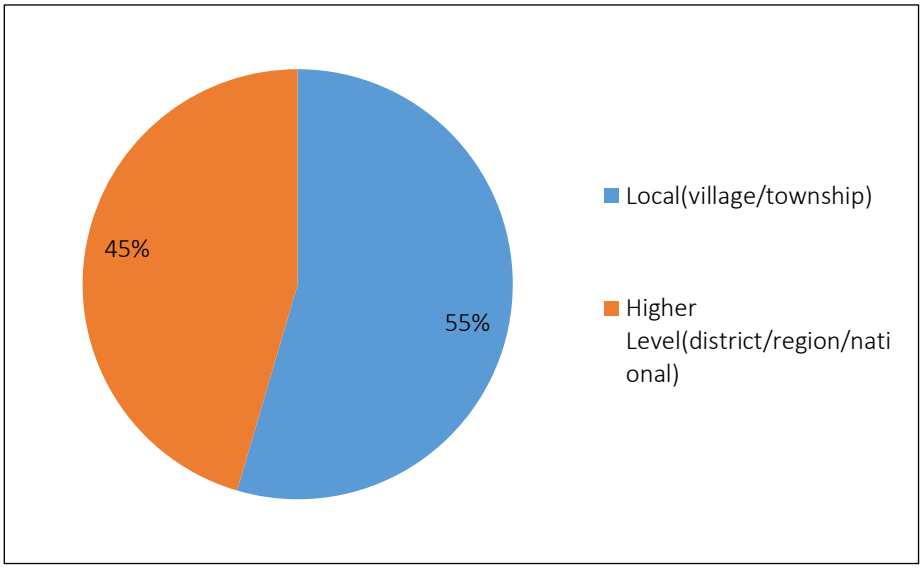






ANNEX 3: Constraints and challenges across different administrative levels





ANNEX 4: Workshop's methodological steps

Session	Activities	Objective(s)
IDENTIFYING CONSTRAINTS AND CHALLENGES/MERITS/POSITIVE IMPACTS OF THE SYSTEM		
1. Opening and participant introduction	Participants (1) introduce themselves and receive information about the workshop methodology and (2) are subdivided over different stakeholder groups, identified by coloured cards	• To ensure an equal representation of participants over the different stakeholder groups
2. Individual brainstorming about constraints and challenges	Participants individually identify five constraints and challenges they face in their respective areas relevant to the current fishery management system. On the back of their coloured cards, participants write their gender (male/female) and age	• To make an inventory of general constraints and challenges in the current fishery management system faced by stakeholders • To capture constraints and challenges of gender and age groups
3. Developing a Top 5 of constraints and challenges in stakeholder groups	Participants (1) discuss constraints and challenges within respective stakeholder group, (2) develop a stakeholder group Top 5 of constraints and challenges, (3) present the Top 5 to other stakeholder groups and (4) have discussions within and between stakeholder group(s)	• To gain insights into the key constraints and challenges experienced by different stakeholder groups • To create awareness and stimulate learning among stakeholders
4. Identifying the type of constraints and challenges	Participants (1) categorise Top 5 constraints and challenges as relating to the four dimensions (people & livelihood, natural system, institutions and governance, and external drivers), (2) present results to the other groups and (3) have discussions within and between the stakeholder group(s)	• To gain insights into types of constraints and challenges • To create awareness and stimulate learning between stakeholders
CATEGORISING CONSTRAINTS AND CHALLENGES/MERITS/POSITVE IMPACTS OF THE SYSTEM		
5. Categorising constraints and challenges along the dimensions that can enable or constrain innovation	Participants (1) categorise Top 5 constraints and challenges along the four dimensions driving innovation and (2) discuss them within and between the stakeholder group(s)	• To gain insights into how the stakeholder constraints and challenges relate to the four dimensions of Erikkson 2016 and whether these enable or constrain innovation capacity • To create awareness and stimulate learning between stakeholders
6. Categorising constraints and challenges across different (administrative) levels	Participants (1) categorise Top 5 constraints and challenges across different administrative levels (e.g. National, Township, and Village and community (fishers)), (2) discuss results with other stakeholder groups and (3) have discussions within and between the stakeholder group(s)	• To gain insights into how key constraints and challenges relate to different institutional (administrative) and community levels • To identify and analyse interactions between different levels • To create awareness and stimulate learning between stakeholders
7. Identifying relationships between constraints and challenges, and identifying key constraints	Participants (1) jointly discuss and identify relations between the different constraints and challenges, (2) identify constraints or challenges that are central in the analysis and (3) have discussions within and between the stakeholder group(s)	• To analyse relationships between different constraints and challenges • To identify key constraints and challenges • To create awareness of the interconnectedness of stakeholder constraints and stimulate learning between stakeholders
8. Categorizing constraints and challenges along Intermediate Development Objectives, e.g., increasing income, improving nutrition, fishery productivity, sustaining resources, women, innovation and capacity	Participants (1) categorise stakeholder group Top 5 constraints and challenges along the Intermediate Development Objectives and (2) have discussions within and between the stakeholder group(s)	• To analyse constraints and challenges along the Intermediate Development Objectives • To create awareness and stimulate learning between stakeholders
EXPLORING SPECIFIC AND GENERIC ENTRY POINTS FOR INNOVATION		

9a. Subdividing between constraints that stakeholder groups can solve themselves versus problems that can only be solved with or by other stakeholder groups	Participants (1) categorise Top 5 constraints and challenges as: 'can be solved within the stakeholder group' or 'can only be solved in collaboration with other stakeholder groups' and (2) have discussions within and between the stakeholder group(s)	• To identify constraints and challenges that require collaboration between stakeholder groups • To create awareness and stimulate learning between stakeholders • To identify Entry Points for innovation in the fishery management system
9b. Subdividing between constraints and challenges that are easy/difficult to solve	Participants: (1) categorise Top 5 constraints and challenges as relatively 'easy' or 'difficult' to address and (2) have discussions within and between the stakeholder group(s)	• To explore which constraints and challenges require system optimisation (easy to address) and those that require system transformation (difficult to address) • To create awareness and stimulate learning between stakeholders • To identify Entry Points for enhancing the innovation capacity in the fishery management system
10 Identifying time path for addressing stakeholder constraints and challenges	Participants categorise what constraints require short-term (< 1 year), medium-term (1-5 years) or long-term (>5 years) actions	• To subdivide between constraints and challenges that can be addressed within a relatively short term and those that require more medium- and long-term efforts.

Characterisation of Fisheries Management Systems in AD and CDZ

MYFISH 2

Case Study 10 Report

(Individually-managed Lease)

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AD	Ayeyarwaddy Delta
CDZ	Central Dry Zone
CSO	Civil Society Organization
DoF	Department of Fisheries
FAO	Food and Agriculture Organization
FDA	Fishery Development Association
FG	Fishers' Group
FGD	Focus Group Discussion
HH	Household
KII	Key Informant Interview
NGO	Non-government Organization
PDAM	Participatory Diagnosis Adaptive Management
RAAIS	Rapid Appraisal of Agricultural Innovation System
USD	United State Dollar
WF	WorldFish

Note:

Currency Exchange rate: 1 USD =1,346 Burmese Kyat

Weight Conversion: 1 Viss = 1.6 kilogram

1. Objective of the study

The aim of this case study is to generate an "in-depth" understanding of the individually managed leasable fishery in Myit Thar Nagabut Lease (Central Dry Zone), with a focus on identifying major issues and potential entry points to address them. The specific objectives are as follows:

- Assess performance of the Individual Lease fisheries management system based on agro-ecological, social, and institutional environments in Myit Thar Nagabut village tract.
- Identify key issues and opportunities for interventions to improve the performance of the fisheries management system in the area.

2. Methodology

This case study documented the individually-managed leasable fishery management system based on its current performance, strengths/merits, and weaknesses/constraints using both quantitative and qualitative indicators. The final output was the identification of entry points both at the local and higher level to achieve a sustainable capture fishery in the area. The selected case study is located in Myit Thar Village tract, Tada U Township. The information and data used in the analysis were collected both from primary and secondary data sources.

Review of Secondary data

A matrix was developed to compile existing information about the site, fisheries, and type of management in the target area. The information gathered to complete the matrix was sourced from census, FAO assessment, MYFish 1 fishery survey, MYFish 2 Component 2 and other available information from DoF District, Township and Region.

The Analytical Framework

The proposed analytical framework is adapted from the Rapid Appraisal of Agricultural Innovation Systems (RAAIS). RAAIS is a diagnostic tool originally developed for the agricultural sector which allows for the analysis of agricultural issues from broad entry theme to more specific entry points for productivity, natural resource management, social development, and institutional innovation. We propose to combine RAAIS with another theoretical framework tailored to the identification of fisheries management issues: the Participatory Diagnosis Adaptive Management (PDAM). We combine these two frameworks by adopting the four radar issues of PDAM as the four analytical dimensions to be investigated by RAIIS. These dimensions are elaborated in Box 1 bellow.

Box 1: PDMA dimensions – Definitions and Indicators

People & Livelihoods: this is the socio-economic aspect of the fishing communities and it encompasses household well-being, which includes household income, diversification of household livelihoods, household fish consumption, living conditions, norms and culture, and household assets. It also can include conflict with other users and resource use.
Indicators: Living conditions; diversification/income dependence; assets and income poverty.

Natural system: a biological classification of yield, biodiversity, and sustainability of the fisheries resources and ecosystem, its stock status and trends (total catch, total catch by species, fishing effort, catch by unit effort, and number of species), fishing practices, and aquatic ecosystem condition, such as connectivity, breeding ground, pollution from upstream, agriculture, industry.
Indicators: Biodiversity; stock status and trends; fishing practices; aquatic ecosystem condition.

Institution s & governance: the manner in which power is executed in the management of the fisheries sector. It is the enabling environment aspect in governing fisheries management in order to reach maximum sustainability (legitimacy, membership rules, access rights, management controls, representation rules, sanctions, enabling legislation/policies/legal framework, local support, financial management and services, access to market, organisational and institutional capacity.
Indicators: Fishing and development policies; organizational and institution al capabilities; access to markets and financial services; collective action abilities; governance performance and rights; legal frameworks.

External drivers: outside influences that can impact the fisheries resources and its ecosystem. Various external factors can impact the ability of the fisheries to achieve its maximum productivity/biodiversity and sustainability. These external factors include infrastructure development, macroeconomic instability, climate change and environmental uncertainty, migration, market demand changes, price fluctuation, land use changes, migration.
Indicators: Infrastructure development; conflicts with other sectors or users.

The resulting framework relies on multiple methods of data collection, building on existing experiences with rapid appraisal approaches and (participatory) innovation systems analysis. Our investigation generated both qualitative and quantitative data; facilitates 'insider' and 'outsider' analysis; targets different stakeholder groups across different levels with individual, group, and multi-stakeholder perceptions on weaknesses/constraints and solutions; and provides sufficient detail on the main weaknesses/constraints under review, the innovation capacity in the fishery management system and the functioning of the fishery management system.

Methodological steps

Based on RAAIS tool, the following main stages were conducted to assess the existing fisheries management systems based on the context of each site: (i) identifying strengths/merits, and weaknesses/constraints; (ii) categorizing strengths/merits, and weaknesses/constraints; and (iii) exploring specific and generic entry points for recommendations for the current fisheries management system for equitable and sustainable fisheries. The objectives, sessions and activities of each stage are presented in detail in Annex 1. The following research steps were conducted in Myit Thar Nagabut village over the course of 2 days to gather a broad range of information from relevant stakeholders. The participatory assessment of the fisheries management system was facilitated by a research team of 7 members (incl. 3 WorldFish staff and 4 DoF staffs).

The **multi-stakeholder workshop** represented the first step of the research and focused mainly on 'insider' analyses of the fisheries management system. A total of 19 stakeholders were invited and convened in four groups (figure 1), namely Lease main fishers (i.e. the lease owner and the main labourers employed by the lease owner), Secondary fishers (i.e. outside fishers and sub-fishers), Government and institutions (i.e. Assistant fishery officer, District officer, village tract leader, village leader) and Private sector (i.e. Mostly farmers). Those stakeholder groups were all represented equally – secondary fishers had a slight majority–and a quarter of participants were women. The workshop offered an opportunity for each group to assess the overall performance of the fisheries management system and identify associated strengths, and constraints. As such, this first step provided entry points for the next two steps of the study.

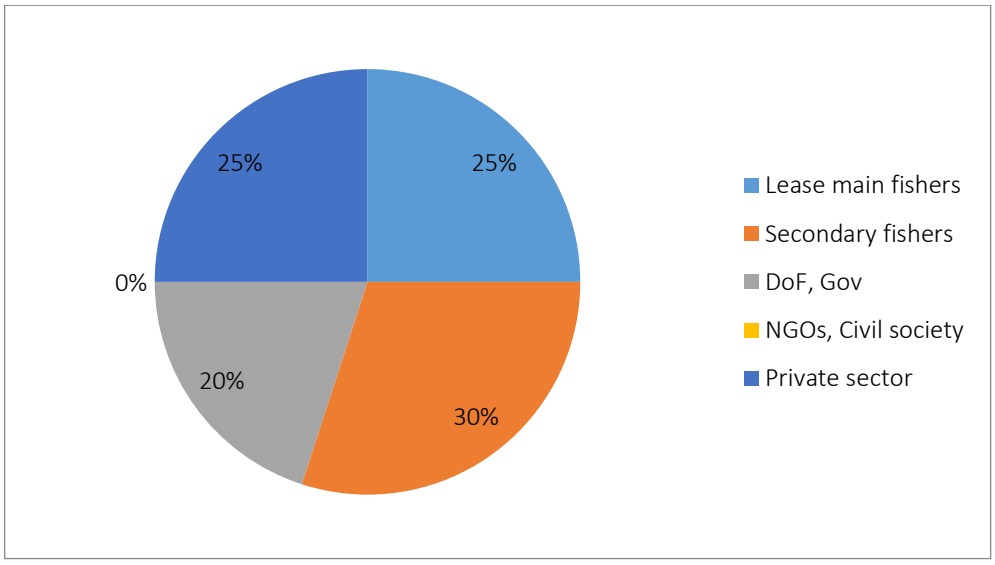


Figure 1: Participants proportion

The local competition for this lease seems very high, especially since the actual owner was not from the local village and the village head himself is looking to win the next auction. This results in a climate of suspicions and low engagement of local actors with the survey. The DOF, due to the nature of the management system (individual management), is not really involved in its management and hence does not have real means to increase local participation. Prior to the

workshop the lease owner had a small bike accident, he was present during the "Lease main fishers" workshop but did not officially take part in it. We paid very high attention to separate the different groups of stakeholders to reduce suspicion, and bias in their answers. Unfortunately, it was not enough to get them interested in the study, the local fishers have other activities besides fishing and sometimes fish outside the lease, the local owner was not willing to share precise information on the lease management or its performance, the local authorities were disconnected from the local reality and the village head was looking to get the DoF's favour in light of the upcoming auction. The only group who cooperated well was the private sector group.

In addition to this, some internal staff health issues made organising meetings difficult and made a return to Yangon necessary.

In this situation, it was not possible for us to plan KIIs and FGDs following the Workshop. The time spent before and after the workshop allowed the team to gather accurate information in addition to the information gathered during the scoping mission.

Figure 2: Workshop session

A total of 20 respondents participated information gathering during three days of field work (7 -8 February 2019) at Myit Thar Nagabut village, Myit Thar Nagabut Township. All groups were represented by a similar number of respondents during data collection. The absence of CSOs and NGOs explains the non-participation of this type of stakeholders in this case study. A detailed list of these stakeholders across the different methodological steps is provided in Table 1.

Methodological steps	Stakeholders groups targeted – Sample size

	Lease main fishers	Secondary fishers	Government Officials	NGOs/CSOs	Private sector	TOTAL
Multi-stakeholder Worksop	5	6	4	0	5	20
Key Informant Interview	0	0	0	0	0	0
Focus Group Discussion	0	0	0	0	0	0
Secondary data	N/A	N/A	N/A	N/A	N/A	
TOTAL	5	6	4	0	5	20

Table 1: Summary of data collection methods and participants

3. Study site

3.1. Background information

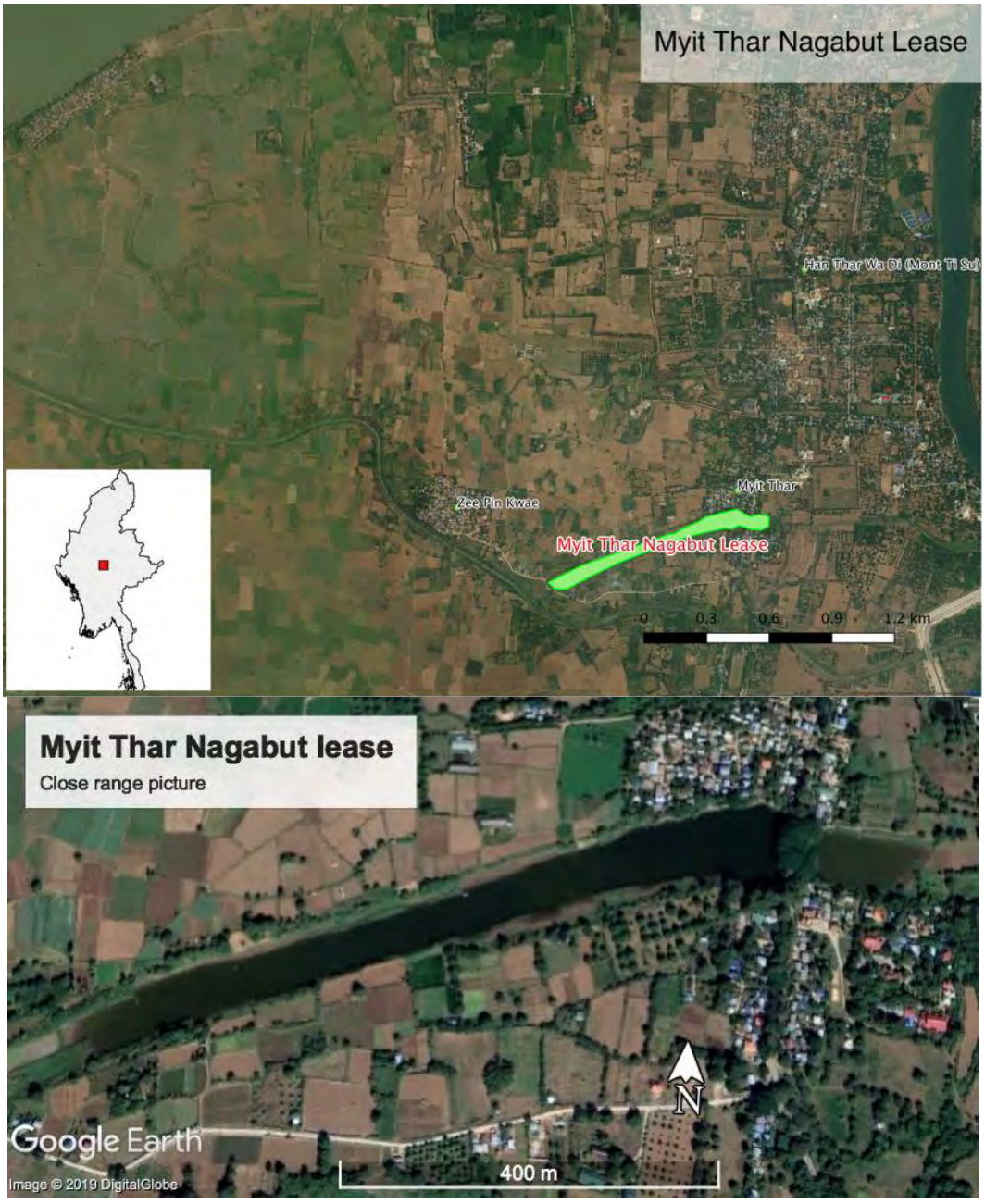


Figure 3: Map of the Myit Thar Nagabut Lease

The study site is located in Myit Thar Nagabut village tract, 27 km South of Mandalay near the Ayeyarwady river. The lease area is a creek of 800 meters long and 50 meters wide. It is not directly connected to a large river and is delimited in the East by a bridge, in the West by land and small roads. There are 3 main villages along the shore or nearby the lease: Myit Thar village, Zee Pin Kwae village, and Hlaw Kone village.

Area (km2)	0,04 km2 (10 Acre)
Demographic	Myit Thar village: pop=684, HH=121

	Zee Pin Kwae village: pop=800, HH=200 Hlaw Kone village: pop=240, HH=58 Tot HH pop = 379 HH
# of fishers	35 HH
# of others	153HH (50%) farmer, 68HH (20%) Livestock, 34HH (10%) Others
Start Date of this lease management	2013
Date of this kind of management (individual or community based)	2017
Lease price	2018-2019: 3 580 000 Ks
Peak fishing season	December to March
Low fishing season	July to November

Table 2: Lease general information

3.2. Fisheries System

3.2.1. Natural system and fishing techniques

The Myit Thar Nagabut lease is a creek largely surrounded by farming and agricultural activities. Fishing only represents 20% of livelihood activities undertaken by the population of Myit Thar Village. Residents of the two others villages do not officially fish in the lease. The majority of the population focuses on farming (paddy, lentils, and other crops) and small-scale livestock farming (one to 5 heads). The water level in the lease stays relatively high which supports farming activities in the surrounding area as it also used as a water reservoir.

The lease is about a one-hour drive from Mandalay on the Mandalay-Naypyitaw-Yangon expressway between Tada-U and Inn Wa village. It is located on the side of the road alongside the Myit Thar village and the Zee Pin Kwae village a bit farther down the other side of the road. This explains the higher engagement of the Myit Thar community compared to Zee Pin Kwae community.

Figure 4: Myint Thar Nagabut Lease picture

The high fishing season is between December to March, when the water level decreases making it easy to catch fish using surrounding nets and beach seine nets (with various mesh sizes) depending on the water level. Currently, the average fish catch is around 100 to 150 Viss/day, which is very high, explained by a stocking and feeding strategy that implies little harvesting throughout the season. The most commonly targeted species are tilapia, *Notopterus notopterus*, and *Channa striata*. The average fish price per viss in the area is around 5000 ks/viss, which implies fishers can make around 500 000 MMK/day during the peak fishing period. The low season is between July and November. Between April and June there is, in theory, an open access period during the auction process. The gears used are the same ones used in the low fishing season with a productivity of 30 to 50 Viss/day, which amounts to daily earnings of 150 000 ks/day. Given the local tensions between the different actors in the village regarding lease ownership, the actual owner was not willing to share his yearly profits or the number of fishing days. The two main reasons were a will to keep his profits secret for the local community (who started requesting co-management of the lease), the other reason could be linked to some "out of fishing period" activities that the local institutions might not agree with. The estimated overall cost of this lease (Auction, restocking, labour) is around 4 100 000 ks/Season, and the minimum profit based on a reported 10 days fishing/month during high season, which to a doubling of his initial investment. These are just estimates based on the numbers provided and they might be subject to strong bias.

3.2.2. Former fisheries management and changes over the time

The first official records date back to 2013, but it was probably used informally for a long time prior to this. The major evolutions this lease management has been through are listed in the table below.

Year	Actor in charge of the management	Management main lines
2013-2014	Individual	Start of the auction
2014- 2015	Individual	Extension of lease tenure for three years (yearly auctions with a price increase of approximately 10%)
2015-2016	Individual	idem
2016-2017	Individual	idem
2017-2018	Individual	Return to new auction system resultant of a change in fisheries minister
2018-2019	Individual	Individual auction

Table 3: Past evolutions and events

It does not seem major evolutions have occurred in the management system recently, the lease has been under individual management for many years and the rules and regulations have remained similar. A few years ago everyone seemed to fish in the lease during the lease auction process (April to June) but the last owner hasn't following those rules for the last two years.

The prince of the lease has been rising in the past years similarly to what has been observed across the country more generally. At the same time, some actors reported that wage labour prices have dropped compared to 3 years ago when the lease was under different ownership.

Figure 5: Price evolution

3.2.3. Current organization and management

The current organisation is centralised under a single owner, the lease is auctioned on a yearly basis by the DoF. It seems that the several actors who are interested in this lease gather in small groups and agree on repartitioning the lease prior to the DOF auction. After the auction the lease is split in two parts, one large and one small. The smaller one was sub-leased for 300,000 Ks in 2018 by the owner to a sub-lessee from Zee Kone village. The exploitation of the lease is exclusively supervised by the owner (and the sub-lessee in his part of the lease) with restrictions on use of wage labour and fishing for surrounding communities.

The majority of the fish caught are sold by the owner on the large Mandalay market, only a few fish sold locally on Naing Lone Ngar and Ngar La Pya markets. This in contrast to agricultural products, of which the majority of crops are exported to China and India, and dairy products are sold domestically.

Species	5 years ago (ks per viss)	In 2018 (ks per viss)
Tilapia	2500	5000
Notopterus notopterus	2500	5000
Channa striata	2500	5000

Table 3: Local market price evolution in the past five years

Access management

Access rights haven't changed for many years and are relatively simple. The owner doesn't allow anyone to fish in the lease at any time of the year –including the auction period which is supposed to be an open-access period.

Only a few close relatives to the lease owner are employed as labourers in the lease. On average 6 to 7 fishers are hired and they are paid around 80 000 ks/month. It is considered as generous and comfortable which ensures the owner gets support of a few local families, among other things to watch over the lease when he is away. To conclude, the access to the resource here is very low, and only few people have the advantage of employment at good wages.

Illegal fishing

Because access is very restrictive, it is relatively natural that the main owner is concerned about illegal fishing activities. Electrofishing and use of poison are being done up-stream as well as inside the lease, which in combination structures blocking the waterway has reduced fish migration and subsequently lease productivity. It was reported most of the illegal fishing practices are done by actors outside of the community and occur mainly at night.

The illegal fishers are extremely hard to catch. Sometimes the owner is warned by friends or family members of illegal activities going, on but most of the time he only managed to confiscated the gears without catching the fishers.

Opinion on the management

The local opinion on this management system overall is quite bad, in large part due to the very accessibility of the lease and the lack of an open access period -which is against the law. The local communities would like to have the opportunity to fish for personal consumption in this lease, or to get the responsibility to manage it as a community-managed lease. Another reason for the low opinions of the management system might lie in the fact that the lease owner is not from the same village, and that he is not being very communicative towards local communities.

External conflicts

The general feeling about this lease is that conflicts are high, both internally and externally. Within the lease area, illegal fishing is carried out in response to very restrictive access, with some jealousy regarding the limited job opportunities offered by the owner, and with stocking practices enabling water use for domestic labour. Externally, there is high competition regarding water use by the farming sector, and external upstream illegal fishing practices.

4. Results

4.1. Strengths and merits of the management system

During the workshop, participants were asked to elaborate on what they identified as the most important positive changes brought on by the new management system. Below a summary of their views is presented by stakeholder group, before proposing a summary of those strengths that are common across different stakeholder groups.

Lease main fishers

According to the Lease main fishers group –composed of the lease owner, sub-lease owner, and labourers –the main strengths of this management system are the employment the lease provides to a small number of people around the lease. The owner provides decent salaries to a few friends and relatives who fish and watch over the lease area for the owner. Another point is the restocking conducted by the lease owner which leads to increased productivity.

Secondary fishers

According to the secondary fishers' group –composed of fishermen occasionally employed by the owner during the high fishing season (most of whom are normally engaged in livestock or crop farming –the water supply of the lease is the main advantage of the system. This water is largely used for agricultural activities but also for domestic uses such as washing or as drinking water for livestock. This management system also provides a local market supply of fish, not only to export markets. Finally, this lease is provides some job opportunities to households living close to the lease.

Government officials:

From a government and DOF perspective, the main strength of this management system is the fact that an individual ownership is easier to handle for them, the regulations and the

information sharing are faster and their implementation is stronger (e.g. regarding illegal fishing). Another advantage of the individual management is the certainty of payment, and the investment the owner is able to make to sustain high productivity levels, which ensures local fish supply.

NGOs and CSOs

This group was not represented in the area and was not mentioned by any of the interviewed stakeholders.

Private sector:

According to this group, the large water supply in this lease, and its support to the local farming activities is the main strength of the system. They feel the level of conflict among the communities is low and the fish supply supports local livelihoods in addition to providing some diversification opportunities.

Merits and strength	Groups	Description
Water supply supporting local activities	Private sector, Secondary fishers	With its permanent water source the lease is a real support to local livelihoods and farming activities. It plays an important place in agricultural productivity as well as in the livestock farming or domestic uses. This is even more valuable considering the natural climate in the Central Dry Zone.
Easy management of the lease	Lease main fishers, Private sector, Government	The individual management allows a more direct and strong management of this lease, especially by the government, regarding application of regulations and financial reliability.
Local job opportunities	Lease main fishers, Secondary fishers, Private sector	The lease activity involves several local labourers throughout the year and provides alternative sources of incomes at the local level.
Productivity sustainability	Lease main fishers, Government	Due to its restrictive access and individual management, the lease exploitation seems sustainable with only a few harvesting periods combined with stocking and feeding activities.
Local market supply in fish products	Lease main fishers, Secondary fishers, Private sector, Government	The local trade of fish provides a reliable source of fish products to the local population, which is very valuable in the Central Dry Zone.

Table 4: Main merits and strength of this management system

4.2. Weaknesses and constraints of the management system

Similarly, participants were asked to elaborate on what they identified as the most important constraints and challenges brought on by the new management system. Below a summary of the assessments made by the different stakeholder group is presented, before proposing a summary of those challenges that are common across different stakeholder groups.

Lease main fishers

According to this group, the major weakness of the system is related to management of water levels. The owner would like to have the opportunity to empty the lease at the end of the lease period before the new auction, but it is not possible due to farming sector relying on the water supply from the lease. This restriction to draining the lease is even more damaging to the owner because he restocks the lease and he might lose all the fish that weren't caught at the end of the season. Related to this issue, the owner mentioned a malfunctioning of the sluice gate due to a block of concrete obstructing the water flow and reducing the stream and in turn hindering fish migration as well. Another weakness was the illegal fishing practices carried out inside the lease at night and the use of poison fishing upstream, which also affects fish migration.

Secondary fishers

This stakeholder group talked about limited access to the fishing grounds for local communities as a major weakness of the system. The owner doesn't allow any fishing during the auction period –which is against DOF recommendations, during this period the lease is considered as an open access area –and the community would like to manage this fishing ground under a community-managed system. Another limit is the fact that the owner only offers job opportunities to a very small proportion of the community, only relatives or good friends are able to get jobs and these jobs are not publicly announced. Finally, according to the few fishers who previously received authorisation to fish, it seems that the lease productivity is low due to its small size compared to other leases in the area, but also due to its bad water flow after construction of the Mandalay-Yangon highway.

Government officials:

For the government officials, the major weakness of this system is the water management of the lease. The owner, even if he doesn't fully drain the lease, he does still pump some water in January which reduces the water supply for surrounding farming activities. In addition to this, alongside with the stocking practice the owner also uses using local feeding with community waste which reduces water quality and it renders villagers unable to use it domestic use. Another issue is the low salaries paid to casual labourers employed in the lease, and the complete restriction on access to the fishing ground for local communities. Finally, it seems that the lease owner does not want to share any information with the DOF, which doesn't allow local authorities to support or follow the enforcement of regulations. This creates suspicions about the fishing practices he employs, such as closure period and temporary open access during the auction time.

NGOs and CSOs

This group was not present in the area and was not mentioned by any stakeholders interviewed.

Private sector:

The current management systems had few weaknesses mentioned by the private sector. The major weakness is the difficulty to match the lease production to the fluctuating market demand. Depending on the agricultural season the demand in fish products can vary which creates difficulties for suppliers to match that demand. The only other challenge they mentioned was the decrease in productivity due to illegal fishing practices –like use of poisoni and electrofishing –upstream of the lease.

Constraints & challenges	Groups	Description
Water resource competition	Lease main fishers, Government	Competition for water resources between the fishing and farming sectors. This inhibits the lease owner to fully drain the lease in order to catch the remaining fish at the end of the fishing season. Impossibility for the local population to use the water, because it is polluted by the stocking and feeding practices. Water flow reduced by water control gate malfunctioning and the limited capacity for drainage, which affects water flow in the lease and fish migration.
Fishing ground access restriction	Secondary fishers, Government	The complete restriction imposed by the owner, even during the auction period, doesn't supporting community livelihoods. Even subsistence fishing is not allowed.
Unequal employment chances	Secondary fishers, Government	The low number of labourers employed, the low salary given to the additional workers during the high season, and the preference to give jobs to relatives creates unequal employment opportunities. This is increased by the fact that the owner is not from the region.
Productivity and market fluctuation	Secondary fishers, Private sector	The recent road construction reduced water flow in the lease and its productivity, in addition to this the market demand is fluctuating depending on the productivity of other sectors, which makes it for the fisheries sector to match the demand.
Illegal fishing	Lease main fishers, Private sector	The restricted access to the fishing ground encourages illegal fishing in the lease (especially at night) and upstream of the lease which affects productivity in the lease.
Management transparency	Government	The owner's management practices are not communicated to the authorities, which doesn't enable any real support from the DOF or any form of supervision –among other things on closure periods.

Table 5: Constraints & challenges of this management system

4.3. Performances of the management system

Participants were invited to reflect on the performances of the management systems along the four dimensions of the PDAM (see Box 1), considering the current performance on one hand (i.e. evolution of key indicators over the past 5 years) and future performance under

current management conditions on the other (i.e. inferring on the trend of these key indicators over the next 5 years). The results of this assessment are presented and discussed below (with the support of the ANNEX 1 and ANNEX 2).

4.3.1. View by stakeholders

Lease main fishers

This group was composed of the lease owner, and some of the main labourers employed by the owner. Overall, they considered the current performance of the management system to be low for several dimensions, and medium for ***Institution & governance***. They are expecting the performance to decrease in the future for the ***people & livelihood*** and ***External drivers*** dimensions, and to remain stable for the ***Natural system*** and ***Institution and governance*** dimensions. (Figure 5).

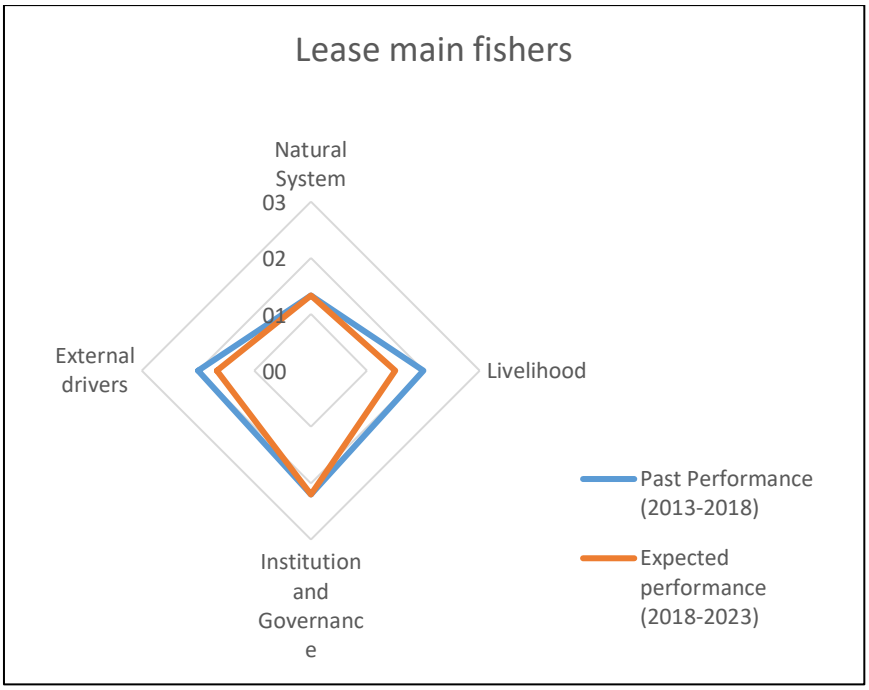


Figure 6: Performances view by the Lease managers group

The expected stability of the ***Natural system*** dimension's performance seems to be due to a stability of the biodiversity in the lease, and no expected improvement in water flow obstructions up-stream or in drainage pipes. The stability of the ***Institution & governance*** performance seems to be related to a lack of improvement of financial access, market access, and no variations in access to the lease or to the enforcement of rules and regulations. On the other hand, the expected decrease of the performance for the ***External drivers*** dimension seems to be mainly linked to an increase in illegal fishing practices in the lease, due to the restrictions in access to the lease and the fact the lease is managed remotely. The ***People & livelihood*** dimension is expected to see a decrease in performance, mostly due to the decrease in productivity, and a a lack of improvement in food security for the local population.

Secondary fishers

This group was composed of fishers who have occasional access to the fishing ground, or those who fish in other leases in the surrounding area. They consider the performance to be "medium" for the ***Natural system*** and the ***External drivers*** dimensions –and they expect it to remain stable or decrease slightly-, and low for the other two dimensions -with an expected significant increase for the ***People & livelihood*** dimension. (Figure 6).

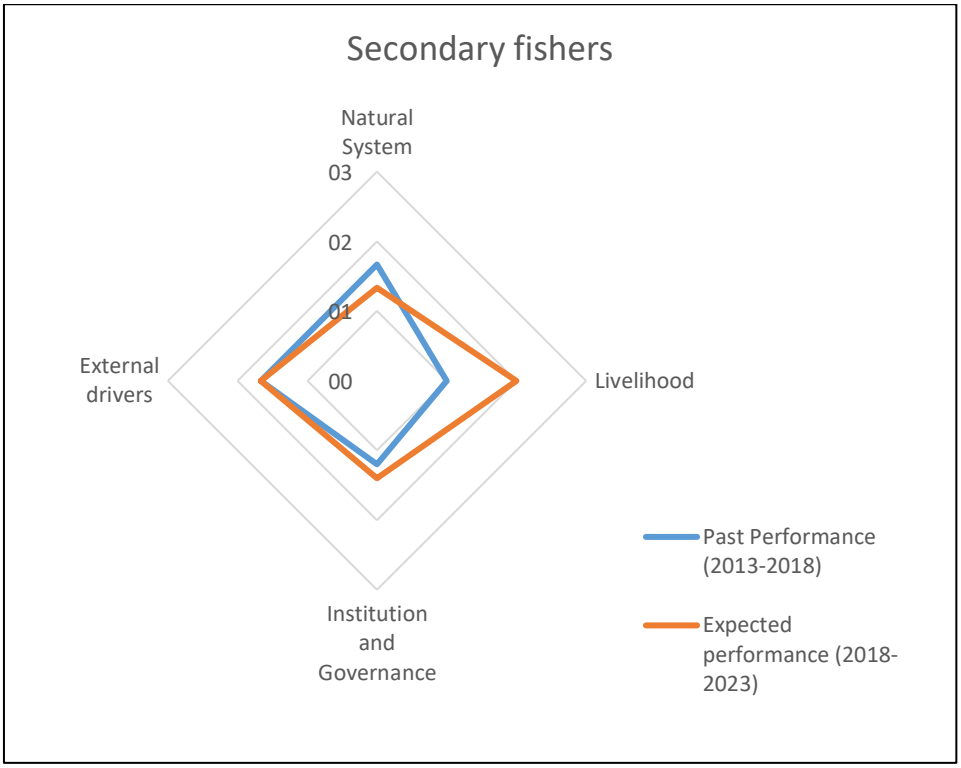


Figure 7: Performances view by the Fishers group

The low performance of the ***Natural system*** dimension seems to be linked to the decreased the water flow due to construction of the road and obstruction of the stream obstruction. This affects the fish migration within the lease and connectivity to Dokehta river. The expected large increase in the performance for the ***People & livelihood*** dimension -from very low to medium- is largely based on assumptions by this group that the lease access will become more open –or alternatively, under community management –and that they will have increase income from fishing, which seems unrealistic. The small improvement of the ***Institution & governance*** dimension is based on the same kind of assumptions -hoping that the DOF will support the community's access to water in the future. The ***External driver*** dimension is expected to stay stable, illegal fishing is not expected to decrease, and the physical barriers blocking the water flow are not expected to be removed.

Government and local institutions:

The government group -composed of DOF Assistant district officer, village head and village tract head – rated the performance of the system overall as a medium in all four dimensions. They expect the performance will improve significantly for ***People & livelihood***, improve slightly for ***External drivers*** and ***Institution & governance***, and to decrease strongly for ***Natural system*** (Figure 7).

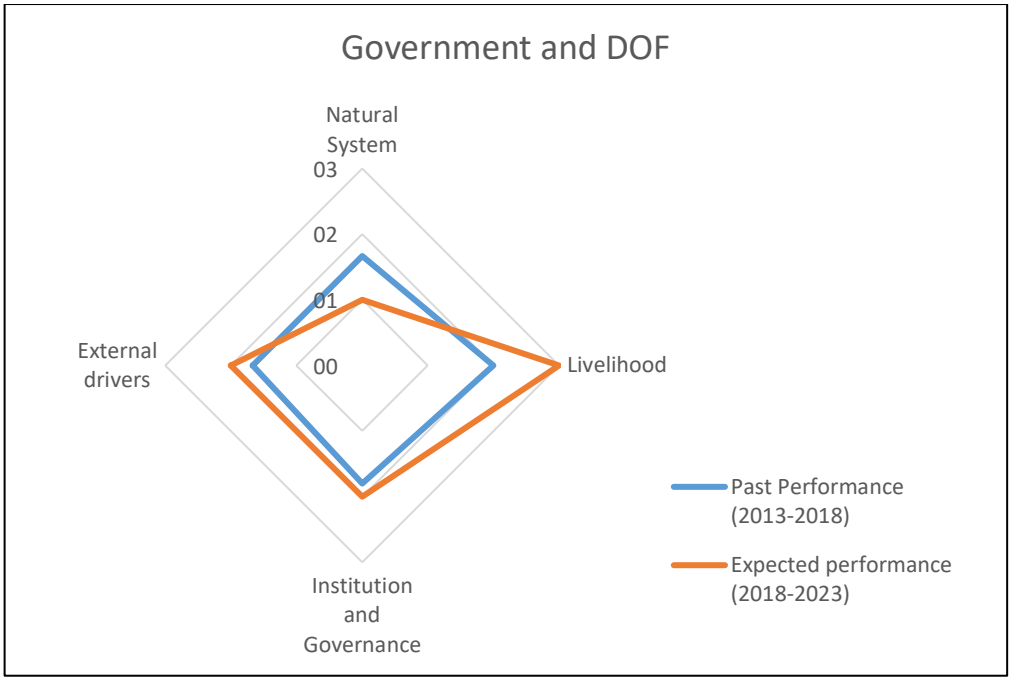


Figure 8: Performances view by the Government group

The expected decrease of the ***Natural system*** performance seems to be linked to several factors already presented. These include an increase in illegal fishing practices leading to a degradation of biodiversity, use of chemicals to pan gold upstream, and a constantly increasing deforestation in the Ayeyarwady basin reducing available fish habitats. The large expected improvement of the ***People & livelihood*** dimension is linked to the fact that the fishing sector will become more important in terms of local food security and income. This is driven by the attractive prices for fish products and the trend showing a reduction in livelihood diversification, whereby people focus more on one main activity. The slightly improvement for ***External divers*** is based on the assumption that the illegal fishing activities would decrease if the owner increases access rights for the local community, but this is highly hypothetical. The small expected improvement of the system performance in the ***Institution & governance*** dimension is related to the potential increase of access rules due to the rising awareness of the local population, and better financial support (under the form of loans) by the government. But this group is also aware that local regulations are not always followed by the population, because they focus mainly on getting higher incomes.

Private sector:

This group – composed of part-time fishers and farmers– rate the performance of this system as low overall. Both the ***Livelihood*** and the ***Natural system*** dimensions are very low, while the two other dimensions ***External drivers*** and ***Institution & governance*** are scored medium. They do not expect any changes to occur in the coming years. (Figure 8).

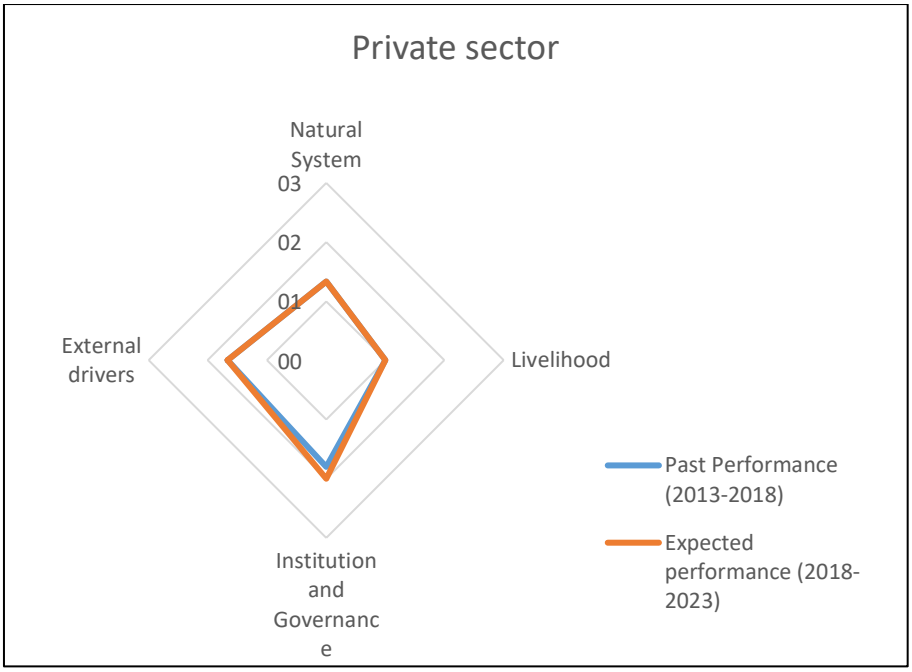


Figure 9: Performances view by the Private sector group

They rate the performance for ***natural system*** low due to persistent illegal fishing, external pressures that reduce fish migration and fish reproduction. They believe that the lease productivity is decreasing, which pushes people to focus on other sources of food and income. Therefore, they gave very low scores to the performance of the ***People and livelihood*** dimension. The ***Institution & governance*** dimension will remain the same, with increasing market opportunities, no planned access to new financial services, a stable increase in enforcement of rules and regulations regarding illegal fishing, and lower wages than before. The **External drivers** dimension will have the same performance, no infrastructures or environment degradation is planned in the coming years, and constant increase in upstream illegal fishing activities when not managed properly.

NGOs and CSOs

This type of actors where not present in the area, and no Civil society activities related to the lease were mentioned during our study. It was not possible represent the opinions of these stakeholders.

4.3.2. View shared across the stakeholder groups

Performance of this current fisheries management system was determined based primarily on the perceptions of four groups of stakeholders who shared their responses during the multi-workshop activity. The PDAM framework was used to assess the performance based on four dimensions: ***Natural system***, ***People & livelihood***, ***Governance & institution s*** and ***External drivers***. The performance score of each indicator was divided into three, with 3 being the highest score (Figure 9).

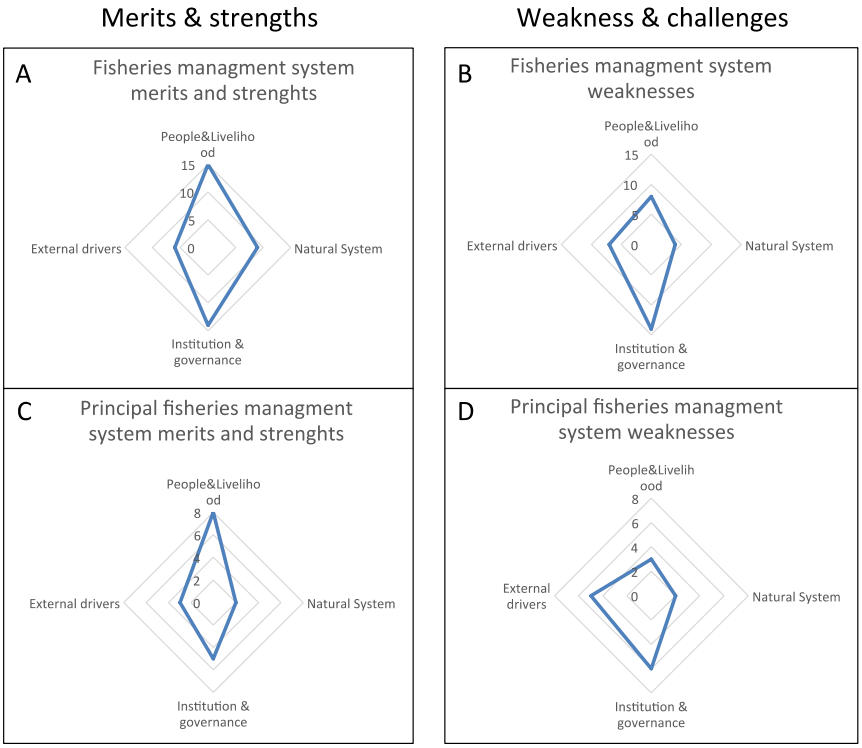


Figure 10: Metris and strengths compare to the constraints and challenges

It is clear that the according to the different stakeholders involved in the case study the majority of the Merits & strengths lie within the ***people & livelihood*** dimension (Figure 9: A and C). However, it seems to be strongly related to the natural environment in the lease, presenting a reliable water supply to the surrounding activities. This has an impact on people's livelihoods, but the assigned roles within the management system seem weak. This is confirmed by the analysis of weaknesses & challenges (figure 9: B and C), which shows that the major constraints of this system are related to the governance of the lease, and to external drivers that impact productivity.

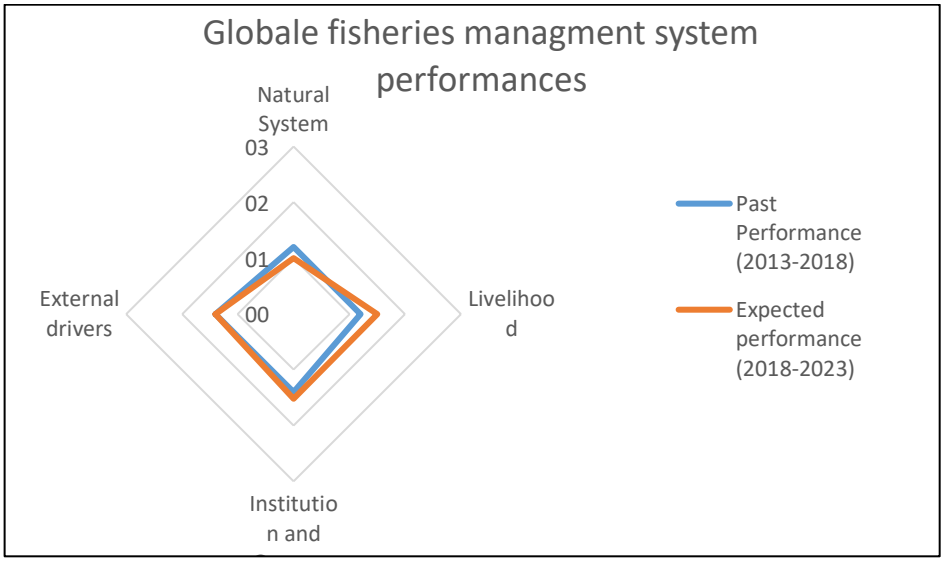


Figure 11: Summary of the strength shared across the stakeholder groups and the four dimensions

Overall, participants consistently reported low to medium performance for all four dimensions (Figure 10). The ***Natural system*** will continue to degrade due to declining biodiversity and stock status. No improvement of fish habitats is expected either. This dimension was expected to have the lowest performances and this seems to be linked largely to the constraint mentioned under the ***External drivers*** dimension. The illegal fishing inside and upstream of the lease will continue to be very damaging. On the top of this they expect to see pollution coming from sources farther away, and reductions in water flow due to degradation or construction of infrastructures. The small positive evolution seen in the ***People & livelihood*** dimension is largely based on expectations by the government and Secondary fishers who hope for an increase in access rights to the fishing ground, which seems unlikely to happen. And finally, the poor ***Institutional & governance*** dimension performance seems to be highly linked to a drastic restriction of access to lease, presumed non-compliance to DOF rules regarding fishing periods and open access, and poor local involvement of the lease owner in supporting community livelihoods (Figure 11).

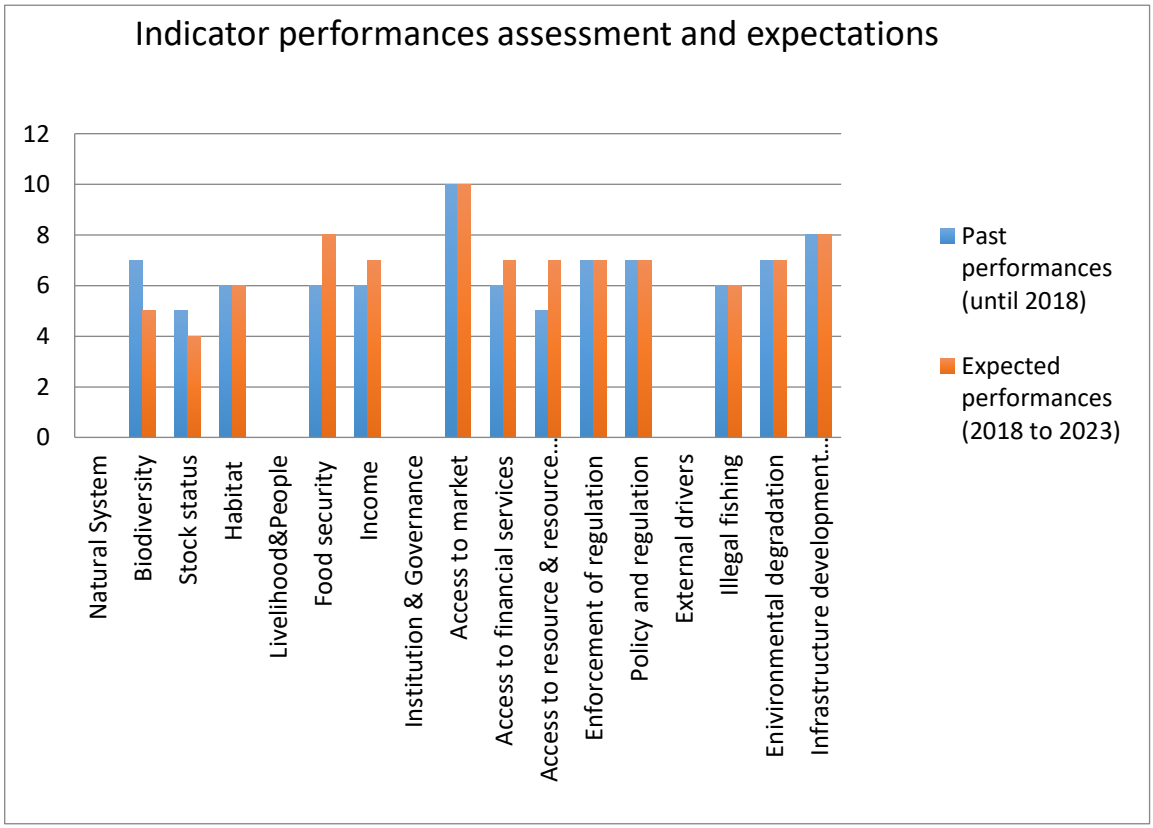


Figure 12: Indicator performances shared by stakeholder groups

5. Discussion

This lease has been under an individual management system for many years, and management hasn't changed significantly over the past few years. The particularity of this system is its location in the Central Dry Zone, as it also functions as water reservoir. The activities in the

area are crop and livestock farming, which means the importance of the fishing sector is far lower in terms of livelihood support. This lease is auctioned by the DOF annually for a duration of one year. Under the current system, the management practices are based on highly restrictive access, and seasonal restocking with well-defined harvesting seasons using surrounding nets and beach seine nets. Under these conditions, water level is a key point in order to enable a complete harvest at the end of the season and it requires a real drop in water level. The number of labourers employed by the owner in his lease is low (under 10) and highly selective, and a part of the lease is sub-leased to a sub-lessee on the other side of the lease. One last important point is that the actual owner is not from the local area.

The major merits and strengths of this system are found under the people & livelihood dimensions, with high support to community livelihoods. The main livelihood activities are related to farming, and this lease acts as a reliable water source, in direct support of crop and livestock production. In addition to this, fish products are sold mainly on local markets, which increases the local population's access to fish products at affordable prices. The local government feels comfortable having an individual in charge of the system, as this facilitates communication and payment of the lease fees.

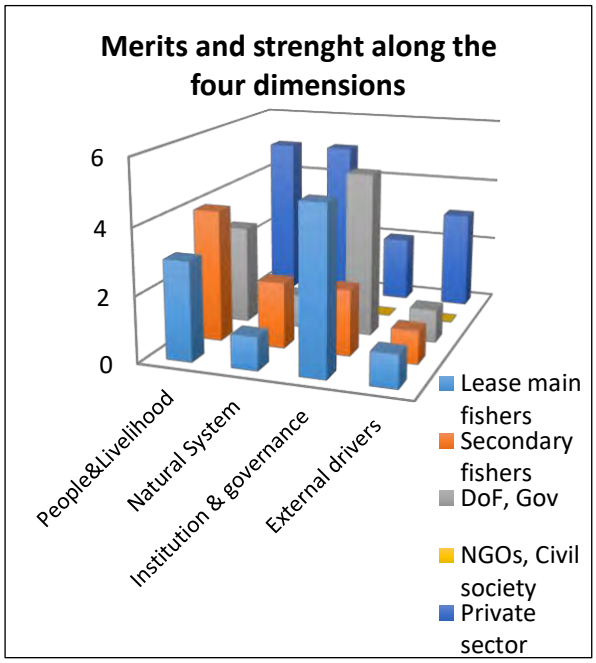
The lease also has several weaknesses and challenges, especially regarding the performance of the 'institution and governance' dimension. There is a high competition between the fisheries and other sectors regarding water use. The lease owner would like to fully drain the lease area, but water is considered too valuable for the farming sector to be wasted like this. The high restrictions on access to the fishing ground have led to an increase of illegal fishing carried out both in and out of the lease area, and the low equity in job opportunities employment isn't supporting the local population, which leads to mistrust towards the non-local lease owner. Even if the DOF is happy to have a individually managed system, the lease owner does not communicate enough with local institutions, which according to local actors might cover up a disregard of local regulations. In addition to those weaknesses, some external drivers are lowering the productivity of the lease, due to reduced water flow caused by damage to or construction of infrastructure both upstream and downstream, which directly impacts natural fish migration.

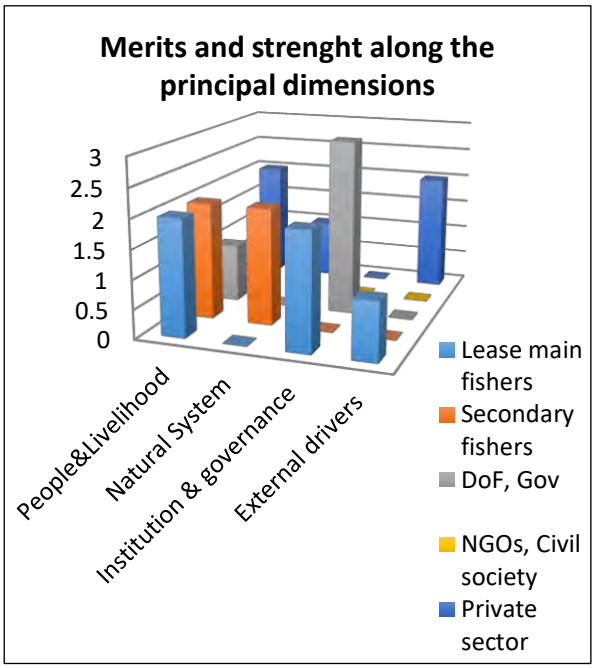
In this situation –according to the stakeholders interviewed –the potential to solve those issues are thought to be mainly at the local level (village or township level) for 69% of issuas, and then at the higher level (district, regional and national level) for 31% of issues (Annex 3). What is interesting is that the group representing the higher level -government and DOF actors – and the Main lease fishers only consider the local level to be in charge, while the private sector and the secondary fishers –who represent the "local community" – mainly stated that higher-level support is necessary in combination with certain local actions. This gives a clear image of the disengagement of the government in an individually-managed lease –which suits the lease owner perfectly, as he has full power over the lease for one year –and the desire of the local population for more equity and support. As expressed by several actors, the performance of the lease for certain dimensions is expected to get better, mostly if a shift management occurs, especially concerning restrictions on access to the fishing grounds. A better arrangement between the fishing community and the farming sector could benefit both through common

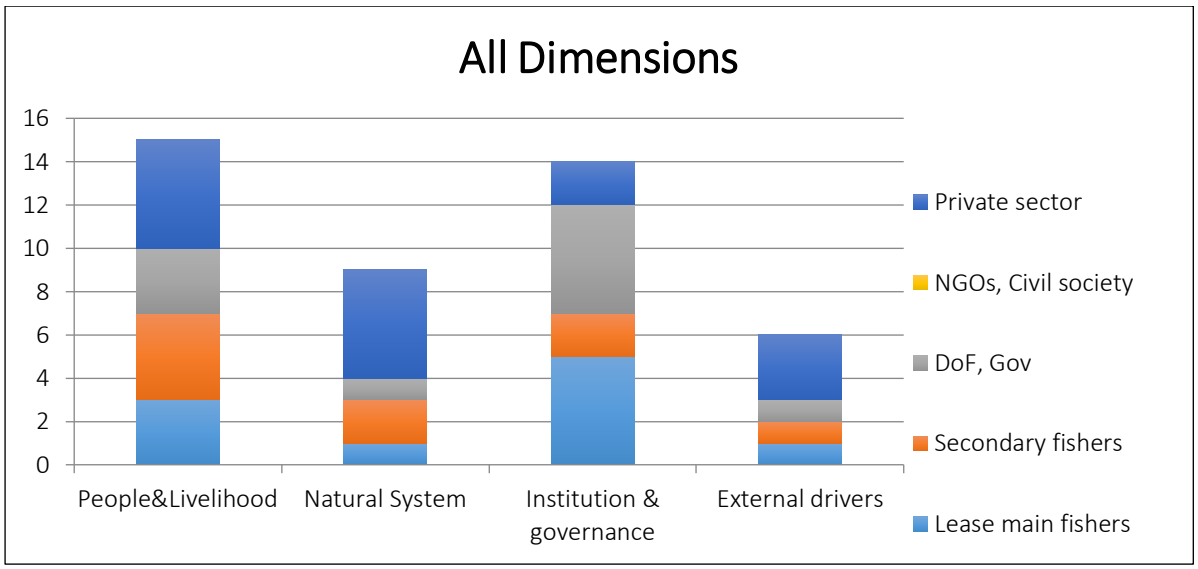
management of water gates, but there is a chance that obstructions to water flow –and the lack of action by the government to solve it –may not be as accidental as it seems. Regarding the internal management of the lease, the owner could consider to allow open access fishing during a certain period, especially during the auction process, which is requested by the government, or to have a more inclusive approach regarding employing the local community.

ANNEX

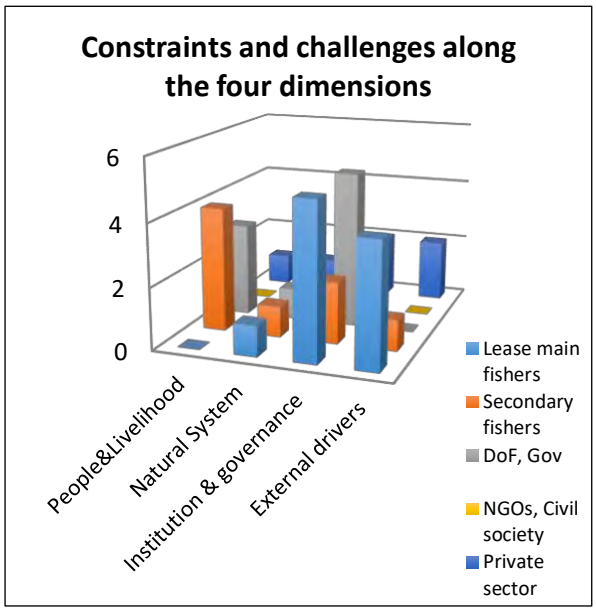
ANNEX 1: Merits and strength along the four dimensions according to the different stakeholders

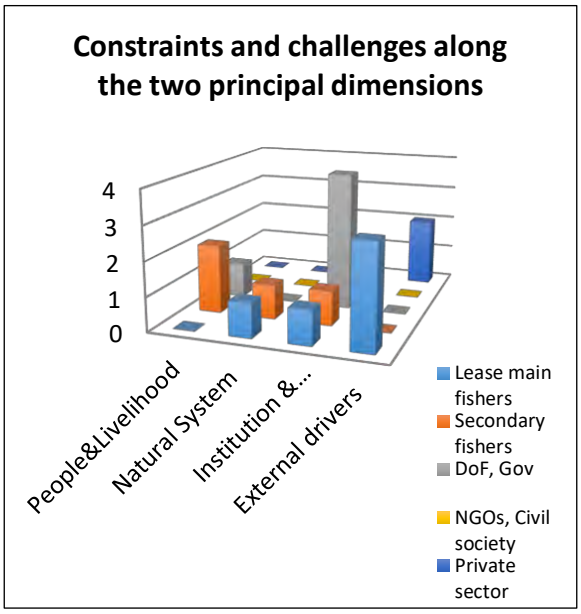


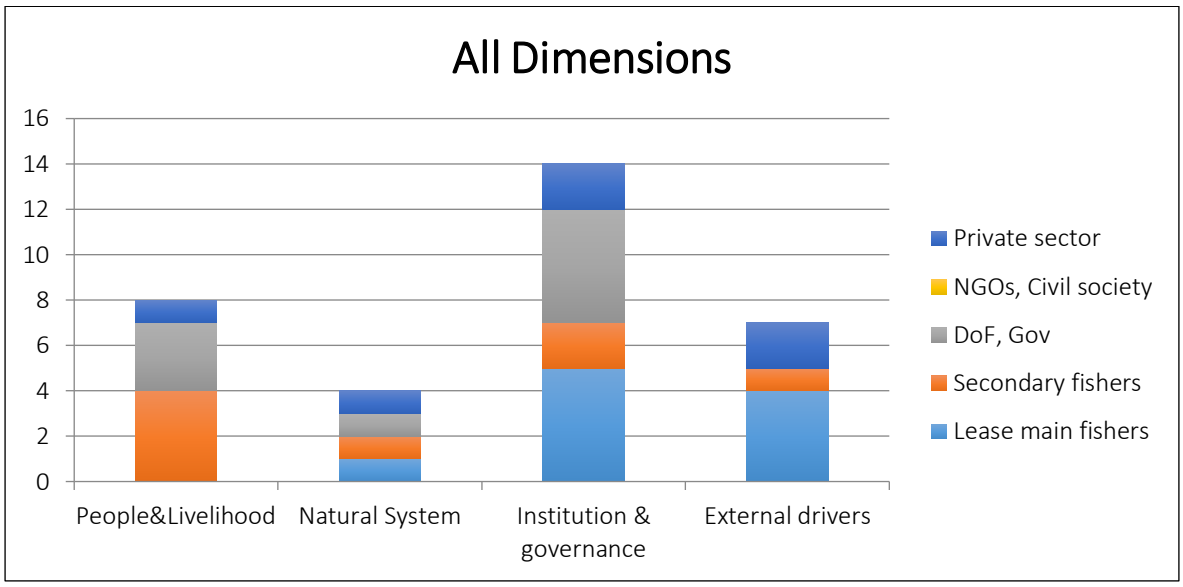




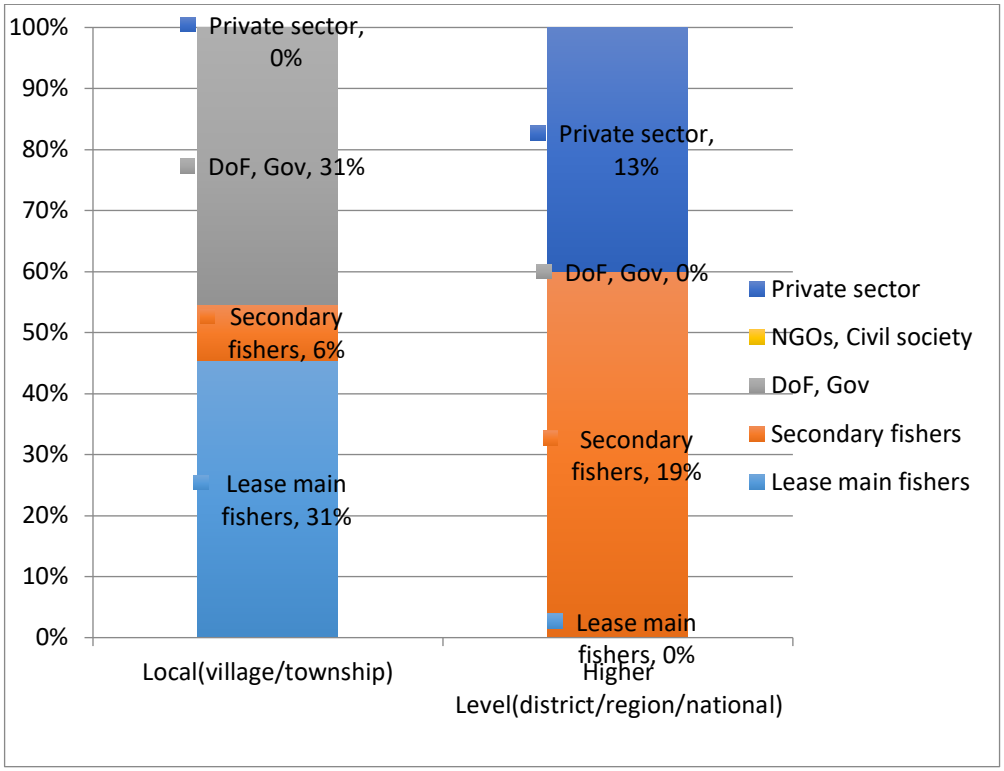
ANNEX 2: Constraints and challenges along the four dimensions according to the different stakeholders

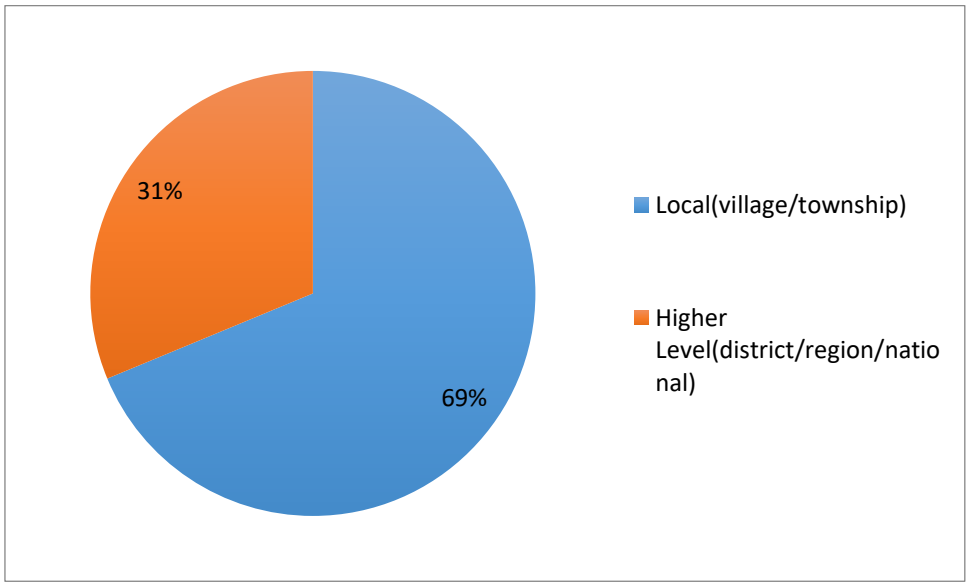






ANNEX 3: Constraints and challenges across different administrative levels





ANNEX 4: Workshop's methodological steps

Session	Activities	Objective(s)
IDENTIFYING CONSTRAINTS AND CHALLENGES/MERITS/POSITIVE IMPACTS OF THE SYSTEM		
1. Opening and participant introduction	Participants (1) introduce themselves and receive information about the workshop methodology and (2) are subdivided over different stakeholder groups, identified by coloured cards	• To ensure an equal representation of participants over the different stakeholder groups
2. Individual brainstorming about constraints and challenges	Participants individually identify five constraints and challenges they face in their respective areas relevant to the current fishery management system. On the back of their coloured cards, participants write their gender (male/female) and age	• To make an inventory of general constraints and challenges in the current fishery management system faced by stakeholders • To capture constraints and challenges of gender and age groups
3. Developing a Top 5 of constraints and challenges in stakeholder groups	Participants (1) discuss constraints and challenges within respective stakeholder group, (2) develop a stakeholder group Top 5 of constraints and challenges, (3) present the Top 5 to other stakeholder groups and (4) have discussions within and between stakeholder group(s)	• To gain insights into the key constraints and challenges experienced by different stakeholder groups • To create awareness and stimulate learning among stakeholders
4. Identifying the type of constraints and challenges	Participants (1) categorise Top 5 constraints and challenges as relating to the four dimensions (people & livelihood, natural system, institutions and governance, and external drivers), (2) present results to the other groups and (3) have discussions within and between the stakeholder group(s)	• To gain insights into types of constraints and challenges • To create awareness and stimulate learning between stakeholders
CATEGORISING CONSTRAINTS AND CHALLENGES/MERITS/POSITVE IMPACTS OF THE SYSTEM		
5. Categorising constraints and challenges along the dimensions that can enable or constrain innovation	Participants (1) categorise Top 5 constraints and challenges along the four dimensions driving innovation and (2) discuss them within and between the stakeholder group(s)	• To gain insights into how the stakeholder constraints and challenges relate to the four dimensions of Erikkson 2016 and whether these enable or constrain innovation capacity • To create awareness and stimulate learning between stakeholders
6. Categorising constraints and challenges across different (administrative) levels	Participants (1) categorise Top 5 constraints and challenges across different administrative levels (e.g. National, Township, and Village and community (fishers)), (2) discuss results with other stakeholder groups and (3) have discussions within and between the stakeholder group(s)	• To gain insights into how key constraints and challenges relate to different institutional (administrative) and community levels • To identify and analyse interactions between different levels • To create awareness and stimulate learning between stakeholders
7. Identifying relationships between constraints and challenges, and identifying key constraints	Participants (1) jointly discuss and identify relations between the different constraints and challenges, (2) identify constraints or challenges that are central in the analysis and (3) have discussions within and between the stakeholder group(s)	• To analyse relationships between different constraints and challenges • To identify key constraints and challenges • To create awareness of the interconnectedness of stakeholder constraints and stimulate learning between stakeholders
8. Categorizing constraints and challenges along Intermediate Development Objectives, e.g., increasing income, improving nutrition, fishery productivity, sustaining resources, women, innovation and capacity	Participants (1) categorise stakeholder group Top 5 constraints and challenges along the Intermediate Development Objectives and (2) have discussions within and between the stakeholder group(s)	• To analyse constraints and challenges along the Intermediate Development Objectives • To create awareness and stimulate learning between stakeholders
EXPLORING SPECIFIC AND GENERIC ENTRY POINTS FOR INNOVATION		

9a. Subdividing between constraints that stakeholder groups can solve themselves versus problems that can only be solved with or by other stakeholder groups	Participants (1) categorise Top 5 constraints and challenges as: 'can be solved within the stakeholder group' or 'can only be solved in collaboration with other stakeholder groups' and (2) have discussions within and between the stakeholder group(s)	• To identify constraints and challenges that require collaboration between stakeholder groups • To create awareness and stimulate learning between stakeholders • To identify Entry Points for innovation in the fishery management system
9b. Subdividing between constraints and challenges that are easy/difficult to solve	Participants: (1) categorise Top 5 constraints and challenges as relatively 'easy' or 'difficult' to address and (2) have discussions within and between the stakeholder group(s)	• To explore which constraints and challenges require system optimisation (easy to address) and those that require system transformation (difficult to address) • To create awareness and stimulate learning between stakeholders • To identify Entry Points for enhancing the innovation capacity in the fishery management system
10 Identifying time path for addressing stakeholder constraints and challenges	Participants categorise what constraints require short-term (< 1 year), medium-term (1-5 years) or long-term (>5 years) actions	• To subdivide between constraints and challenges that can be addressed within a relatively short term and those that require more medium- and long-term efforts.

Characterization of Fisheries Management Systems in Myanmar

Synthesis Report

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Abbreviations

AD	Ayeyarwaddy Delta
CDZ	Central Dry Zone
CFG	Community Fishery Group
CSO	Civil Society Organization
DoF	Department of Fisheries
DoA	Department of Agriculture
FAO	Food and Agriculture Organization
FDA	Fishery Development Association
FGD	Focus Group Discussion
HH	Household
KII	Key Informant Interview
NGO	Non-government Organization
PDAM	Participatory Diagnosis Adaptive Management
RAAIS	Rapid Appraisal of Agricultural Innovation System
TA	Technical Assistance
USD	United State Dollar
WF	WorldFish

1. Background

Myanmar inland fisheries are characterized by a broad range of governance arrangements. While many of their features can be traced back to the 19th century (Reeves *et al.* 1999), governance arrangements prevailing today are largely the product of the extractive economic agenda that has characterized successive political regimes in Myanmar's modern history (Tezzo *et al.* 2018). Inherited from the British occupation, the granting process of tender and lease licenses (see Box 1) is now being increasingly criticized. The latter consists in an auction system that sees the most productive inland fisheries allocated to the highest bidder, with very limited regard for the eligibility criteria of the bidders. Another central aspect being criticized is the 10% yearly increase that is imposed on the license floor prices. Inherited by the socialist regime, this policy disconnect the prices of the licences from their actual productivity. Recent evidence suggests that these policies contributed to exclude the poor and incentivize unsustainable harvesting practices, leading to growing contestation from the resources users.

The current pace of political reform is unprecedented. On the one hand, the political transition after 2010 saw the effective decentralization of inland fisheries management to regional governments. On the other hand, there was increasing political mobilization of civil society organizations (CSOs) in the debate. As a result, there have been some attempts to address the situation by allocating tender and lease licenses to groups of fishers in the Ayeyarwaddy Delta Region. The last *Ayeyarwaddy Region Freshwater Fisheries Law* passed in 2018 effectively allows Regional Fisheries Officer to bypass the auction process and allocate licenses under MMK 4 million[1] to newly established Community Fishery Associations (CFGs). In December 2018, its by-laws were drafted in consultation with the Department of Fisheries, civil society organizations, and resources users. The latter define the modalities by which Community Fishery Associations (CFGs) are to be established and their membership vetted by local authorities. Although these by-laws are still to be validated by the Regional parliament, they are already being used as an implementing guideline to experiment with community-based fisheries management.

WF/DoF is implementing the project "Improving fishery management in support of better governance of Myanmar's inland and delta fisheries" (MYFish 2, 2017-2020)". The project objectives are: (i) characterize existing fishery management practices and assess their performance on fish production and benefit distribution in key fish-production areas; (ii) field test and adapt improved fisheries management approaches for different access arrangements in key fish-production areas of Ayeyarwady Region; and (iii) strengthen R&D capacities of government, partners and fisheries organizations for improving the management fisheries and associated natural resources, and providing guidance for governance and policy development.

To address the first objective, WF/DoF conducted a series of case studies in AD and CDZ. The Rapid Appraisal of Agricultural Innovation Systems (RAAIS) framework was adopted to guide the analysis. This diagnostic tool was originally developed for the agricultural sector and allow for analysis of issues from broad entry theme towards more specific entry points for productivity, natural resource management, social development, and institutional innovation. The RAAIS framework was combined with another theoretical framework tailored to the identification of fisheries management issues: the Participatory Diagnosis Adaptive Management (PDAM). The Participatory Diagnosis and Adaptive Management (PDAM – see

[1] At the time of this study, MMK 4 million corresponds to approximately USD 2,600

Andrew *et al.* 2007). Eriksson *et al.* (2016) made use of the same framework to implement a participatory diagnosis of ecosystem-approach to fisheries management across 4 countries. Their analysis helped introduce innovations or interventions that were responsive to the existing institutional contexts. The diagnostic helped identify priority issues in fisheries management as perceived by local stakeholders and as entry points for improving fisheries management in Myanmar context.

For the sake of consistency, the framework is presented in this introduction. RAAIS was the lead framework and PDAM was used to bring forth the radar issues (hence RAAIS first and PDAM second).

Box 1: Freshwater fisheries management categories

- Leasable fisheries (locally known as "*Inn*") – are large areas of water that are leased primarily to individuals by the government on an annual basis through an auction system. This is similar the system used in Cambodia to allocate "fishing lots". Leaseholders have exclusive rights to harvest fish in the area using any gear.
- Tender lot fisheries – Licenses to use some of the larger stationary fishing operations in open water areas, such as those using "bagnets" or "stow nets" set on river channels, are allocated by the Department of Fisheries (DoF) on annual basis by so-called "floating tender" system in relation to specific fishing location (FAO-NACA 2003; Tsamenyi 2011). All fishing gear requires a license, license fees are variable between regions in line with productivity and capacity, and target those fishing commercially over subsistence fishers (ibid).
- (Licensed) open fisheries – Fishing rights are permitted to individuals through licenses which allow fishers to catch fish using the licensed gear in open access fisheries areas within a specific township. Licenses are issued by DoF on an annual basis for a fixed fee, which is variable between regions and according to production, capacity and type of fishing gear (FAO-NACA 2003; Tsamenyi 2011).
- (Non-licensed) open fisheries – Some 15 fishing gears are exempt from DoF license requirements for use in open access fisheries areas. These gears are often favored by poorer members of the community who cannot afford license fees (Tsamenyi 2011).
- Reserved fisheries – Water areas in which fishing operations are prohibited at specific times or in which fishing rights are granted subject to conditions in order to propagate fish or prevent the extinction of fish. However, "reserved areas" under the *Freshwater Fisheries Law* do not necessarily prohibit exploitative activities (Tsamenyi 2011).

2. Study Objectives

The aim of this study was to generate an "in-depth" understanding of the different management practices that currently exist in Myanmar, with a focus on the potential entry points for improved governance. The specific objectives were as follows;

- Assess performance of the fisheries management systems based on agro-ecological, social, and institution environments; and
- Identify key issues and opportunities for interventions to improve the performance of existing fisheries management systems.

3. Study sites

(Will include a map that shows the areas of the case studies conducted)

4. Methodology

4.1 Site selection

A case study approach was used to document the performances, strengths, and challenges of existing fisheries management systems using both quantitative and qualitative indicators. The main units of analysis were fishery sites, that is to say, delimited water bodies where capture fisheries occur under different management systems. The selection of floodplain , permanent lakes, segment of rivers and creeks offered a broad perspective on the three different management systems in Myanmar, namely tender lot, leasable, and open access fisheries (see Box 1), all administratively managed at township level.

The selection of target townships was left at the discretion of DoF based on set criteria agreed with the WF research team. The intention was to cover a broad range of aquatic systems and governance regimes. Study sites were also selected based on the availability of DoF to facilitate field visits and coordinate the meetings with the different stakeholders. DoF and WF staff selected the site based on the criteria agreed before the data collection. The study selected a total of 10 study sites distributed across 2 administrative regions: 8 in the Ayeyarwady Delta Region, across Maubin and Pyapon Townships, and 2 in the Central Dry Zone Region, across Kyaukse and Tada-U Townships. In each regions, the site selection intentionally covered a mix of individually-managed and community-managed (leasable and tender) fisheries. Open fisheries were occasionally covered in these same sites whenever relevant.

4.2 Review of secondary data

A meta-analysis was used (i.e. using the data and results of previous studies) to review available information for each study site. In some of them, descriptive information on the ecological characteristics and management regimes were already collected (e.g. FAO assessment, MYFish 1 leasable fishery survey, Myanmar Census for each townships, etc.). The compilation of existing datasets was coordinated by WF. In addition, the DoF liaised with all township officers and other relevant departments to gather existing information in the target study sites. All of this information was synthetized into a standardized format and made available to the research team before starting the primary data collection.

4.3 Collection of primary data

The methodological framework for data collection was adapted from the Rapid Appraisal of Agricultural Innovation Systems (RAAIS). RAAIS is a diagnostic tool originally developed for the agricultural sector and allowing the analysis of agricultural issues from broad entry theme towards more specific entry points for productivity, natural resource management, social

development, and institutional innovation. Our methodological framework combined RAAIS with another theoretical framework tailored to the identification of fisheries management issues: the Participatory Diagnosis Adaptive Management (PDAM). These two frameworks were combined by adopting the four radar issues of PDAM as the four analytical dimensions to be investigated by RAIIS. These dimensions were elaborated, as follows:

- People & Livelihoods: the socio-economic aspect of the fisheries communities that encompasses household well-being, which include household income, household diversification of livelihoods, household fish consumption, living conditions, norms, culture and household assets. It also can include conflict with other users and resource use

- Natural system: The biological classification of yield, biodiversity and sustainability of the fisheries resources and ecosystem, its stock status and trends (total catch, total catch by species, fishing effort, catch by unit effort, and number of species), fishing practices, and aquatic ecosystem condition, such as connectivity, breeding ground, pollution from upstream, agriculture, industry.

- Institutions & governance: The manner in which a power is executed in the management of the fisheries sector. It is the enabling environment aspect in governing the fisheries management to its sustainability (legitimacy, membership rules, access rights, management controls, representation rules, sanctions, enabling legislation/policies/legal framework, local support, financial management and services, access to market, organizational and institutional capabilities.

- External drivers: Outside influences that can impact the fisheries resources and its ecosystem. Various external factors can impact the ability of the fisheries to achieve its productivity/biodiversity and sustainability. These external factors might include infrastructure development, macroeconomic instability, climate change and environmental uncertainty, migration, market demand changes, price fluctuation, land use changes, migration.

RAAIS as a participatory diagnostic tool was combined with multiple methods of data collection, building on existing experiences with rapid appraisal approaches and (participatory) innovation systems analysis. The methods for the RAAIS generated both qualitative and quantitative data; facilitate 'insider' and 'outsider' analysis; targets different stakeholder groups across different levels with individual, group and multi-stakeholder perceptions on problems and solutions; and provide sufficient detail on the main problem under review, the innovation capacity in the fishery system and the functioning of the fishery innovation system. On the other hand, the innovated framework was used to identify the performance, merits/strength and constraints/challenges from the reviewed management system.

4.4 Stakeholder's Identification

WF/DoF initially visited the study sites and coordinated with the DoF office in the township in identifying and selecting the respondents for the different tools one week before the actual data collection. All relevant stakeholders from the management constituency were invited to provide information on the context and issues of the system, which then served as entry point for capture fisheries management and sustainability.

4.5 Methodological Steps

A standardized series of methodological steps was followed in each study site. Overall, these successively supported: (i) an assessment of the current and future performance of the management system based on the four dimensions, (ii) the identification of strengths/merits of prevailing management system; (iii) the identification of constraints and challenges; (iv) the categorization of constraints and challenges; and (v) the exploration of specific and generic entry points for improvement towards more equitable and sustainable fisheries systems. The objectives, detailed sessions and activities for each stage are presented in details in Annex 1.

The methodology described below was followed in each study site to gather a broad range of information and articulate a participatory assessment of prevailing fishery management systems. The detailed steps of the methodology are detailed below and summarized as follows:

(i) Identification missions represented the first step of the investigation and were conducted at least a week prior to the workshop. The identification mission consisted in early consultation with local DoF and relevant stakeholders from the management constituency to gather background information on the local context and indications on the main issues at stake. These introduction visits supported the identification of entry points to the study and enable the identification of groups of participants to be invited for the workshop.

(ii) Multi-stakeholder workshops represented the second step and focused mainly on insider analyses of the fishery management system. Different groups of stakeholders (maximum of 25 participants) were invited to share their perspectives on the fisheries management system. The workshop offered an opportunity for each group to assess its overall performances and conjointly identify associated strengths, and constraints. As such, this first step provided entry points for the next two steps.

Building on the identification mission, the DoF/WF research team led the selection of stakeholders who participated in these multi-stakeholder workshops. Each category of stakeholder groups consisted of between 2 to 5 (male and female) participants.

- Fishery (tender/lease) license holder (incl. CFG committee if applicable), sub-license holder(s) or their representative(s);
- 'Insider' fishers operating in the licensed fishery in agreement with license owner;
- 'Outsider' fishers excluded from operations in the licensed fishery;
- Local authorities (e.g. Village or Village tract Head) and relevant local government officials (DoF, DoA, DoI);
- Trader/collectors/retailers involved in processing and/or provisioning fish sourced from the licensed fishery;
- Relevant (private sector) local businesses and SME which activities interfere with the licensed fishery operations (e.g. fish farmers, paddy farmers, etc.).
- Civil society organizations (CSOs) and or community-based organizations (CBOs) operating in the area;

(iii) Key Informant Interviews (KII) and Focus Group Discussions (FGDs) represented the last steps of data collection. These consisted in conversations with respectively one and multiple stakeholders of importance as per identified during the workshop. These were used on the one hand to triangulate and validate information gathered during the workshop. On the other hand, KIIs and FGDs were used to gain more in-depth insights on this information and understand the perspective and dynamic of different groups on

the existing fisheries management system in the area. Discussions revolved around the "entry theme(s)" identified during the workshop and the functioning collaboration between the different stakeholder groups.

The data tools presented above were implemented for three days of data collection as presented in Table 1. Day 1, activity in the morning includes travel and coordination with the DoF and focal point in the village. The multi-stakeholder workshop was conducted in the afternoon of the first day. In the evening, - the team facilitators assigned in each group encoded the information gathered in the workshop and sent/submitted to the team leader. The team leader consolidated all information from the workshop and come-up with the main merits/strength and constraints/challenges that were included in the FGD and KII questionnaires for the next day. In day 2 morning – The team leader debriefed the facilitators and note takers on the result of the consolidated constraints of the workshop and the developed questionnaire for the identified target respondents. Upon agreement on the questionnaires, these were printed and guided the facilitators during the FGDs/KII. In the afternoon - the team conducted the FGDs/KII with the identified target respondents, usually the fishers outside the lease area, retailers/traders, processors, fishers' group members, and any associations in the target area. 3rd day morning – the team continued to conduct the KII with the identified respondents during the workshops and FGDs. KII was conducted in the place appropriate to the respondents and short period of time; usually individual respondents (businessman) are busy on their business and could only provide few minutes of their time for an interview. Finally, in the afternoon of the 3rd day, the team travels back to their bases.

Table 1. Timeline of information and data collection

Day1		Day 2		Day 3	
am	pm	am	pm	am	pm
Travel to the site and coordination with DoF	Conduct multi-stakeholders Workshop	Debriefing of result of the MS workshop and introduction of questionnaire for FGD/KII to the team	Conduct FGD/KII	Conduct KII	Travel back to base

After the information and data collection, the team members cleaned the information/data collected and submitted it to the team leader. The team leader collated and analyzed the information and data then wrote a stand-alone report for the case studied. In this study, 10 cases were documented and combined into one synthesis report as presented in this document.

4.6 Synthesis of finding

Synthesis workshop

Two workshops were conducted with the research team members, first was the inception workshop, which discussed and agreed on the approach methodology including tools and questionnaires in gathering the information and data from the target sites and respondents. The 2nd workshop was the debriefing and discussion of the outline and expected output of the synthesis report. The discussion in the 2nd workshop had brought the decision of synthesizing the analysis of the different management systems through a spectrum using the governance/institution variables. This spectrum was discussed in details below:

A spectrum of individual-community governance

Following the synthesis workshop, it was agreed to analyse the results in the light of a purpose-built typology that recognised the existence of a spectrum of governance types from individual to community-based.

While the original intention was to compare the widespread granting of fishing licenses to individuals with more recent experimentations consisting in granting licenses to CFGs, the ten cases were selected with a view to cover a similar share of licenses granted to community and individuals for each geographical sample (3 townships). The rationale underpinning this methodological approach was the assumption that licenses granted to CFGs would result in more community-based governance. Yet, the results of the case studies pointed toward an important ambiguity between the granting processes and the resulting governance scenario (individual/community). The sample indicated that the granting of license to community did not necessarily translate in community-based governance, with the same observation applying to the granting of license to individuals. As opposed to the simple dichotomy originally assumed between individual and community-based governance, the results pointed toward the existence of a spectrum of governance types from individual to community-based.

To capture this range of scenarios, we hereby proposed to build on an existing typology. The latter was developed in the context of Myanmar to integrate the complexity of prevailing inland and coastal fisheries governance arrangements (Soe et al. 2017). For the purpose of this study, we put forward a simple scoring system focused essentially on the governance components, namely the equitability of access rights, and the sharing of decision-making and benefits within the fishing community (see Annex 2). We made use of this typology to categorize our cases *a posteriori* along a spectrum thereby creating 5 distinct types defined along a gradient of individual-community-governance (see Figure 1). We labelled our cases according to these groups for the data analysis. These types are described as follows;

- "Individual" tenure (2 cases): Access rights, decision-making, and profits generated from the fishery are limited to license holder (incl. CFG committee if applicable);

- "Quasi-individual" tenure (3 cases): Access right occasionally extends beyond the licenses holder (incl. CFG committee if applicable) through the payment of a fee but the decision-making and profits generated from the fishery are limited to the license holder (incl. CFG committee if applicable);

- "Mixed" tenure (2 cases): Access rights extends beyond the license holder (incl. CFG committee if applicable) through the payment of a fee, the decision-making is limited to the CFG committee with little inputs from other users, and the profit generated from the fishery is redistributed within the fishing community;

- "Quasi-community" tenure (2 cases) – access right extends beyond the license holder (incl. CFG committee if applicable) through payment of a fee; the decision-making is shared by all CFG members through consultation or via an elected body, and profit generated from the fishery is redistributed within the fishing community;

- "Community" tenure (1 case) – access right is granted for free for subsistence fishing activities, the decision-making is shared by all CFG members through consultation or via an elected body, and profit generated from the fishery is redistributed beyond the fishing community.

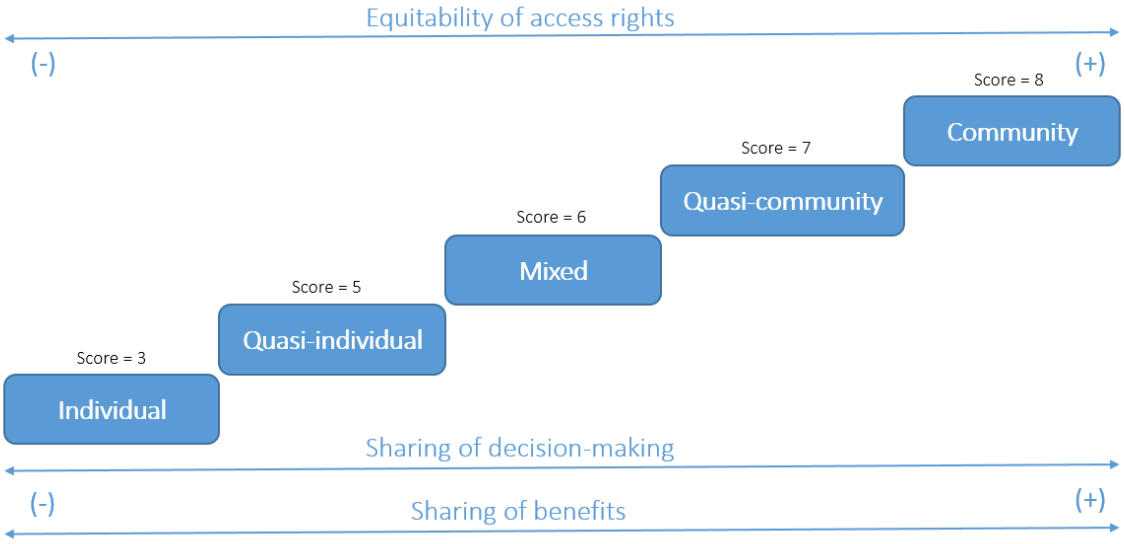

Figure 1. Spectrum of governance from individual to community-based

In the remainder of the report, we used this typology to support a broad reflection on the actual benefits and drawbacks associated with community-based and individual based governance. We did an identification of patterns between data associated with each study site (i.e. performances, strengths, weaknesses, issues, and solutions put forward) and its location along the spectrum of governance types. We supplemented this analysis with additional features specifics to each sites, such as the type of license, the aquatic environment, the support of CSO organization, etc. All of these features are summarized.

Based on the analysis depicted below, we further identified specific policy recommendations associated with the different type of governance arrangements and situated these within the existing legislative and regulatory framework.

5. Results

Background information of the fishery management systems studied is presented in Table 2 below. The case studies were conducted in four townships in Ayeyarwaddy Region. Information were gathered in three types: license (lease and tender) and one without license. The study team collected from two types of management (community and individual), which later were classified into 5 typologies of management (spectrum). Length of management, types of environment and the presence of CSO/NGO were also identified during the information and data collection.

Table 2. Information of the different fishery management systems

#	Fishery name	Township	License system	Type	Revised typology (spectrum)	Years of management	Aquatic environment	CSO/NGO involvement
1	Ah Lae Matkkon	Maubin	Lease	Community	Quasi-community	2	River	Yes
2	Aut Matkkon	Maubin	Lease	Individual	Individual	6	Channel	No
3	Hlaing Tar Mezali	Maubin	Lease	Community	Quasi-community	2	Channel	No
4	Kyonekadon Yeyoe Gyi	Pyapon	Lease	Community	Quasi-individual	1	River	No

5	Ha Hpaung	Pyapon	Lease	Individual	Quasi-individual	5	Channel	No
6	Ah Char Ka Dar	Pyapon	Tender	Community	Mixed	3	Channel	Yes
7	Sar Ma Lauk	Maubin	Tender	Individual	Mixed	2	Channel	No
8	Pa Zun chuk Sat Yone	Pyapon	Tender	Individual	Quasi-individual	3	Coastal	No
9	Sunye Inn	Kyauks e	N/A	Community	Community	3	Oxbow lake	No
10	Myint Thar Ngapat	Tada U	Lease	Individual	Individual	3	Oxbow lake	No

5.1 Individual Tenure

5.1.1 Management Performance

a. Aut Matkkon Lease

The lease is located in Maletto Auk Met Kun, Maubin Township. The lease was awarded to individual license with a price of 9,000 USD, an increase of more than four times compared 10 years ago. The lease owner divided the lease into four segments; he managed one segment while the three sub-leasers managed the other segments. The usual practice was to award the segment to their relatives; the same with the subleasee who provided access in the lease area first to their relatives and friends fishers. They provided all equipment, including boats and gears to their fishers on loan system with interest to be paid every time the fisher sells his catch to the owner. No fisher can sell his catch to anybody unless allowed by the lease/sublease owner (collector paying to the sublease owner).

People & Livelihoods:

Fish consumption among the population around the lease was sustained because they could catch fish outside the lease and buy fish from aquaculture. However, some stakeholders were concerned about the decline of fish from the wild, which may affect the poor who were food-dependent on capture fisheries. The fishers mentioned that their income decreased because the numbers of fishermen increased and aquaculture were expanding, affecting fisheries productivity in the fishing lease area. The fishers under the lease and sub-lease owner and collector mentioned that their income was still stable since they were allowed to fish in the lease area and sell their catch to the lease/sub-lease owner and collectors.

Natural system:

The biodiversity in the lease area was degraded because of the impact of the government priorities in agriculture such as irrigation and subsidies. After the construction of the irrigation gate in the lease area, the natural migration of fish was blocked. The change of ecosystem from natural flooded area to aquaculture also changed the habitat and spawning behaviour of many aquatic species. Illegal fishing system such as electro fishing and poisoning affected mortality and survival of larvae and juveniles of many fish species. The change of weather conditions affected the existence of some local species. Currently, lease productivity declined from 32 kg/fisher/day to only 11 kg/fisher/day during the peak season and from 8kg/fisher/day to 3 kg/fisher/day during the low season. Habitats in the creeks and rivers were at bad condition due to sedimentation and pollution. The restocking/reseeding of the lease areas was not working because of high activities on illegal fishing.

Institutions & governance:

On access to resource and resource sharing, only fishermen allowed by the lease and sublease owners can fish or have access in the fishing areas of the lease. Individual lease was not fair to

the small fishermen because they lacked equipment and the lease and sublease owner don't trust them. The fishers allowed to fish do not have problem on market because the sub-lease owner and collectors bought all their catch. The market demand for wild fish was increasing compared to fish from aquaculture. Fishers have limited access to loan or financial services, only sublease owner or collectors were providing loan to their fishers. The financial institutions and the government have inadequate financial support to fishermen. The sublease owners were not enforcing the policy on closed season agreed with the government because they need to recover their investment and gain revenue. The fishers were not aware of any regulations being imposed by the government because they were not informed. The policy and regulations was inexistent in the lease area, the sub-lease owner could not control illegal fishers in their respective area especially at night time. The fishers follow the instructions from the sub-lease owner who allowed them to fish in the lease area. The people were not concerned about policies and regulations to sustain their resources because of population increase and decreasing fisheries resources. On the other hand, the lease and sublease owners were only concerned on their benefits.

External drivers:

Illegal fishing activities in the lease area were on the increase due to lack of enforcement of the law. Poverty in the area forced people to do illegal fishing as food and as earned income. The lease and sub-lease owners had limited capacity to monitor the area the whole time. The ecosystem was degrading because of aquaculture, agriculture, and the establishment of new infrastructures. Irrigation was raised as main infrastructure that affected the ecosystem, especially on fish to migrate for breeding and spawning. The communities' expansion of aquaculture and agriculture contributed to pollution as effluents were directly discharged to the creeks and channels leading to the degradation of habitats and water quality.

b. Myint Thar Ngapat

The lease is located Myit Thar Nagabut Village Track, Mandalay, the lease was auctioned as individually managed since 2013. The lease was under individual license with a price of 3,580,000 Ks, an increase of 10% from the previous year. After the auction, the lease was divided into two segments (a large and small segment). The lease and sublease owner exclusively managed the lease with high restriction from surrounding communities. The lease and sublease owners employed their relatives at an average number of 6 – 7 fishers, which paid a salary of 8,000 ks/day. Conflict was high in the lease with illegal fishers as a result of a very restrictive fishing ground access.

People & Livelihoods:

Fish consumption was not much affected in the lease area because of the availability of aquaculture fish in the market. Some communities diversified to other food products. The lease/sublease owners were the only stakeholders affected by loss of income due to the decreased of productivity of the lease. The fishers involved were not also affected because their salary is fixed. Other communities were not dependent in fishing because they have diversified their source of income including farming as the main source of income in the lease area.

Natural system:

Biodiversity and fish stock continued to decline in the volume, the number of species and reduced size of catch due to illegal fishing, climate change, and change in connectivity of the natural flow of water. Fish stock continued to decline due to decrease of the water flow caused

by the road construction and up-stream obstruction. Old connectivity with the larger Dokehta River affected fish migration in the lease. Panning of gold using chemicals up-stream had impacted the water quality and productivity of the lease area. The increasing deforestation in the Ayeyarwady basin reduced the fish habitats in the lease area. The lease productivity continued to reduce, forcing people to focus on other sources of food and income.

Institutions & governance:

The lease owner had restricted access into the resources in the lease. Although, he allowed use of water for other purposes, i.e. agriculture; however, he restricted them to fish in the lease. Fish market has improved in the past years, lease retailers can sell their fish in other markets with a better price. Only the lease owner provided financial assistance to his employees. Previously, there was a financial institution supporting the farmers but later left the village. The lease owner decides on the rules and regulations to his fishers and the village track head shared the rules and regulation from DoF to inform them about illegal fishing activities. The DoF enforces the law, but no change was seen regarding the lease rules and regulations.

External drivers:

The lease restriction and remote management of the lease owner forced the fishers to do illegal fishing activities including poaching of outsider fishers from other villages. The lease environmental conditions were continuously degraded due to population waste and agricultural pollution. Road and irrigation infrastructures affected connectivity of water flow and fish migration.

In summary, the individual tenure had a very low level of performance across all dimensions of the system, especially for the ***Natural System*** dimension (Figure 2). Stakeholders worried about the continuous deterioration of the integrity of the fishery ecosystem, including water quality, biodiversity, habitats, and fish stock. This tenure system reportedly aggravated by the ***External Drivers***, such as illegal fishing, and other anthropogenic activities (i.e. agriculture, aquaculture and waste disposal) that contributed to a fast deterioration of the ecosystem. Both cases were notably characterized by irrigation infrastructure that blocked the natural flow of water and the migration of many river fish species. The decreasing biodiversity and lower catch seemingly affected the ***People and Livelihood*** dimension, including food security and community cohesion. Illegal fishing, poaching and conflicts in the lease area had increased due to the lease holder restriction. Fishers reported that only the license and sub-license holders benefited from the system. Almost all the catch was sold to the owner who solely determines the price. The license and sub-license holder administered the system by giving access only to their relatives or friends. The license holder made all the decision on both open and closed season, the fishing operations, post-harvest and marketing. The monopoly of decision-making benefits to the owner resulted into poor performance on the ***Institutional and governance*** dimension, with most fishers in the village reported that they were deprived of taking part to the fishery management. In both cases, the license holders were reported to not care about implementing conservation plan agreed with DoF, incl. restocking and respecting a close season. The license holders wanted to get returns and profit from their investment rather than be concerned about the sustainability of the system. Since there was no guarantee regarding license in the next auction, the license holders tried to harvest all fish before the end of their tenure.

The stakeholders of both cases were skeptic about the future of the lease because of the declining productivity of the fishery. The development of agriculture and aquaculture reportedly had a negative impact on the natural ecosystem, contributing to habitats destruction, interruption of water natural flow, sedimentation and pollution. Stakeholders

further explained that the opening up of factories in the village draw in people who lose interest in fishing because of lower catch and income. This system makes them desperate about future development of the lease.

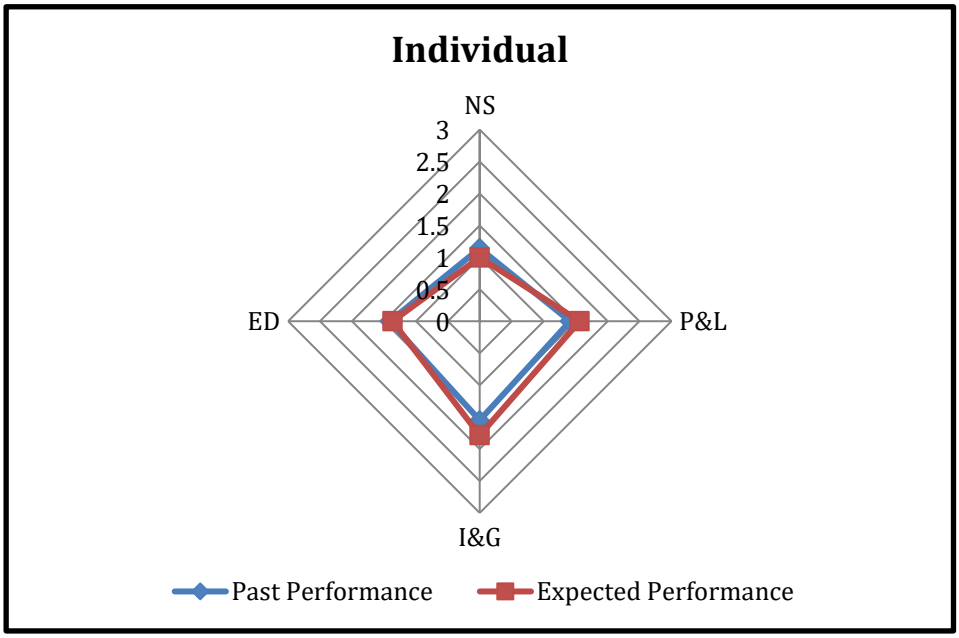

Figure 2. Individual Tenure Performance

5.1.2 Constraints and Challenges

Most of the constraints/challenges mentioned in an individual tenure fell under the People & livelihood (Figure 3). In this type of tenure, only few fishers had access to the lease and the lease holders decided who can access to fish in the lease. The restricted access of the lease to selected fishers resulted to the issue of food insecurity and income of the fishers in the immediate villages of the lease. The main issue of the fishers with access to the lease was the controlled market by the lease or sublease holder, according to the fishers, the lease holder dictates the price of their catch. The lease fishers received loan support from the lease holder for gears and other expenditures for their fishing activities; however, they were compelled to sell their catch at agreed price, which was usually lower price than the market price. This indicated that even if they were allowed to fish in the lease, their income was still constrained with this condition yet providing better income for the lease holder. This context, put Institution & Governance second as a constraint in the operation of the system. The restriction of the lease encouraged illegal fishing (including poaching) from the lease. Access to market, financial institutions and to the sharing of resources had been denied in this management system because all benefits went to the lease holder. The objective of the individual tenure was mainly business, thus even if there were agreements in the contract for the auction, such as close season, reseeding, no take zone, these were very seldom followed. Some DoF policy and regulation were not also enforced due to the priority of the lease holders and the limited cooperation of the DoF with the lease holders after award of the lease. The current management system is a profit oriented system without the concept of conservation or sustainability of the ecosystem. Stakeholders cited that without proper collaboration of the current management system with the government and other sectors the External Drivers will continue to contribute destruction in the ecosystem. The cited issues were illegal fishing, pollution from agriculture, infrastructure such as road cutting the connectivity of the lease, encroachment of habitats for aquaculture, sedimentation, water pumping for farming, and irrigations affecting fish migration and water level. The Natural System had the least challenges

because overall the mentioned constraints resulted to the reduction of productivity that affected food security and livelihood of the people.

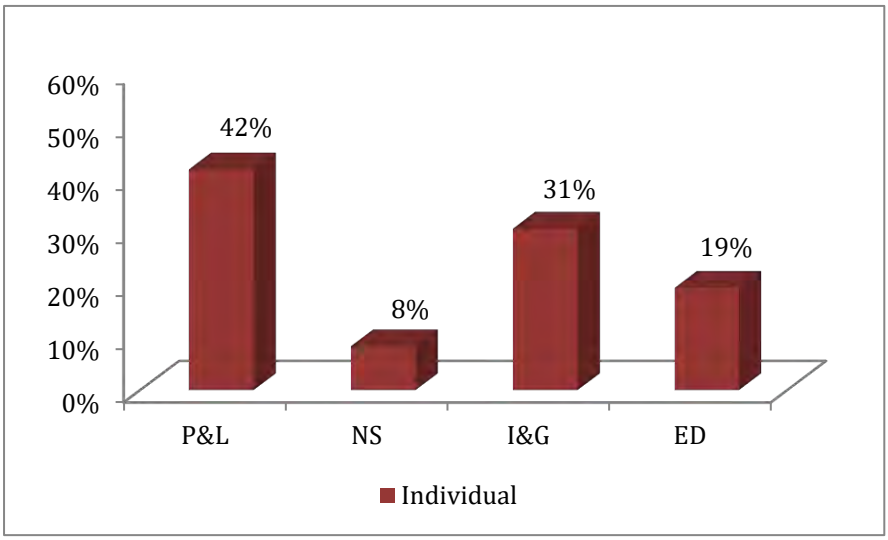

Figure 3. Percentage of identified challenges in an individual tenure

5.2 Quasi-individual Tenure

5.2.1 Management Performance

a. Kyonekadon Yeyoe Gyi Lease

The lease was located in Kyon Ka Dun Village, Pyapon Township. The lease was awarded to community fishers group (CFG) for a community-based management system. The current system coincided with the broader regional policy change which prevented 'minor licensed' fisheries (i.e. leases and tender with annual license price under 4 million Kyats) to be auctioned. The new policy required them to be systematically allocated to local fishing communities at floor price. The current price of the lease was 3,000,000 Ks, which was 50% lower than the highest auction price in 2012. The CFG committee managed the lease, the lease was divided into 6 segments for large stow net operation. The CFG members were provided access rights through paying their fees based on the type of fishing gears. The CFG have a financial structure with revolving fund dedicated for the next auction and for the day-to-day operations. The new management system allowed all fishers to sell their catch to their preferred buyer. Importantly, the decision-making was now very much in the hands of the large-scale (stow net) fishers who were the only members to sit in the CFG committee.

People & Livelihoods:

Both the dwindling resources and the increasing demand for fish outside the fishery had resulted to the decreasing amount of fish consumed by local communities over the years, thereby affecting local food security. The decreasing contribution to food security could be explained by the increasing population. The large-scale fishers and Government officials reported that income generated from fishing had improved under the new management system because of the increased fish price. On the other hand, small-scale fishers and CSO reported that the increased fish price had only partly compensated for the lower catch, and that the income of fishers was still the same.

Natural system:

The biodiversity in the lease area deteriorated due to the deforestation of mangrove by local communities who used wood for cooking purposes. This alteration of the fish habitat adversely affected the natural breeding and spawning of some species (e.g. sea bass and prawns were impacted the most). The CFG had a very limited control over the mangrove deforestation. Fish stock and size were reduced in the lease area due to pollution and use of chemicals to catch prawns.

Institutions & governance:

Fishers and traders increased their access to market. This trend was largely justified by the freedom of fishers who sold their catch to their preferred buyers under the CFG management, but also by the increased demand and overall number of fish collectors. A very positive trend was observed about the equitable access to the fish resources. The CFG management on access rights (for both large and small-scale fishers) were very positive developments for the local fishing community. There was an improvement of the situation of the enforced rules and regulation, however, the CFG still had difficulty enforcing rules and regulations in the fishery in their current capacity. The CFG management contributed to increasing awareness of the fishers about the DoF rules and regulation. However, illegal fishing activities (e.g. use of chemicals to catch shrimps, continuation of fishing during the closed season) were aggravated, representing an important threat for the sustainability of the fishery resources. Finally, there was no access to financial services in the village, fishers got indebted with private moneylenders charging with a very high interests.

External drivers:

Agricultural activities in the surrounding were blamed for negative impact to the natural fish productivity. Small-scale fishermen reported decreasing catches due to sedimentation and decreasing level of water caused by the irrigation sluice gate. In addition, there were complaints about the important level of chemicals used by neighbouring farmers that affect primarily the shrimp production.

b. Ha Hpaung Lease

The lease was located in Ah Paung Village, Pyapon Township. This lease was awarded to rich individual owner and hired a local fisher to take care of the lease on a daily basis. The owner allowed fishing in the lease from June to November; however he charged high fees on the type of gears the fisher will use. Although, the owner allowed fishing during the month of December to May, only few fishers availed access of the lease because of high price of rights and catch was low. Furthermore, the lease owner allowed small-scale fishers to fish for their own consumption only between the months of January to March. The lease was divided into five segments where the lease owner directly managed the four segments, allowing a sublease owner to manage the fifth segment. The Lease owner installed the stow-net as the main fishing gear during the peak season from June to October.

People & Livelihoods:

Local communities' fish consumption decreased due to the declined catch in the lease area. Population were increasing, thus fish consumption in the village had increased, with lower catch, fish consumption per household had reduced in the village. Fish is an important source of income in the village since other opportunities within the village have lower revenue. Although catch decreases, the price of wild fish in the local and export market had increased.

Natural system:

Stakeholders perceived not much change of biodiversity in the lease; however they observed destruction of habitat and conversion of river banks into gardens causing pollution,

sedimentation and narrowing of the channel in the lease area. After the Nergit storm, it was observed some appearance of new fish species (tilapia, wallago attu labeocalabasu and clarias species). People perceived that climate change and other irregularity of water quality had contributed to the deterioration of biodiversity, fish stock and habitats of the lease.

Institutions & governance:

The lease owner allowed fishers to fish as long as they pay for their access fee. This access right was limited for the month of June to November. The poor or small scale fishers were allowed to fish during the peak season but for consumption only. Fish were sold to the lease owner who determined the price. Fishers did not have other options to sell their catch because there were no collectors in the village with the current management system. The fishers did not have access to any financial service from any institution in the lease area except with the owner. The DoF was supporting the lease owner in the enforcement of the fisheries law, but not on a regular basis.

External drivers:

The paid access rights of fishers in the lease reduced the illegal fishing activities as the small size of the channel made it easy to control. The real issue seems to lie in the destructive illegal fishing using poison and electro-shock fishing. Stakeholders observed that farmers' excessive use of fertilizer and pesticides also contributed to water pollution. Another issue brought out was the closing of the upstream water gate to conserve water and prevent salt intrusion which resulted to a slower flow and shallower water in the downstream lease that made a migration barrier between the floodplain and the lease area.

c. Pa Zun chuk Sat Yone Tender

The tender was located in Chaug Wa Village, Pyapon Township. The tender was awarded to individual tender holder at around 2.5 million Ks. The tender holder divided the tender into three segments. A segment holder normally employs 4 to 6 fishers. The tender holder and sub-leasers fish between October and February, with the rest of the year left open to villagers to access. The tender holder and sub-lessees used fence net and the other fishers used traps and pull nets along the beach during the open access fishing. There was no closed season imposed by DoF, but fishing between May and July was not productive since the high water level was not conducive to fence net fishing. Fishers had to ask the segment holder on their access rights even before the auction.

People & Livelihoods:

Stakeholders observed a 20% decline in overall consumption of fish as source of protein. The reasons provided were the decline of fish catch and higher market price. Some stakeholders mentioned that some villagers turned to other sources of protein. Income from fish varied among stakeholders: tender holder's income was stable although fish productivity decreased yet offset by increased market price and lesser cost of transport due to better road infrastructure; on the other hand, the income of fishers and processors decrease due to lesser volume of fish and the increase of materials and ingredients in processing fish. Another attributor to the declining fishers' income was the tender holder controlled market and price. Fishers tried to compensate for loss of income through diversifying other sources of income.

Natural system:

Stakeholders noted the declined in fish biodiversity and stock in the lease due to fragmentation and degradation of habitat in the system and illegal fishing activities. Significant forest covers of mangroves were cleared prior to the Typhoon Nargis. The expansion and intensification of paddy farming and construction of sea dikes had contributed in the destruction of fish habitat

in the tender including pollution, erosion and sedimentation. The paddy irrigation gate had blocked fish migration, which resulted to decrease of fish size and catch in the tender area. It was observed that some commercially valuable species had declined including sea bass, tank goby and wallago attu. It was observed that fish escaped from aquaculture pond had contributed to the introduction of exotic fish species in the tender fishing area replacing other endemic species.

Institutions & governance:

The tender holder allowed everyone to have access into the fisheries resources of the tender as long as they satisfy the conditions set including the fees, gears and timing. Fees were charge according to gears the fishers will use. The tender was open at all times except during the peak season and time for the tender holder to fish through fencing of the tender area. As catch declined demand and price were increasing in the market. Tender owner and commercial fishers, and processors had better access to market and price while small scale fishers with small size of catch experience limited market and price. Tender owner and commercial fishers had better access to financial services from both government and private financial institutions. Some fish processors were receiving financial support from NGOs. Small scale fishers usually did not have access to financial support both from government and financial institutions. The tender holders didn't have much problem in the enforcement of regulation in the tender areas because people acknowledged their access in the tender during the open access period. However, the DoF noted illegal fishing activities in the water adjacent to the tender areas due to limited awareness of the people about the law. The DoF had recorded conflicts among commercial fishers, small scale fishers and illegal fishers outside the lease area. The DoF had limited staff and resources to conduct regular patrolling activities in the adjacent water of the tender. According to stakeholders, the fisheries law was still limited on its content including sustainable management of the inland and coastal fisheries in terms of closed season and restriction of gears. They mentioned that there were no clear policy and regulation to promote sustainable fisheries at the local level context.

External drivers:

Stakeholders mentioned that illegal fishing activities in the adjacent water of the tender area were widespread and increasing. They said that previously people did not practice illegal fishing activities but currently it became rampant including fish poisoning. The government acknowledged that it was hard to control illegal fishing particularly use of poison which was operated at night time. Environmental issues were also a challenge in the tender area, including the use and inappropriate disposal of plastic, use of toxic chemicals in farming, destructive fishing of large fishing vessels, and cutting of mangroves for firewood. The operation of irrigation gate and canal for paddy production and sea dikes as infrastructure had impacted fish habitats and fish migration.

In summary, stakeholders rated *Satisfactory* the management performance of this tenure on the Institution and Governance dimension (Figure 4). The lease/tender holder (individual/CFG) in this tenure allowed access rights to fishers provided they pay their obligation fee, use allowed fishing gears and fish only when the lease is open for fishing. The fishers sold their catch to their preferred traders or market as demand had made fish products easier to trade in the area. Fishers have access to financial services from lease holders and other financial institutions, however many fishers were indebted to moneylenders who charged high interest.

Cooperation of the fishers was sought to enforce the law and regulation, and fishers largely follow the legal system. The External Drivers dimension was rated as satisfactory level of performance because lease/tender holders in a smaller lease can control illegal activities. But

in the big lease areas, the lease/tender holder could not fully controlled illegal activities. Lease holders cited as constraint the limited support of the DoF in the enforcement of the regulations they agreed on. Also, lease holders could not control the building of irrigation water gates which resulted to the low water level of the lease and which affected fish migration. Encroachment and clearing of habitats for agriculture and aquaculture, as well as human settlement and industries, were on the increase within the lease area and affects its productivity through pollution and sedimentation.

There was also a satisfactory rating on the People & Livelihood dimension, since this system provided fishers' access to the lease, better market, and access to financial support to the fishers. Some stakeholders mentioned that the price of high value species had increased in the past years because of the declining fish population and increasing demand. The income of fishers increased, while other sources of income were availed. However the poor who were dependent in fishing were the most affected by the declining catch in the lease/tender. Fish consumption among the population and availability of fish at the local markets started to reduce because of high demand in the urban areas. Finally, the Natural System rated the lowest performance among the dimensions. The fast deterioration of fish stock and biodiversity of the lease came about as adverse impact of habitat degradation, poor water quality and level, sedimentation, pollution from agriculture and human waste, migration of fish to breed and propagate, illegal fishing, and overfishing. The lease towards the coastal area was undergoing habitat modification due to paddy development and building of sea dikes along the shore, where mangroves were cleared.

The stakeholders perceived that lease/tender holder's management or the Institution and Governance dimension will improve in the coming years. Improved management of the system may control the contributing factors in the External Drivers and maintain the system in its current state. However, the future performance for Natural System dimension shall be a trend of deteriorating ecosystem of the lease. Stakeholders were cynical that the natural system can recover since the external drivers cannot be controlled without cooperation among the direct users of the lease, the government and other development partners. Stakeholders supported that the DoF, promote awareness raising of fishers to conserve their natural resources and close collaboration with other sectors may promote sustainable management and productivity of the system. The Figure 3 below expressed the stakeholders' skeptic rating of People and Livelihood dimension, which food security and income will continuously reduce in the coming years based on their experience and observation of the current context.

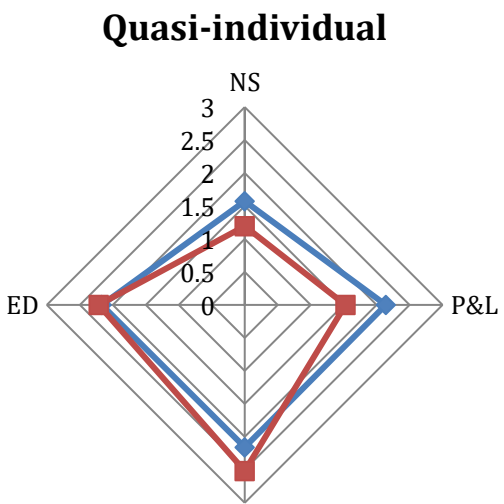

Figure 4. Quasi-individual Tenure Performance

5.2.2 Constraints and Challenges

Stakeholders identified constraints/challenges highest under the People & Livelihood dimension (Figure 5). The main issue in this tenure was the limited access of the local fishers in the fishing area affecting food consumption and income of the people. The lease/tender holder or the government (DoI) restricted access by local fishers in the area but allowed large scale fishers in the AD and to some employed fishers in some leases in CDZ. The challenges in Institutions & Governance were the enforcement of policy and regulations including closed season and reseeding agreed in the auction. The lease holders could not control the External Drivers of illegal fishing activities, pollution, sedimentation because of the limited collaboration with DoF and other relevant sectors in the lease area. The limited collaboration contributed to the decline of the Natural System productivity, including biodiversity, habitats and fish stock.

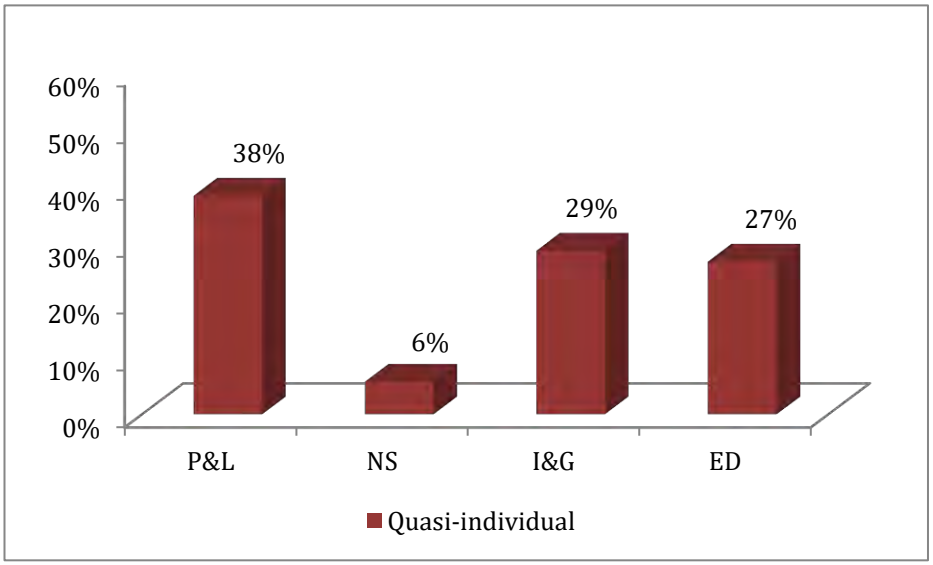

Figure 5. Percentage of identified challenges in a quasi-individual tenure

5.3 Mixed Tenure

5.3.1 Management Performance

a. Ah Char Tan/ Ka Dar Tan

The tender was located at Ah Char Village, Malato Village track, Pyapon Township. The tender was awarded to community-based management system under FDA at around ? Ks. This tender consisted of two tenders previously under individual management. The Fisheries Development Association (FDA) facilitated the setting up of a community-based fishers that circumvented the legal requirement of a CFG. This transition to community-based management reduced the license cost to at least 50% of its previous price. The most significant change in the new system was the reduction of stow nets in both tenders which enabled space for drift net operators. However, the restriction on the number of stow nets sparked internal tensions

between the CFG and FDA, leading to the former removing the latter in the management constituency.

People & Livelihoods:

Fish consumption among fishers was reduced because most fishers now sold their catch for income, thereby ensuring fish availability in the local markets. The community-based management had lowered down the license floor price, which allowed lower investment fee for the fishers and provided better income for the fishers. The free market allowed additional income for the fishers. Small-scale fishers who were not members of the CFG were able to benefit as they could fish without having to pay for access fees since previously restricted small water channels were opened up to them. These fishers utilized more trading options either within the village or with external retailers for their catch, giving them the opportunity to increase their income

Natural system:

Biodiversity and fish stock in the tender had declined due to the use of agriculture pesticides and chemicals that polluting and killing the larvae, fry and fingerlings of different species. Over extraction, illegal fishing activities, and loss of habitats had contributed in the decline of biodiversity in the area. Mangrove as main habitat in the area had been deforested for firewood, which resulted to erosion, sedimentation and loss of spawning area for many species.

Institutions & governance:

The price of the lease was reduced under the new CFG management and fishers paid lower access fee to fish in the tender areas. Fishermen were at liberty to sell their catch to their, preferred retailer, thus enabling increased income more so for wild fish catch which fetched higher prices. Better transportation to the urban areas was also a factor for better prices and more trading opportunities. There remained few financial institutions and NGOs providing financial services to the communities--including Mya Sein Yaung, NAG grant and World Vision. These institutions had limited support to small scale fishers because of the latter's delayed loan payments. Stakeholders said that most fishers abided on the law and regulation in the tender after open access was given them, especially on the use of legal gears and waterways. Furthermore, regular patrolling was conducted and strict penalties were implemented when found violating the fishing rules of the CFG, including removal from membership. On the other hand, the government was skeptic on the sustainability of the fisheries resources because they thought that open access may result to overfishing of the tender. With the presence of the CFG as a centralized organizational structure, the DoF can effectively support the community to raise awareness or disseminate information to local members on important topics. With good participation by members and fair benefits given by the CFG, the DoF can properly assist in coordinating maintenance and development of the lease.

External drivers:

Outsider fishers were reported conducting illegal fishing near the tender areas. According to stakeholders it is difficult for the DoF to properly monitor the large river because they are under-staffed. The stakeholders were skeptic that the tender environment and water quality will be difficult to improve due to the continuous contamination from agriculture pollution and waste effluents from the residents near the tender.

b. Sar Ma Lauk

The tender was located at SarMa Lauk village, Maubin Township. The tender was currently awarded to a CFG organization. This is currently managed by the CFG designated person. The CFG secured the tender with the sum collected from sub-lessees of the segments. The floor

price of the tender was reduced to 50% after it was awarded to the CFG. The tender was awarded in May and concluded in April of the following year. The tender was sub-divided into 3 broad segments, two of which were sub-leased to villages within the 3 village tracks around the tender. Fishing was open to all during the flood season (Jun-Aug), after which the tender holder and sub-lessees exercise restrictions. The tender holder decides on price for segments subject to sublease, the number of people allowed and the fee to access fishing in the segment under the CFG arrangement. The segment holders can decide on the number of fishers and the price for access or otherwise fish it themselves. Since the fishers made down payment prior to the bidding, they were free to sell their catch to any customer.

People & Livelihoods:

Currently, small-scale fishers' catch still met the local consumption demand. However, the market demand for capture fisheries is increasing and some small-scale fishers sold most of their catch. The local community prefer to consume wild fish rather than those raised through aquaculture, therefore, wild fish consumption will further increase in the next 5 years. But the income from fisheries decline with the lesser catch volume and lower price, except among fish retailer and processors whose goods have higher value.

Natural system:

Biodiversity in the tender declined in the last five years due to illegal fishing activities and over fishing. Introduction of new species that escaped from aquaculture were affecting endemic species to be extinct. It was observed the decline in volume and species of many local fisheries resources due to overfishing. Fish stocks were declining due to over fishing of both breeders and fingerlings during the peak season. According to the fishers, almost 50% of their catches were reduced compared 5 years ago. Other contributors of the decline of biodiversity and fish stock were the expansion of fish ponds and agriculture along the tender. Habitat in the tender had been fragmented due to fish pond excavation and blocking of the canal for irrigation. Sedimentation and narrowing of the canal had been attributed to the degradation of fish habitats within the tender. No habitat in the tender was protected and the extent of detrimental fishing, eutrophication and sedimentation due to practices in and nearby the site environment threatens productivity and viability of the system.

Institutions & governance:

The government change of policy in the lease and tender had provided fishers better access on the resources in the area. The people enjoy free access to fishing, whether they are legal or illegal and detrimental, as oppose to several years before when their access was restricted. There was no limit on gears and people were also allowed to fish during the flooded season, July-August, as oppose to the general closed season rule imposed by DoF between May and July. Each village along the lease was given their own designated area/segments for their members to fish. The CFG allowed the fishers to sell their catch on their preference. The decreasing supply of wild fish had triggered the increase of price. The retailer and processors brought their products in the township market with better access to transportation and better roads. One of the main positive outcome of the CFG management was the access by local fishers to low or free interest loan to fishing from local fish collectors/ retailers. In addition, government had also recently provided small loan to all poor households for their livelihood development. There was presence of financial institutions in the township with better coverage areas. The government had extended financial support in the sector. There was little to no restriction or enforcement in fishing and everyone tends to enjoy current access. There appears to be misperception that current access and (lack of) management was the norm under CFG. Fishers were not aware or they didn't have idea on rules & regulations. There was no law enforcement in current area and weak on awareness for local people about the fisheries law.

External drivers:
Illegal and detrimental fishing were going on unabated, usually happened at night time. It was observed that even during the closed season, some fishers were still fishing inside the tender. DoF had prohibited fishing during the closed season and used of restricted fishing method including use of poison and electric. The current aquaculture and agriculture development in the flood plain couple with residential development and waste disposal had increased pressure on the fisheries and habitat through sedimentation, eutrophication, and pollution.

In summary, the stakeholders rated *high* the Institutions and Governance dimension of the mixed tenure per current management of the lease due to the fair access of fishers in the lease/tender, mostly legal but illegally in some cases (Figure 6). Those with access are free to use any type of gears without limit and allowed during the closed season. The CFG management of the lease has no clear guidelines to control overfishing and illegal activities, therefore, resulting to decline of productivity and biodiversity of the system. The fishers of the lease were allowed to sell their catch to any traders or the CFG management could bring it in the market for a better price. Better roads and infrastructure towards the urban areas made the market accessible. The fishers perceived that the price of fish had increased because the catch of high value species declined and demand was higher in the market. Fishers' access to financial services was still limited since these institutions doubt the capacity of the fishers to pay their loan, especially among poor fishers. The government and CFG tried to provide loans to the fishers but with limited capital, so some fishers took loans with higher interest from the traders or collectors who controlled the price of their product. Enforcement of the law had not been fully implemented because of limited enforcement policy and plan. The CFG was very new on its operation, hence unclear about how to implement the policy on arrest and penalties under the current Fisheries law or their by-law. Open access without monitoring, control and surveillance had triggered the proliferation of illegal fishing and poaching in the area.

In summary, the People and Livelihood performance in this tenure was rated *Average*. There were access of fishers in the lease no matter what season; fish was available for fishers' households; and, income had been stable even with decline of fish stock due to the increase of price and high market and demand. The External Drivers performance was also rated *Average* because of the new CFG management system of the lease/tender; although, the management still need to improve on, as it could not fully monitor and stop illegal fishing, however, stakeholders felt that it was better than the previous individual management system. The same with other tenures, the Natural System performance had the lowest score due to the declining biodiversity, fish stock and productivity of the system. The fishers observed the decline and loss of many fish species and biodiversity of the lease in the last 10 years. Again, agriculture, aquaculture and human settlements contributed to the deteriorating eco-system, but the wider area of rivers were less impacted by pollution and sedimentation.

The stakeholders' view of future management performance of the system was still positive. The Institutions and Governance and External dimension depends on an improved CFG management through policies, guidelines, plans to implement, monitoring, control and surveillance of the lease towards its sustainability. The CFG committee and the fishers are optimistic that the DoF at the township level will be equipped with human and other resources to implement and support the CFG to address the External Drivers of illegal fishing activities and environmental degradation. Stakeholders said, "If government will support the CFG management, there is a chance that the external drivers will be controlled." But stakeholders doubt that the Natural System and People and Livelihood dimension will not further improve. Habitat destruction and deterioration of water quality of the system coupled with illegal

activities led to a weak performance of the **Natural System.** This affects the catch of the fishers and detrimental to the food security and income of the people (**People & Livelihood**).

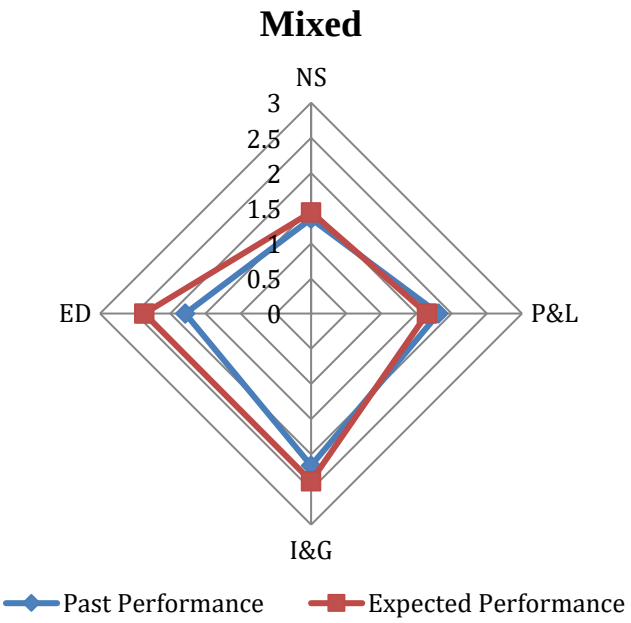

Figure 6. Mixed Tenure Performance

5.3.2 Constraints and Challenges

More than 50% of the constraints/challenges mentioned in mixed tenure management system fell under People and Livelihood. Although, the CFG managed some of the lease/tender, the management of the lease and provision of benefits to wider number of fishers was an issue (Figure 7). In some cases some of the village representatives didn't agree on the CFG committee; in this case, the fishers were the most affected on their food consumption and income. Fishers lost their revenue in the tender were affected on their food security and income. There were limited livelihood opportunities in the village aside from agriculture and fishing. Development support for SMEs was limited or lacking, that could possibly provide additional income for the fishers. Institution & Governance issue was related to the capacity and trust of the CFG members, particularly leaders in other segment of the lease. The leaders or focal point in the segments were representing the CFG members, supposedly providing clear information back to its members including access to resources and support, conservation, and benefits of the CFG members. The limited participation of the CFG committee and members on meeting or workshop with government and other stakeholders to increase their management capacity, awareness and knowledge about the purpose of the CFG and sustainability of the resources had resulted to weak management of the system. The non-cooperation among the committee and members of the CFG within the lease had resulted to illegal fishing activities in the lease and uncontrolled External Drivers. Aside from uncontrolled illegal fishing, pollution from agriculture and population, sedimentation, water quality and level issues, habitat degradation the Natural System was now suffering on its productivity. Although, the weakness had been focused to people & livelihood, the main root cause of this was the undistributed benefits of the lease to the fishers especially to the poor. Without good collaboration of the stakeholders with government and development partners for the development and sustainability of the lease, the food security and income of the people will be at risk.

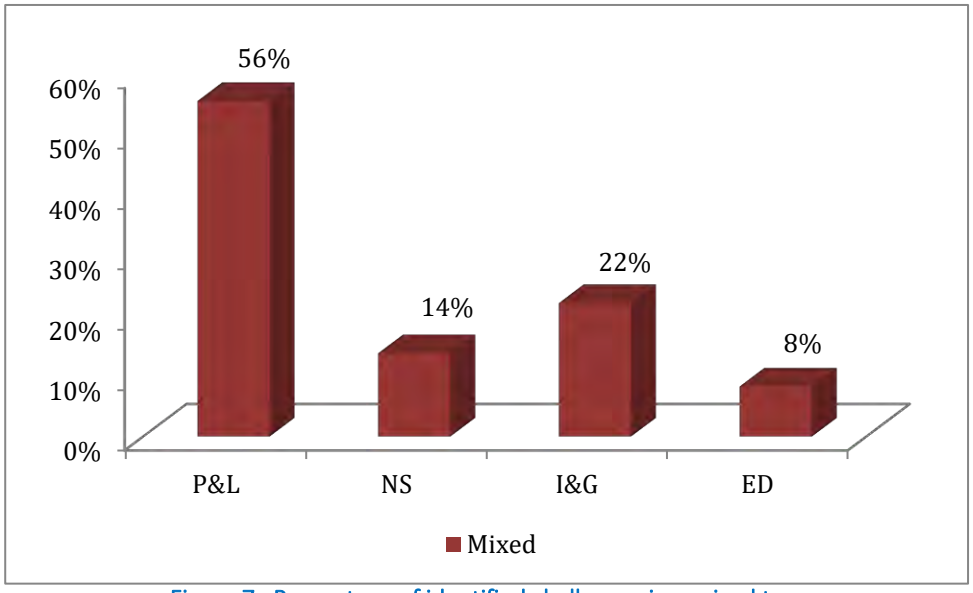

Figure 7. Percentage of identified challenges in a mixed tenure

5.4 Quasi-community

5.4.1 Management Performance

a. Ah Lae Matkkon

The lease was located at Pantanaw Township, Maubin District. The lease was awarded to CFG organization under FDA. The current lease price was around 3 million Kyat (2,154 USD) an increase of more than 200% from 2018 floor price. The lease was divided into 6 segments (6 villages) and the fishers' group in each village had full control over their agreed territories. The control and monitoring of fishers and gears were strictly implemented because every village leader had taken loan from money lenders with high interest to complete the contribution of the village HH for the total lease fee. The current CFG management system could now control illegal fishing activities because of the cooperation of the fishers to protect and conserve their investment and resources as their assets. The lease was awarded during the month of May for a whole year management. The peak fishing season was during the month of August and September. Fishing was expanded to the floodplain during the start of open season, fishers were allowed to fish in the rice farms during the open season but only for two months.

People & Livelihoods:

Fish consumption was still stable in the villages due to fishers open access to fish in the lease areas. Fishers with enough money to pay their license have better access to fish in the lease and with better income than the small scale fishers without the capacity to pay their license. The fishers' liberty to choose their trader had provided higher income to them compared before that they were not allowed to sell their catch to anybody except to the lease holder. The declined of productivity of the lease had reduced the income of fishers, in particular the small scale fishers. Other fishers had changed their source of their livelihood to more productive one than fishing.

Natural system:

The lease biodiversity and fish stock continuously to decrease due to overfishing, expansion of fishponds in the previous spawning ground of different species, illegal fishing and use of poisonous chemicals. The non-management and conservation previously had resulted to the decrease of biodiversity in the lease. Another contributor in the loss of biodiversity was the integrity of the habitats, according to stakeholders, the sedimentation in the creek was very

high, increase of water hyacinths, construction of dikes and fence for agriculture purposes and no protection measures to conserve the habitats in the lease area.

Institutions & governance:

The new CFG management had allowed all fishers to fish in the area. The lease floor price had been reduced to encourage an open access to the lease. The Fishers mentioned that in the previous lease management there was a lot of conflict on the access to the fisheries area between fishermen and the owner, now conflicts have been reduced. However, some respondents mentioned that benefit sharing and equity was not yet really applies. Although they pay the same fee of 5,000 Kyat/fisher (around 4 USD/fisher) for the payment of the lease, but catch in the lease differs from different gears used. The current issue of the fishers now was their access to the floodplain during the open season where fish were in the rice fields or habitats to spawn. According to the fishers a big size of the lease area had been converted to either agriculture or aquaculture areas. The fishers complained that they cannot fish near aquaculture ponds as they were apprehended by the guards. Fishers mentioned that high dikes and fences were built to exclude fishers to fish in the farms that were previously part of the lease area. In terms of trading, the fishers mentioned that it improves; now they had a better market price in the village because there were more traders where they can sell their catch. However, the traders complained that price at the township and regional was not increasing and they were losing when giving better price to the fishers. Fishers, processors and traders had limited access to financial support from both private and government. Enforcement of fisheries law and FDA rules and regulations had been effective at a local level implementation. With CFG members' investment and provisions of segment per village had been an effective mechanism to protect the lease from illegal fishing activities. Each CFG segment had the same management system on setting up a no take zone area of the lease and the members strictly following the open and close season. However, the rules and regulations on the mandates of the CFG and guidelines on the sustainable use and management of the lease were still limited.

External drivers:

It was observed a significant reduction of illegal fishing activities in the current management system. The investment, tenure and ownership of the segments had provided more responsibility to the villagers to take care and prevent their area from destruction and illegal fishing activities. With ownership, the CFG members were strictly following the laws and policies being implemented by the DoF. Agriculture had been an issue in the lease because of the uncontrolled use and disposal of chemicals towards the lease resulted to pollution in the immediate water bodies. Expansions of fishponds were affecting habitats at the lease areas resulted for the loss of the fisheries habitats for breeding and spawning during the flooded season.

b. Hlaing Tar Mezali

The lease was located in Mallago village track, Maubin Township, Maubin District. The lease was awarded to CFG organization under FDA. The lease floor price in 2017 was at 13 million Kyat a 10% increase from the previous year. Under the current management the lease was divided into 7 segments following the village administrative boundary through a consultation made between the LMC, chief of the village tract, and a township DoF staff. For each segment a non-fishing zone, about 100m x 10m in size, was designated. LMC supervises how fishing was allowed in each and all segments. The village CFG leader was the holder of the segment and makes upfront investment to contribute to cover the overall cost of the lease. The reduced fees on access to fishing had enabled many more local fishers to access fishing in the lease segments. The lease was awarded during the month of May and closed until August. Fishing

starts in September until April, peak season falls between the month of September and November. Small scale fishing was allowed during the closed fishing season.

People & Livelihood

Food security including fish consumption in the village was stable according to the stakeholders, in particular that fishers were given full access to fish in the lease. Fishers mentioned that with better income they could suffice their need for food and nutrition. Stakeholders mentioned that aquaculture in the area play a role of sustaining availability of fish supply in the village. Currently, fishers were getting better income compared in the past that they were forbidden to fish in the lease area. The fishers' free access to the lease had significantly improved their livelihood and income. Although there was a decline of fish catch, the current increase of price of fresh fish had maintains better income for the fishers and traders. Other stakeholders got benefit from the open access was the processors, more fish to process could be bought from more fishers.

Natural system

All stakeholders agreed that biodiversity in the lease continues to degrade to date. Infrastructure in the channel including gates to control water for irrigation observed to impact a long term effect on the natural system of the floodplain where the lease was located. The gates were closed during the flooded season and fish migration for breeding and spawning, which affecting fish stock and biodiversity. Although there was a seed stocking practice being implemented in the lease, endemic species continuous to decrease and some exotic species released from ponds were invading natural water bodies when accidentally escaped to the natural water system. Expansion and diking of fishponds in the floodplains were affecting habitat destruction and fragmentation.

Institution and Governance

The CFG availed lease had provided an equitable fishing access to all fishers in their immediate lease segments. Small scale fishers were allowed to fish in the lease all year round, providing better food and income for this group. Road infrastructure had provided better transportation in trading fish in the urban market to get better price for both fishers and traders. Access to financial services both from private and government were still limited, especially for the small scale fishers because of their limited capacity to pay their loans on time. The CFG members were enforcing the rules and regulations stated on their by-laws or guidelines for the CFG mandate. However, the CFG mandate was still limited including apprehension of illegal fishing activities in the immediate water bodies of the lease segments. The DoF was the only institution mandated to penalized perpetrators from outside the community. The CFG did not have legal mandate to apprehend the farmers in using too much chemicals and pesticide and release their waste in the lease water bodies. The current government policy was providing priority to agriculture production than conservation of the fisheries in the lease.

External drivers

The fishers had a better compliance of the rules and regulations to conserve the fisheries resources. After the provisions of fishing access for a full year round, it was observed a reduction of illegal activities within the lease area. However, the CFG had conflict with other villages outside the area because of poaching of fishers from other villages, particularly during closure season. Some illegal fishers were using electro fishing and poisoning, which affecting the larvae and juveniles of many fish species. The increasing intensive agriculture and aquaculture including more use of chemicals have been the main cause of water pollution and sedimentation in the lease area. The Village leaders advised farmers to reduce their use of too much chemicals, however he was ignored. . The expansions of aquaculture in the nearby

wetlands were observed to reduce fishing areas. The irrigation gates were considered as a major barrier to fish migration as it closes in the wet season between May and August. Other infrastructures such as roads and buildings were affecting connectivity of the ecosystem of the lease resulted to reduced productivity of the lease.

In summary, the stakeholders rated *more than Average* the current performance of quasi-community tenure on the dimensions of Institutions & Governance, External Drivers, and People & Livelihood (Figure 8). The Institutions and Governance was rated average because of the provision of access to more fishers, including the poor, at least equal sharing of the resources and more participation in the decisions on the management of the lease. The CFG's current management divided the lease into segments using the boundaries of each village. The village head was the representative of the village CFG members. Stakeholders said the current management system gave the fishers the privilege to select their buyers to increase the price of their catch. In some cases, the CFG provided loan to their members without interest. However, some financial institutions were still hesitant to provide loan to fishers because of previous experience that the fishers could not pay their loans. There was good enforcement of the fisheries law and a close collaboration with the DoF. These measures included: conservation (no take zone), allocation of fund for conservation, awareness raising in each village, demarcation of the conservation, and enforcement of regulation, including penalties on violations. The DoF remains the authorized entity to enforce arrest and penalties to violators.

The stakeholders rated *more than Average* the current performance of the External Driver dimension, due to the reduction of illegal fishing in all segments of the lease and attributed to the better access to the lease and its division into segments which enable rights and segmental management on preventing illegal fishing. The investment of the CFG members into the lease ensured that no encroachment happen in their communal fishing area such that it leads to sustainability of their investment. The CFG and DoF also started to negotiate with the rice farmers to manage their irrigation gates and to no encroachment in the habitats. But the agreements could not be fully implemented—due to different timing of the need for water between the lease and the rice farms. Aquaculture continues to be established in the lease; this affects the habitats and contributes to sedimentation. Increasing population and industries in the area also add waste pollution in the lease.

The more than Average rating on People and Livelihood dimension meant an improve food security and income of the fishers. Fishing fee on the segments were reduced significantly in the new management. Fishers that could not pay on time can take loan without interest from the CFG. This system of investment for the lease auction built ownership among the CFG members and fishers. The fishers were allowed to sell their catch to whoever they preferred. Some sell their catch in the market with higher price, where fresh fish was better priced than processed fish. Aquaculture also contributes to fish supply in the market and ensures the year-round availability of fish. But some people didn't like to eat cultured fish and prefer the catch from the wild.

Finally, the stakeholders rated *less than Average* the Natural System dimension. Biodiversity, fish stock and habitats were seen to have decreased significantly. The previous management did nothing to sustain the resource. Instead, they tried to harvest everything for profit. Likewise, illegal fishing was uncontrolled, particularly the bigger lease areas. Other factors mentioned in the decline of the lease productivity were: the change of water quality and level due to pollution and sedimentation of the river caused by population and industries' waste. Encroachment for agriculture and aquaculture were observed to have contributed to the fragmentation of habitats and sediments in the rivers. The water flows from irrigation during

the flood and dry season affected the water level and the fish migration. The previous lease holders did not follow their agreement with the DoF to allocate conservation area and reseed the lease. The impact of what the present CFG management was not yet manifest, because it just began to implement the agreed management of the natural resources.

Stakeholders perceived that performance of the quasi-community management system are expected to increase in the next coming years. The CFG predicted a positive view on **Institution and Governance** in the next coming years since the segmented-type of management was working, regulations were being enforced and there was now an agreement on management and sustainability of their segment. There was an optimist view that that the fishers will sustain their segment because they invested into it from their own-pocket or from interest-free loan from the CFG. This investment will motivate fishers to be more involved in management and sustainability of the lease. The cooperation of the DoF and other relevant institutions in the management of the CFG also bodes well for future positive outcomes. The strong cooperation among the CFG members and their committee representatives points out this assessment. CFG leaders said, "People are now aware on the purpose of the no take zone (conservation), closed season, reseeding, and avoidance of the use of illegal fishing to sustain their resources."

Similarly, the stakeholders were confident that the performance of **People & Livelihood** will improve in the next coming years if the government continues to provide the lease to the CFG. Food security and livelihood can be ensured if protection and conservation of the fisheries will be implemented. More fishers will get benefit because of open membership to the CFG and loan assistance for their shares in the use of the lease. Better road also provided better access fresh fish to market and its better price in the urban markets. The **Natural System** performance was also seen to improve in the next coming years due to the protection and conservation initiatives of the CFG. According to the fishers, "The restocking of the lease increased our catch. But the increase of predator tilapia species brings harm to the native species. The CFG and DoF implemented a no take zone and the closed season. We hope this will increase biodiversity and fish stock in the lease." "The CFG and DoF also started to collaborate with other relevant sectors on the management and sustainability of the natural resources in the lease area. This dialogue with various stakeholders from different sectors will eventually reduce the pressure in the ecosystem, thus can ensure the natural productivity of the lease."

On the other hand, the **External Drivers** dimension was presumed not to improve due to government priority on agriculture, industries, and construction. The government was now shifting towards an aquaculture production strategy rather than sustaining the capture fisheries, because of the deteriorating state of natural fish habitats, biodiversity and fish stock. The CFGs were also skeptic that the external drivers could still be controlled, but said that illegal fishing activities can be controlled because it goes against fisher's investment in their segment of the lease.

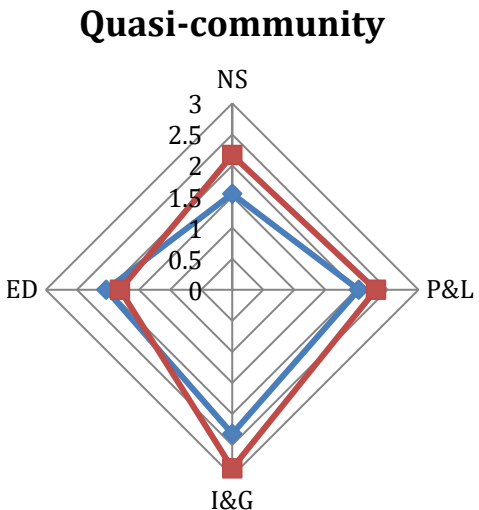

Figure 8. Quasi-community Tenure Performance

5.4.2 Constraints and Challenges

Most CFGs were just started the management of the lease recently, thus, more numbers of constraint/challenges mentioned were under the Institution & Governance dimension (Figure 9). Since the CFG concept was very new to the fishers, some of the fishers did not join or involve with the current management system. Although the lease was divided into segments, the new system was not yet fully informed to the other fishers including the poor fishers. The limited guidelines for the CFG committee on how to manage the lease had resulted to limited access of other fishers in the lease. The limited access of other fishers in the lease area had resulted to the issues of food security and income for the community. The context had made the stakeholders identify weaknesses under the People & Livelihood dimension. Aside from limited access to the lease, the fishers were still limited on their access to financial and technical support from external institutions and the government. Since the CFG management system was very new in the operation of the lease, a clear policy to guidelines the CFG on the sustainable management of the lease for the betterment of the fishers was not yet developed. For example, awareness raising with the community both inside and outside of the lease need to be conducted however because of the limited capacity of the CFG committee and no clear policy, this important activity has not been implemented. Although conservation initiatives, including close season, reseeding, no take zone area, had been agreed in the contract with DoF, some uninformed fishers had violated these and conduct illegal fishing activities. Monitoring, control and surveillance of these activities do not have yet supporting guidelines and plan on how to be implemented. The limited capacity and guidelines of the CFG committee has resulted to the weak collaboration with other stakeholders including other sectors such as agriculture and rural development. This limited collaboration continues to increase the impact of External Driver dimension in the lease. Other water user groups continued to utilize the water without coordination with the fisheries sector. Some issues highlighted issues were pollution, water quality and level, and fish migration. Encroachment for rice intensification and aquaculture contributes to erosion and sedimentation of the channel. The limited capacity of the CFG to control external drivers had made the Natural System at risk, however, this was the priority of the CFG and DoF to collaborate with other sector to protect and conserve the ecosystem of the lease.

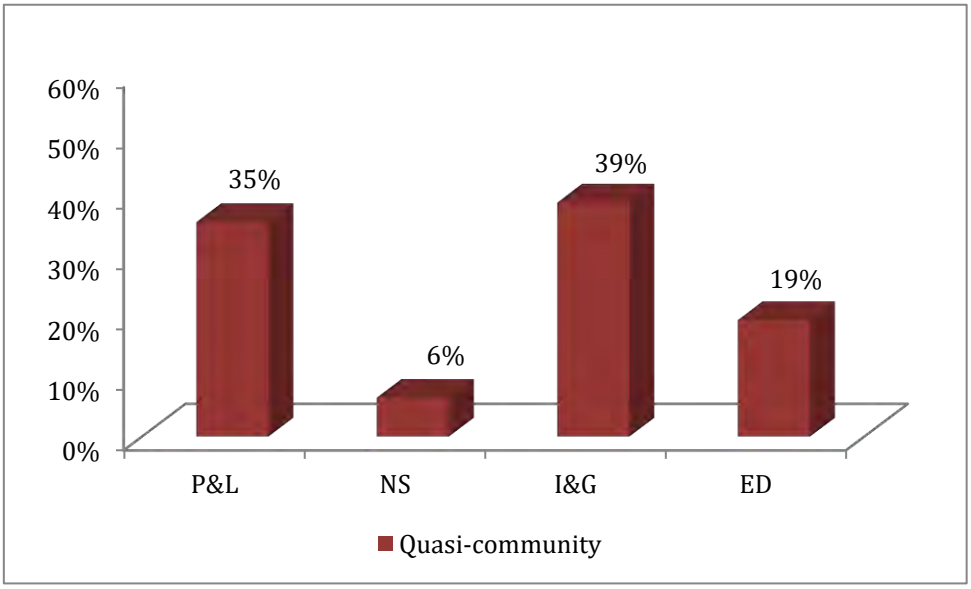

Figure 9. Percentage of identified challenges in a quasi-community tenure

5.5 Community Tenure

5.5.1 Management Performance

Sunye Inn

The lease was located in Kyauk Se Village Track, Kyauk Se Township. The lease was previously under the Department of Science & Technology then they decided to transfer it to the Department of General Administration who hand it over to the CFG. There was no auction of the lease during the time that the lease was under the DoST until it was transferred to the CFG management. The CFG committee managed the lease on behalf of the CFG institution. One of the major roles of this committee was to monitor the good compliance of the fishers to the management measures put in place like the fishing time, illegal fishing reduction and "village fund" activities. The lease was an open access to anyone who wanted to fish as long as they pay to the DOF the national license fees and compile to the local regulation. The high fishing season was mostly identified during October to November and the low fishing season was on December to January. Both fishing season's activities were dominated by the use of gill nets fishing gears, long lines, and small fish and shrimp traps.

People & Livelihood

Food security in the villages along the lease was better at the current management because everybody could fish and sold their catch within the village. It was assumed that fish consumption in the village was stable as before because of fishers' access in the lease. More equitable benefits sharing for the fishermen who sold more than 75% of their catch in the way they want. Since there were no closure periods, fishing activity was a very reliable source of income especially for the small scale fishers and retailers who could guarantee a continuous supply to larger export market. The liberty of the fishers to sell their catch freely had resulted for their higher income. The lease management with its port catches collection system was ensuring sustainable revenue to the fishermen. Other benefit of the CFG management on economic and social development was the introduction of the "village fund" funded by the CFG benefits it is all the area population who get benefits of the lease productivity. The building of school had reduced the exodus, the roads restoration had favoured local business, and the ambulance purchased had impacted the local health quality.

Natural system

Stakeholders were not aware if biodiversity have been decreased in the lease since the same species were caught in the last five years except that the caught fish species were smaller than before. The volume of fish catch was declining due to the decreased water level caused by sedimentation and waste. The use of water in the lease of other sectors including agriculture was contributor to the reduction of water level. The introduction of exotic species from aquaculture and reseeding of the lease had affected the endemic species causing the loss of biodiversity. Fish stock continues to decline due to pressure from increasing population of fishers. Restocking had been a part of the contract with DoF, however the current CFG committee does not have enough resources to restock the lease. Fish habitats were affected due to continuous reduction of water level during summer to include the increasing sedimentation of the lease and farmers use of water from the lease. Stakeholders assumed that the increase of lotus in the lease can serve as habitats for fish. However, stakeholders think that the high water level during the rainy season had provided good productivity of the lease.

Institution and Governance

The lease management system was perceived to be equitable in term of access and benefits sharing to almost all communities in the village. This was due to the inclusive approach of the CFG management with an open access area and redistribution of the benefits collected from the fishermen through the "village fund". Market had been opened to everyone who wants to trade, opening of new establishments i.e. restaurants in the townships increase market opportunities for fishers and traders. Price of fish had been increased, which benefit both fishers and traders. However, fishers and traders were worried of possible impact of the increase of aquaculture production, which may affect the market price. Development in the area had invited the establishment of financial institutions, e.g. Mya Sein Yaung and Stapanar, which provide financial support to the communities. Some NGOs such as the World Vision was mentioned to support technical and financial to the communities' development. The management committee members were elected and the decisions were taken jointly with the populations, there was a real transparency in the process that favour the compliance to the rules and regulations put in place in the lease. The CFG committee conducted patrolling activities within the lease.

External drivers

Stakeholders believed that the open access that provides income to the fishers had reduced illegal fishing activities in the lease. However, there were reports that fishers from outside villages were doing illegal fishing activities especially at night time. It seems that illegal fishers were not afraid to be apprehended for their illegal activities, when the DoF staff were not around at night time. The whole environment of the lease was degrading due to household waste including plastics. Climate change was observed to impact the lease area, people witnessed for the first time the dried up of the lease two years ago which never happened before. The drying up of the lease was also attributed to the farmers pumping of water during the dry season. To date there was no major infrastructure built in the area except new roads, which may affect connectivity of the ecosystem if not properly planned and built.

In summary, the stakeholders rated *More than Average* the current performance of the community-tenure on the **People and Livelihood dimension** (Figure 10). This indicates that the stakeholders were satisfied with the current management in terms of food security and livelihood of the community. Aside from the open access to fishers, the CFG committee set up a 'village fund' to support public infrastructure such as roads, school, clinic etc., which could provide wider benefits to the community. Stakeholders rated *Average* the dimensions on Institutions & Governance and Natural System, as they observed a better management by the CFG which provided access to more fishers compared to the previous management system. However, the stakeholders observed that the CFG still needs to strengthen collaboration with the government, financial institutions and other relevant institutions in order to gain support to the CFG activities. The low capacity of the CFG committee resulted to low enforcement of laws and regulation on illegal fishers. The CFG was also weak on cooperation with local authorities and the DoF to address illegal fishing. Although the CFG had introduced the 'village fund' concept, the fund remains limited for monitoring, control and surveillance in the lease area. On the other hand, the fishers were satisfied on the open access for fishing in the lease to support food and income for their households. The **Natural System** performance was rated *Average* because the past management by DoST kept conservation areas intact as biodiversity, fish stock and habitats. It was mentioned that restocking of the lease increased productivity in the lease. The **External Drivers** dimensions including illegal activities in lease have been stable because of the open access of the lease, where people were happy on what they caught in the lease had reduced the illegal activities of the fishers in the village. The stakeholders observed

that pollution from agriculture and human waste continuous to deteriorate the quality of the environment affecting the fisheries resources. Natural factors including, sedimentation, algal bloom, increase of lotus weed, and decrease of water level affects the productivity of the lease.

The stakeholders of the community tenure were optimist that the performance of People & Livelihood and Institution & Governance dimensions will increase in the next coming year. The open access fishing for all had provided the notion that food and income under People & Livelihood dimension will increase in the future. Improved infrastructures including roads will provide more opportunities for the people to improve on their livelihood and food security. The Institution and Governance under the CFG was seen to improve also in the future, since the government was promoting a community based management system. However, other stakeholders suggested that the CFG should collaborate with the government and other developments partners to strengthen the capacity of the CFG committee to be able to represent the fishers to other development opportunities including the management and conservation of the Natural System to sustain productivity that will ensure better income and food for the people. Stakeholders were skeptic of any improvement for both External Driver and Natural System. They think that this two will not improve in the next coming years because of some issues such as uncontrolled anthropogenic activities, which include encroachment in the habitats and floodplain. Agriculture and human waste will continue to pollute the water and could not maintain its quality. Climate change was also mentioned that will affect the water level and temperature causing algal bloom. Some stakeholders thought that reseeding of the lease will sustain the current production, however they were also aware that the open access to fishers without proper regulation will eventually overfished the lease and reduce its productivity.

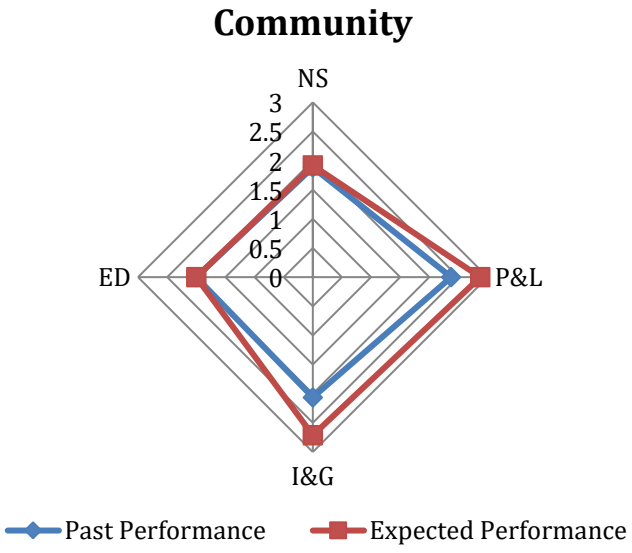

Figure 10. Community Tenure Performance

5.5.2 Constraints and Challenges

The main challenge of the community tenure management system is the limited capacity of the CFG management committee to actively operate the lease (Figure 11). This challenge felt under the Institution & Governance dimension, which indicating the limited capacity of the CFG to

administer, manage, monitor, control and patrol the lease area from both anthropogenic and natural destruction of the lease. Stakeholders mentioned the limited participation of some of the CFG members to attend meetings, workshops and trainings had made them missed their opportunities to learn and increase their capacity to manage the lease. The open access of the lease to all fishers put the lease at risk of overfishing. It was mentioned that this open access gave illegal fishers the chance to operate their activities. Access to fund of the CFG and members was still limited at the locality, aside from their "village fund". This also affected the operation of the CFG including the monitoring, control and surveillance activities. The limited capacity and mandate of the CFG to disseminate awareness to their members and people in community regarding the protection and conservation of the lease had not been fully initiated. The CFG committee knowledge about the fisheries law and other policies including their responsibilities to conserve the lease productivity was still limited. Therefore, there were no proper enforcement on the agreed protection and sustainability of the lease productivity. The stakeholders mentioned that the CFG committee was very seldom to collaborate with the local government and DoF to develop and implement the plan for the sustainability of the lease. The CFG limited collaboration with other sectors had resulted to the uncontrolled External Drivers, including the proliferation of illegal fishing, pollution both from the population and agriculture, and pumping of water for agriculture. Natural factors such as erosion that caused sedimentation, turbidity, and climate change had affecting water temperature and level of the lease. Both anthropogenic and natural issues were affecting the Natural System dimension of the lease, which include biodiversity, habitat fragmentation and fish stock. The stakeholders acknowledged the decline of the productivity of the lease, which affects their food security and livelihood.

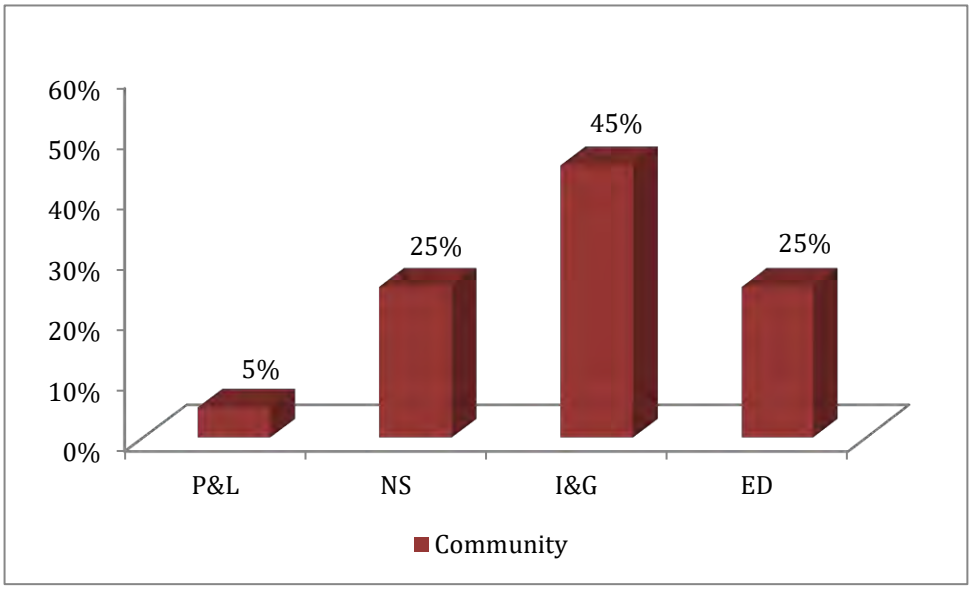

Figure 11. Percentage of identified challenges in community tenure

In conclusion, all stakeholders among the different types of management system, except the community tenure, agreed that the **Natural System** was not performing well in sustaining biodiversity, fish stock and habitats. The cause of deterioration of the natural system was the unabated **External Drivers**, which include anthropogenic activities including illegal fishing activities, encroachment to habitats and floodplain for the purpose of farming and aquaculture,

improper waste disposal of increasing population. Climate change, sedimentation, algal bloom, and lotus proliferation further aggravated the deterioration of productivity of almost all cases except for the community tenure, which the natural resources were protected and conserved during the DoST research management for more than ten years. External Drivers performance was on Average for quasi-individual, quasi-community, and community tenure. Mixed and individual performance was *Under Average*, because stakeholders perceived that there was no initiative from the lease holders to negotiate with other sector or with the government. The Institutions & Governance performance was strong in Quasi-community tenure because of a collaborative management among the CFG, government including DoF and local authorities, and other development partners for a more benefits to people and livelihood. The performance of this dimension was rated *Average* in quasi-individual, mixed and community tenure, because while the CFG managed the lease, the cooperation with other stakeholders were still limited and only few were getting benefits. The least performance in this dimension was the individual tenure where only lease holder gets benefit and everything was profit oriented system. Access of more fishers in the lease and better made the People & Livelihood performance rated *More than Average* under quasi individual, quasi-community, and community tenure. Mixed tenure was rated *Average* and individual tenure performance was rated *Low* on its performance on this dimension, because it was only the lease holders that were getting better income and benefits.

5.6 Observations of performances across the spectrum

In conclusion, the future performance of lease under individual, quasi-individual, mixed, and quasi-community tenure was in vain because of the current situation of the natural system that continues to deteriorate due to the external drivers that could not be controlled. The previous institution & governance was weak to negotiate the control of external drivers affecting the natural system. However, the establishment of the CFG with a mission of fishery management and conservation could be a hope that can save the deteriorating natural system. But such management system is yet newly introduced. The quasi-community and community tenures are optimist options that should be supported with strong institution & governance through the collaboration of relevant government institutions and development partners. Cooperation is a crucial variable to address the External Drivers dimension and Natural System dimension, leading better fish catch that will ensure food and income for the population.

6. Discussion

The study showed that there was a broad range of governance scenarios in Myanmar fisheries ranging from individual-managed to community-led tenure. The results of the study suggested that the sudden change in the management of licensed fisheries can be either detrimental or beneficial to the fishers and/or the ecosystem. The management can be harmful for both fishers and ecosystem if the license holders – whether they are individuals or a CFG do not have the necessary knowledge and capacity in fisheries management. As such, even a genuine community-managed fishery can result in a disaster if the fishers and their committee representative do not understand management and the purpose and objective of the CFG organization. The study showed that a CFG without proper knowledge and capacity can even result to resistance by fishers and other stakeholders and to ineffectiveness due to lack of cooperation. These non-cooperation and non-collaboration of the different stakeholders may result to unaddressed constraints like illegal and overfishing, pollution of the water, sedimentation, turbidity, algal bloom, decrease of water level, increase of lotus plants, and degradation of water quality. Stakeholders observed the continuous decline of habitats, biodiversity and fish stock in the lease area in the last 10 years because of the anthropogenic and environmental issues mentioned that affects the lease/tender. The decreasing productivity

of the lease/tender may result to conflict, food security, and income of the population in the lease/tender.

On the other hand, if the CFG will be organized and guided properly with clear goal and purpose supported with policy that can guide the CFG committee and members on their roles and responsibility to the community and natural resources great benefits can be achieved. This was observed in the combination of quasi-individual, quasi-community and community tenure, where the CFG divided the lease into segments (representing each village) and invites the community fishers to join and share on their investment for the lease auction fee. The members of the CFG committee were the focal point in each of the segments. The CFG management system where members were fully represented had the greater participation and cooperation from the members. It was also observed that if there was an investment from the members (quasi-individual and quasi- community) there was greater participation, ownership and responsibilities from its members. The members were motivated to attend meetings to know their benefits and guard their investment. In a CFG the lease had been an opened access to fishers who can invest and follow the rules and regulation under their by-laws. The allotment of lease segment was another good practice because CFG owner can fully guard their own areas reducing illegal fishing activities. Having tenure in the lease, the people can easily implement conservation initiatives such as conservation area, close season, restocking of seeds, limitation of the use of gears and fishers in the area. A strong CFG had been observed to closely collaborate with the DoF and local authorities and other stakeholders in other sector to reduce impact of external drivers in the lease productivity. Finally, regulated open access to fish, with support from the government and other development partners, there was a greater chance that the lease productivity can be sustained. With abundant fish stock, the food and income of the fishers can be sustained in the next coming year.

It will be also important to address under-funding and ill-equipped capacity of the DoF. Key symptoms of this lack of resources were a limited technical ability to implement fisheries projects and actions to validate the effectiveness of efforts to improve management approaches. Two manifestations of this low capacity were the weak cooperation with CFG and lack of monitoring, compliance and enforcement on the use of illegal gear, mesh sizes, and fishing in restricted areas and reserves. Weak monitoring and enforcement of regulations poses an obvious problem for the sustainable management of the sector. Also, inter-agency cooperation will be crucial. The issues on natural system were clearly beyond the capacity of the CFGs and DoF to address, as it involved other government agencies, notably the rural department, agriculture and the Water Resources agencies. There was a great deal that can be achieved through communication, agreements, and cooperation between government line agencies from the regional to the lower government level.

Finally, it will be important to determine what type of management system among the different tenures can be replicated and supported to sustain the fisheries resources in the region. This was done through the presentation of the lease against the different dimension using a color coding to compare the current status of the different tenures based on the result of study on the four dimensions. The codes used were divided into three colors, *green* which indicates that the dimension in that tenure was on its positive state or higher than the average score; *orange* indicating that the dimension in that tenure was on a warning state or at average score; and *red* indicating that the dimension in the tenure was on a negative state or at less than the average score.

Table 2 showed that the quasi-individual and quasi-community had the most number of green lights (a positive state), indicating the best option to be adopted for a management system of

the lease. With a more collaborative management system the future of natural system dimension in quasi-individual and quasi-community could be turned into positive. With the investment system currently practiced within the CFG members, ownership and responsibility to take care the lease can be ensured the future. Compared with community tenure where the CFG don't have full support from other relevant institutions in the management of the lease, at the same time free for all resulting to over fishing capacity and the sustainability will be in vain. In quasi-individual and community, the CFG members controlled the lease through different segments plus the conservation initiatives such as close season, no take zone, restocking, and limited use of gears which can possibly sustain the fisheries resources.

Table 3. Color coding summary of the different management system performance in each dimension

	Individual	Quasi-individual	Mixed	Quasi-community	Community
Natural System					
People & Livelihood					
Institution & Governance					
External Drivers					

Color Code: Green = Positive State; **Orange** = Warning State; **Red** = Negative State

7. Conclusion

This study's assessment of the performance of the each management system showed that the first case of individual tenure system had a very low level of performance and led to a continuous deterioration of the integrity of the ecosystem on water quality and level, biodiversity, habitats, and fish stock and further aggravated by illegal fishing, poaching, agriculture, aquaculture and water polluting activities. This affected the food security and community cohesion since only the lease/sublease owners and their kin benefitted. It closed the door to wider community participation and to the low implementation of what was agreed with the DoF. This system was not suggested by stakeholders since it is not inclusive and not sustainable for income, food, and natural resources management.

The quasi-tenurial system was rated *Satisfactory* for Institution & Governance, External Drivers, and People & Livelihood. It provided for access rights of the fishers in the lease if they paid their obligation fee, used allowed fishing gears and opened the lease is for fishing. There was good enforcement of the law and regulation in small areas but with regulation issues in big lease areas. The constraint was the lack of control over building of irrigation water gates, encroachment and clearing of habitats for agriculture and aquaculture. The limited institutional support of the DoF made the resolutions of the issues difficult. The impact on the Natural System was seen *Low* as shown by deterioration of fish stock and biodiversity of the lease.

The mixed tenure system rated *High* on Institutions and Governance dimension as it provided fair access of fishers in the lease. However, it was limited on regulation of the gears used and fishing seasonality due to weak CFG enforcement of policy and plan management and weak investment capital by poor fishers. This system rated *Average* on People and Livelihood because of stakeholders' access in the lease. It rated *Average* for External Drivers due to new CFG management system of the lease and low on Natural System due to the declining biodiversity

and productivity of the system. The future management performance of the system was seen to be positive if the CFG improved on their management system and improved DoF support. In comparison to the quasi-community tenure, this system rated less.

The quasi-community tenure rated *More than Average* for Institutions & Governance, External Drivers, and People & Livelihood. This meant it gives better access and equity sharing of resources, more participation of more fishers including the poor and more consensus on their buyers to increase the price of catch. The External Driver dimension rated *More than Average* because of reduction of illegal fishing in each of the segment of the lease since better access translated to more active regulation. Similarly, the People and Livelihood dimension rather more than average score because of the improve food security and income of the fishers coming from reduced fee for their segments , the lease auction built ownership among the CFG members and their preferential option on who to sell their catch at better price. However, the Natural System dimension still rated *Less than Average* due to the decrease in biodiversity, fish stock and habitats due to illegal practices and lesser habitat productivity from contamination from agriculture and settlement activities. The stakeholder perception was that the rating can be improved with better CFG governance, government support for protection and conservation and regulation on agriculture, industries, and construction. The quasi-community had a more balance insight of improvement in the three dimensions for Institutions & Governance, People & Livelihood, and Natural System than the community tenure.

The community-tenure rated *More than Average* on People and Livelihood since food security and livelihood of the community are satisfactory managed by the CFG committee. But CFG close collaboration with the government and other relevant institutions needed to be strengthened due to low enforcement of laws and regulation on illegal fishers. The Natural System performance was rated *Average* because the DoST kept intact areas for conservation of biodiversity, fish stock and habitats. Illegal activities in lease were stable because of the open access of the lease, but pollution from agriculture and human waste continuous to deteriorate the quality of the environment. Nonetheless, the stakeholders were optimistic that People & Livelihood and Institution & Governance dimensions would increase in the next coming year.

Overall, we concluded that among all tenure systems, the Natural System was *not performing well* in sustaining biodiversity, fish stock and habitats. The anthropogenic activities should be addressed, including illegal fishing activities, encroachment to habitats by farming and aquaculture, improper waste disposal, sedimentation, algal bloom, lotus proliferation, including climate change factors are aggravating the deterioration of productivity.

The tenure systems for individual and mixed tenure lease were the *least performing* systems because the benefits were limited to the lease/tender owners. This made prevalent a lease for optimum profit—without considerations of sharing wider benefits to fishers, to policies and regulations that enhances productivity, equity and sustainability of the resources. It also disregarded the collaboration with the DoF and other governance entities that can promote the natural ecology of the system.

The more democratic tenure systems were the quasi-individual and quasi-community, as these ranked *Average* to *Above Average* in terms of ensuring people's livelihood by broader access to the fishery resources. However, there was evidently a need to strengthen the CFG management to make for better equity in the use of resources, for more sustainable methods of fishing and to make more participative the system of safeguarding resources against adverse fishing practices. The CFG also needed to strengthen cooperation with the DoF on enforcement of policy and regulations. At the same time, there was need to enable collaboration with other

government agencies to mitigate or minimize the effects of agriculture, aquaculture and population impact on the fishery resources on the productivity of the Natural System.

The assessment of the constraints and challenges of the management system found that the individual Tenure systems are profit-oriented, without the concept of conservation or sustainability of the ecosystem, and with little benefit to fishers. Only the few fishers related to the lease owner by kinship or patronage have access to the lease. The lease holders dictated the price of their catch and exploit the fishers through loans on their gears, fuel and other expenditures for their fishing activities where they are compelled to sell their catch at the leaseholder's price, usually lower than the market price. The lease holder provided low salary for additional workers hired during the peak season, which also favored his relatives and friends. This made for many constraints to Institution & Governance, since poor fishers resorted to illegal fishing and poaching in the lease. The main profit nature of this contract set aside auctions, open and closed season, reseeding, no take zone, and other DoF policy and regulation not enforced. There was little cooperation between the DoF with the lease holders after award of the lease. The risks and degradation of the Natural System resulted from these constraints on the food security and livelihood of the people.

The mixed tenure management system was also beset with issues on People and Livelihood. The main issue here was that trust and cooperation had not fully cohered between the village representatives and the CFG on the management of the lease/tender, therefore the benefits had not served the wider number of fishers. Weak governance was due to low capacity and trust of the CFG members, particularly leaders in other segment of the lease, and weak cooperation of the members on improving their management capacity, awareness and knowledge about the purpose of the CFG and sustainability of the resources. Weak management led to low enforcement against illegal fishing activities in the lease as well as habitat degradation due to uncontrolled agricultural, aquaculture and settler's activities. The main cause was the undistributed benefits of the lease to the fishers especially to the poor. Without good collaboration of the stakeholders for the development and sustainability of the lease, the food security and income of the people would be at risk.

The quasi-individual, quasi-community and community tenure rated *Very High* on impact on people and livelihood. However, the CFG operations only started recently. There was an apparent lack of capacity on how they can manage their lease areas, thus, on the Institution & Governance dimensions. There was need to enhance the participation of CFG members to attend meetings, workshops and trainings to learn and increase their capacity to manage the lease. There is good opportunity in the division of the lease area into segments where sub-groups can manage more effectively a lesser area than singly over the entire lease area. However, this method lacked guidelines to fully inform other fishers including the poor fishers, resulting to the limited access of other fishers in the lease area. There was an issue too on the CFG members' limited investment. Therefore, enabling workable pooling of resources and access to financial and technical support from government and external institutions would be crucial. The CFGs were committed to conservation initiatives, including close season, reseeding, and no take zone area per contract with DoF. However, the regulations within their ranks and action against illegal fishers had to be strategized and implemented well. Some uninformed fishers violated these and conducted illegal fishing activities. Monitoring, control and surveillance of these activities had yet no supporting policy and plan to be implemented. This weak collaboration of the CFG committee with other stakeholders has had impact on the External Driver dimension in the lease, such as water utilization without coordination with the fisheries sector and issue on pollution, encroachment for rice intensification and aquaculture resulting to erosion and sedimentation of the channel, poor water quality and fish migration.

CFG and DoF collaboration with other sectors would reduce these risks and help to protect and conserve the ecosystem of the lease.

5. Recommendations

Based on the result of the study the following points were recommended in each dimension to achieve more sustainable inland fisheries in Myanmar.

I. Specific Entry Points

People & Livelihood

- Develop policy that will allow the village communities to be a member of the CFGs to ensure their access in the lease.
- Develop a policy that will support the development of cooperative system within the CFG to support technical and financial needs of the community
- Develop a policy that will encourage the creation of enterprises to assist the livelihood of the communities
- Develop and link the fishers children to other development opportunities outside the lease to reduce pressure of overfishing in the lease
- Development of cooperative or enterprise of the CFG to support the livelihood of the members including marketing system
- Government and DPs awareness raising support for the CFG members and communities
- Diversification of alternative livelihood for the fishers
- Strengthen collaboration within the CFG and local authorities to manage and conserve the lease/tender

Natural System

- Develop policy that will support the "ecosystem-approach to fisheries" management in Myanmar.
- Develop policy and guidelines to implement sustainable protection and conservation of the natural resources in the area
- Develop policy on reforestation to reduce erosion that increasing sedimentation in the channels and rivers
- Conduct scientific monitoring in the lease/tender to support sustainable natural resources management in the area.
- Conduct research on specific local species (endemic) to restock the channels and rivers
- Conduct mapping and demarcation of critical habitats in the designated lease/tender areas

Institution and Governance dimension:

- Develop clear policy that will support the organization of community fisheries groups and its network that will support the management and sustainability of the inland fisheries in Myanmar.
- Develop policy to support the financial assistance to the CFG and its members through a public-private-partnership

- Develop policy and plan on monitoring, control and surveillance in the lease/tender to limit fishers/gears that will avoid over capacity in the lease/tender segments
- Encourage the continues auction of the lease/tender based on its productivity
- Support capacity building of the CFG committee management for a long term sustainable natural resources management
- Develop Guidelines for the roles and responsibility of the CFG committee and members
- Support awareness raising and organizational development to the community fisheries group members.

External Drivers

- Develop a policy that will support the cooperation and partnership of different departments and DPs that will balance ecosystem sustainability in AD and CDZ
- Develop a policy that will create a TWGFi in the townships that will address issues on environmental degradation and sustainability of the natural resources
- Develop a policy that will implement the conduct of EIA to all infrastructure especially factories that may discharge their waste in the channels or rivers.
- Develop policy on extension on waste management to be extend to the communities and farmers as the source of pollution in the channels and rivers
- Develop national plan of action for monitoring, control and surveillance
- Increase awareness of the fishers on illegal fishing gears, poisoning and corresponding penalties
- Develop cooperation among the communities and empower them as rangers with allowance from the village fund.

II. General Entry Point at Higher Level

- Government development and revision of the Fisheries Law and policies aligning with other sector in particular agriculture, forestry, and meteorology and water resources
- Government development of policy aligned strategies for the development of inland capture fisheries, action plans, guidelines/proclamation, and monitoring and evaluation system.
- Government promotion and support to an integrated collaborative-management system in the lease/tender areas
- Government promotion of equitable and inclusive “ecosystem-approach to fisheries” to balance development with the whole ecosystem of Myanmar.
- Government should develop a Monitoring Information System that will integrate vital information for the sustainable development and management of the inland fisheries of Myanmar.

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Food system perspective on fisheries and aquaculture development in Asia

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Abstract
This paper reviews development research and policies on freshwater fish in South and Southeast Asia. We conduct a systematic review of academic literature from three major science-based policy institutions to analyze development research and policies that have accompanied the ongoing transition from freshwater capture fisheries to aquaculture in the region. Using a 'food fish system' framework allows for the identification and systematic comparison of assumptions underpinning dominant development policies. We analyze the interrelations between the production, provisioning, and consumption of wild and farmed fish and demonstrate a shift toward food fish systems thinking in the sampled literature. We discuss gaps and weaknesses in the literature, as identified through the application of the food fish systems framework and present an agenda for future research aimed at securing the potential of fish as food.

Keywords Asia · Development policy · Food security · Food systems · Freshwater fish

Introduction

'Food systems' are receiving renewed interest as means of moving beyond the productivist agendas that tend to dominate food policy (Béné et al. 2019). Central to food systems thinking is the transdisciplinary analysis of social and environmental trade-offs and synergies across the whole set of production, provisioning, and consumption activities that affect food security (Ericksen 2008; Ingram 2011; Eakin et al. 2016). Here, food security is understood as a condition related to the availability, accessibility, and use of food (Eakin et al. 2016). Such approaches are increasingly being promoted in policy circles as a way of identifying and understanding the effects of broader drivers of change such as urbanization and globalization on sustainable food provisioning (HLPE 2017; IPES 2017).

Despite growing attention, food systems thinking has yet to be applied in a systematic way to fish production, provisioning, and consumption (Olson et al. 2014; Béné et al. 2015). Recent policy discussions have marginalised or overlooked the role of fish, in comparison with conventional agricultural commodities (HLPE 2014; Willett et al. 2019). This is a major oversight given the significant contribution that fish makes to global food security: fish is a relatively cheap and accessible micronutrient-rich food that provides over 3 billion people with almost 20% of their average per capita intake of animal protein, and a further 1.3 billion people with about 15% of this intake (Beveridge et al. 2013; HLPE 2014). Golden et al. (2016) further predict that over 10% of the world population is vulnerable to micronutrient and fatty acid deficiencies due to declining fish supply over the next decade, with developing nations being particularly exposed.

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Moreover, when fish is considered, it is articulated predominantly in terms of marine 'seafood', leaving freshwater food fish marginalized (Cooke et al. 2013; Lynch et al. 2019). Limited attention to freshwater fish production can be attributed to its relatively dispersed nature, the poor consistency of associated data, and the bias of northern-dominated research towards exported seafoods (FAO and WorldFish 2008; McIntyre et al. 2016; Bush et al. 2019; Tlusty et al. 2019; Belton and Bush 2014). This omission is particularly problematic in the context of South and Southeast Asia, which account for over a quarter of global fish production, the bulk of which is comprised of freshwater fish species (Chan et al. 2017; FAO 2018).

There is a rapid ongoing shift in the supply of freshwater fish in Asia, from wild to farmed sources, constituting an important, yet poorly understood food transition. Throughout inland areas of Asia, fish has been historically supplied by the harvest of wild fish from extensive networks of rivers and floodplains (Delgado et al. 2003; Brummett et al. 2013). The same region now accounts for the majority of global aquaculture (or farmed fish) production, most of which also takes place in freshwater environments. China, South and Southeast Asia are expected to remain the largest suppliers of farmed fish globally for the foreseeable future (Edwards 2015; FAO 2016; Ottinger et al. 2016). Integrated understandings of this transition are rare. Literature on the contribution of freshwater fish to food security tends to emphasize two polarizing narratives. As summarized by Little et al. (2016), the first narrative stresses trajectories of decline in wild capture fisheries production, while the second emphasises the role of a 'booming' aquaculture sector in meeting growing future demand for food fish.

The production focus central to both narratives, risks limiting how policy makers understand freshwater food fish in the context of rapid urbanization, rising incomes and changing diets (Reardon et al. 2014; Béné et al. 2016). A 'food fish system' approach, in contrast, integrates the role that provision and consumption play in shaping different demands for fish as food, and examines how these demands can be met through existing or potential capture fisheries and/or aquaculture production. We argue that this perspective can support the formulation of more proactive food security policies to address healthy and sustainable food fish provisioning at national, regional, and even global scales (see for e.g. Jennings et al. 2016).

Developing a food fish system perspective is especially relevant for South and Southeast Asia, as a major fish producing and consuming region that is undergoing rapid economic and social change. This raises the question of whether, in line with the wider food production literature, a shift towards food systems thinking is taking place in the science-based development literature on freshwater fish as food in this region. In other words, are science-based policy institutions with a mandate to support the fish sector development in South and Southeast Asia moving away from productivism toward more integrated approaches? To what degree are their perspectives locked in the two polarizing narratives of capture fisheries and aquaculture? And to what extent do associated development policies integrate and leverage interrelations across freshwater fish production, provision, and consumption activities?

In this paper we address these questions by reviewing the past 45 years of science-based development-policy literature on freshwater fish as food in South and Southeast Asia. Our investigation builds on a systematic review of the academic literature affiliated with three international organizations—FAO, SEAFDEC, and WorldFish—that have a long history of providing policy advice for fisheries and aquaculture in the region. The evolution of their academic positions provides a basis for identifying and systematically assessing evidence of progress from polarized narratives to more integrated understandings of freshwater fish as food.

The following section introduces the food fish system framework used for the review and positions it within the wider literature on food systems research. Section 3 then describes the methodology used for the review. Sections 4 and 5 present the results of the analysis, identifying and comparing literature focused on farmed or wild fish production, provisioning and consumption. Section 6 evaluates progression towards food fish systems thinking. The remaining sections discuss the broader implications of the results, and the emerging opportunities for revitalizing development agendas around food fish security.

The food fish system

The concept of food systems was formulated as early as in the 1980s, but it remained relatively marginal in food policy over subsequent decades (Kneen 1989). Renewed interest in food systems in recent years provides a framework for understanding trade-offs and synergies between food production with diverse consumer demands and complex provisioning systems that affect food security (Ericksen 2008; HLPE 2017). As argued by Béné et al. (2019), in policy terms this means moving beyond a focus on productivist technology and extension to pay greater attention to the full range of social and environmental concerns that affect how food is distributed and consumed.

'Commodity chain' and 'value chain' perspectives constituted an important first step away from productivist approaches by extending the scope of research and policy beyond the production 'node'. These perspectives emphasize multi-directional flows of products, finance, and information between actors connecting sites of production and consumption, as well as extra-transactional actors that shape these

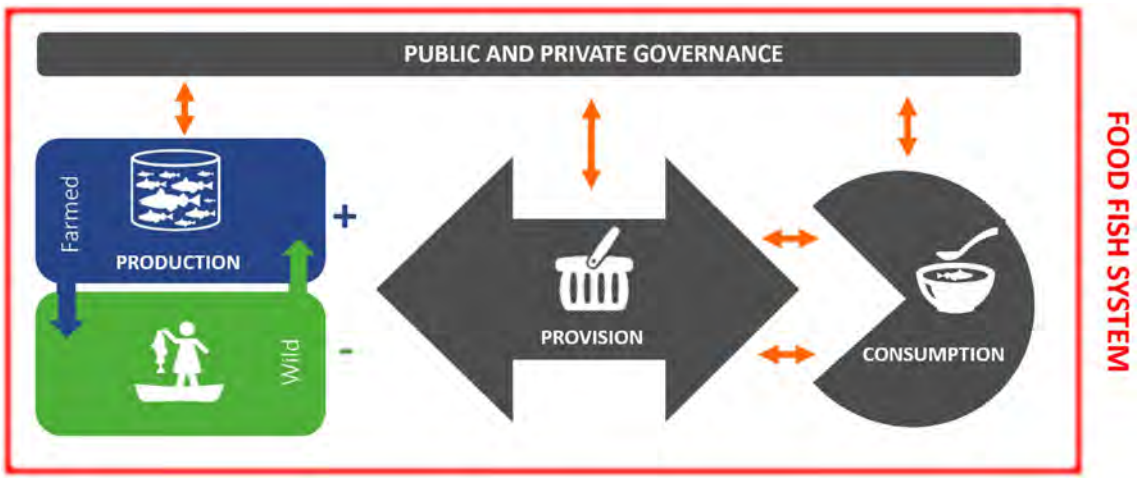

Fig. 1 The food fish system conceptual framework

flows (Ponte and Sturgeon 2014; Bush et al. 2015). Recent years have seen a broadening in the scope of value chain research with increasing consideration for social equity (see for e.g. Barrientos et al. 2003; Kaplinsky 2000). Yet, associated approaches largely conceive governance as a process of linking codified norms to economic value in order to leverage improvements in production (Marsden et al. 2000; Gereffi 2005; Ponte and Sturgeon 2014). Food systems thinking goes beyond value chain-based approaches by recognizing the multidirectional relations between interrelated sets of production, provision, and consumption practices (Spaargaren et al. 2012), and the possibilities for coordinating these practices and relations for achieving outcomes that extend beyond the performance of producers alone, such as food security or sustainability (Ericksen 2008; Ingram 2011). In addition, the food systems approach extends beyond value chain approaches by incorporating broader societal transitions such as urbanization and globalization and their influence on where and how food is produced, distributed, and consumed (HLPE 2017; IPES 2017).

Our review is based on a simplified food system framework that focuses on the interactions between wild and farmed freshwater fish across activities related to the production, provisioning, and consumption of food fish. The framework is used to identify governance approaches used to steer these activities toward normative goals such as food security or sustainability (Fig. 1). Each of these components is explained in turn below.

First, production is defined as the entire set of activities involved in the production of freshwater fish and derived foodstuffs. Production activities related to wild capture fisheries and aquaculture are highly differentiated. Capture fisheries use fishing gears to harvest wild fish and other aquatic organisms (i.e. originating from naturally reproducing, self-sustaining populations) from public or common access water bodies (FAO 2015). Aquaculture is a form of farming. This implies active management interventions to enhance biological productivity (e.g. artificial reproduction, stocking and feeding), and private property relations—i.e. private ownership of fish stocked in enclosed water bodies (FAO 2015; Edwards et al. 2002). However, in practice, the lines between these forms of production are often blurred. For example, aquaculture systems can rely to varying degrees on natural or stocked recruitment of wild fingerlings to ponds, fenced off habitat, or rice fields, while capture fisheries in lakes and reservoirs may rely on stocking of artificially spawned and raised fingerlings (FAO 2015). The review explores the diversity of these production activities and the degree to which they are differentiated from the perspective of provisioning and consumption.

Second, food provisioning refers to the organization of social and economic practices involved in the delivery of goods and services (Fine 1993; Evans 2011). These practices encompass activities related to the transmission and transformation of fish from raw material to marketable products—such as sourcing, transport, storage and trade, as well as processing and packaging. Provisioning practices also include social relations amongst chain actors that enable the flow of goods and/or preservation/transformation of products, including credit and finance, cultural and food safety norms and standards, and the use of cooperation and/or contractualization to set prices and supply (Reardon and Timmer 2014; HLPE 2017). Combined, these food-provisioning practices set the conditions for producers to access markets, information, and resources necessary for production. They also condition consumption practices while at the same time translating consumer demands to producers.

Third, consumption is defined as the entire range of activities related to the selection, purchase, preparation, and eating of fish. Consumption, as such, is influenced by economic

determinants, such as price, but also by a range of practices that determine which species of fish are purchased, in what forms (e.g. fresh, processed, or prepared), from which outlets (e.g. wet markets, supermarkets, or restaurants), and with what consideration to quality—related to food safety, taste or culture (Spaargaren et al. 2012). From a systems approach, consumption is shaped by wider processes of urbanization, globalization and/or food (in)security rather than individual choice alone (HLPE 2017).

Finally, governance is defined as the rules, authority and institutions that coordinate, manage, or steer the food system. These include governments, and non-state institutions such as markets, traditions, networks, and civil society (van Bers et al. 2019). Among these governing entities, the present review focuses on science-based development policy actors and explores the logic of their efforts to move the system toward delivering food security. Food security here is understood as a condition related to the availability, accessibility, and use of fish as food. From a food fish systems perspective, governing food security requires incorporating the multiple ways in which production, provisioning and consumption interact (Ericksen 2008; Ingram 2011). The challenge of accounting for the full range of food system activities is in sharp contrast to the productivist paradigm that permeates much of the science underlying food policy in developing countries (Ickowitz et al. 2019). This focus on production has meant that the governance of food security has relied heavily on the extension of technologies to increase output, with the assumption that food availability would shape provisioning and consumption practices (Ickowitz et al. 2019; Gómez et al. 2013). However, as we explore further in this paper, a shift to a food fish systems thinking calls for understanding production as bound up with both the diverse demands of consumers and the complex factors influencing the development of provisioning systems in between.

Methodology

We undertook a systematic review (Arksey and Malley 2005; Levac et al. 2010) to assess the extent to which the development policy literature on freshwater fisheries and aquaculture in South and Southeast Asia reflects a shift to food systems thinking. We acknowledge that this literature does not provide a complete picture of how fish has been taken up in food systems thinking. But, aligned with our objective, this literature does represent the extent to which academic thinking has been translated into policy-directed science. As we describe below, this methodology follows a two-step process, comprised of: (1) document selection; and (2) content analysis.

Document selection

For the purpose of narrowing the scope, the review of the science policy landscape was limited to a selection of 'boundary organizations' that straddle politics and science (Guston 1996). As such, we only selected documents published by FAO, SEAFDEC, and WorldFish—three multilateral science-based policy organizations with more than 40 years of experience advising governments on improving fisheries and aquaculture for food security. The Food and Agriculture Organization (FAO) is a specialized agency of the United Nations established since 1945. The Southeast Asian Fisheries Development Center (SEAFDEC) is an autonomous intergovernmental body established in 1967 with membership of 11 Southeast Asian countries.[1] WorldFish was established in 1973 as the International Center for Living Aquatic Resources Management (ICLARM) and integrated into the Consultative Group on International Agricultural Research (CGIAR) in the 1980s (cf. Pullin and Neal 1984).

Scientific publications from these organizations addressing freshwater fisheries and/or aquaculture in South and Southeast Asia were sourced through Scopus and Aquaculture Science and Fisheries Abstract (ASFA) databases. The search included all reviews, conference papers, and articles published between 1975 and 2018[2] in academic journals, using the search terms: AF-ID ("WorldFish" OR "ICLARM" OR "FAO" OR "SEAFDEC") AND ("Cambodia" OR "Myanmar" OR "Vietnam" OR "Thailand" OR "Laos" OR "Indonesia" OR "Malaysia" OR "Philippines" OR "Bangladesh" OR "India" OR "Pakistan" OR "Nepal" OR "Bhutan" OR "Sri-Lanka" OR "South Asia" OR "Southeast Asia") AND ("Freshwater Fisheries") OR ("Inland Fisheries") OR ("Aquaculture") in titles, abstracts, and keywords. The pooled search returned a total of 457 (N_T) distinct documents published in English.

Metadata for all articles was imported to Excel and titles, abstracts, and keywords were screened to select documents. First, we removed articles that were not fisheries or aquaculture related ($n_1 = 19$). We then excluded books and book chapters ($n_2 = 48$) as well as non-peer-reviewed documents ($n_3 = 38$) based on the observation that institutional reports from FAO, WorldFish and SEAFDEC were

[1] Brunei, Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam

[2] The search was initially done using 1960 as a starting date, corresponding to the beginning of the Green Revolution. 1975 was eventually retained as the start point because it corresponded to the earliest publication in the sample fitting the review inclusion criteria. The end date of 2018 was used as it corresponded to the year when the review process was initiated.

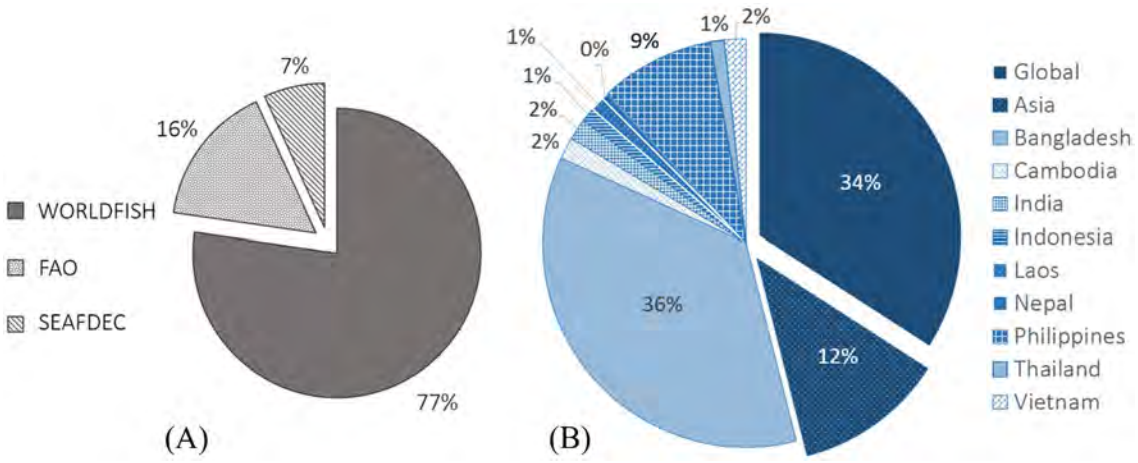

Fig. 2 Institutional (**a**) and geographical (**b**) coverages of the sampled literature

largely replicated in the peer-reviewed literature. We further excluded literature focusing only on geographical areas outside the scope of the study ($n_4 = 37$), as well as articles focusing solely on marine and coastal production systems ($n_5 = 138$). The final sample included 177 (N_{S1}) articles.

Content analysis

The data extraction and analysis was carried out in two-steps.

First, a scan of the literature was conducted over all 177 (N_{S1}) articles. Titles, abstracts, introductions, and conclusions were used to classify articles in terms of their relevance to (1) aquaculture and/or capture fisheries, and (2) production, provision and/or consumption. Papers focusing exclusively on wild or farmed fish were categorized as 'segregated'. Papers focusing on both wild and farmed fish were categorized as 'integrated'. Similarly, the coverage of production, provision and/or consumption supported a further classification: papers that did not explicitly refer to production, provision or consumption, or did refer to one component but did not provide any analytical focus on that component; and papers that effectively covered production, provision and/or consumption as an integral part of their analysis. In case of uncertainty, the screening of the text extended to the results and discussion sections of the paper.

Second, a content analysis of articles cited at least 15 times ($N_{S2} = 85$) was undertaken. For each category defined in the first step, the papers were read and assessed for the degree to which they focused on wild and/or farmed fish, and the extent to which production, provisioning and/or consumption were analysed, including the relationship between them.

Finally, both stages of the analysis took into consideration the change in food systems thinking over time, breaking the literature into five evenly distributed time-periods from 1975 to 2018.

Overview of the sampled literature

The first overall observation about the sampled literature is the institutional bias. The selection of documents is heavily skewed to WorldFish, which represents 78% of all documents compared to FAO and SEAFDEC making up 15% and 7% respectively (Fig. 2). This bias is caused by the higher prevalence of publications by WorldFish staff in international peer-reviewed journals compared to the higher proportion of institutionally published reports by FAO and SEAFDEC. Nevertheless, the review indicates that themes covered in the review are shared across the three organizations and, as a result, our analysis does not make any comparison between them. A detailed comparative analysis of the science policy interface that scrutinizes the contributions of these institutions to the complex process of policy-making (Gluckman 2018) goes beyond the scope of this study.

The second observation is the bias in the geographical scope of the documents sampled. Bangladesh, which has received more development attention than other South and Southeast Asian nations over the past 40 years, represents over 35% of the documents reviewed. The Philippines, which hosted both ICLARM (now WorldFish) and SEAFDEC, makes up close to 10% of the articles reviewed. Meanwhile other major freshwater fisheries and aquaculture countries, such as Thailand and Vietnam, make up only 3% of the papers reviewed (Fig. 2). Overall, however, the sampled literature indicates that development policies and perspectives surrounding fish as food are largely shared across all countries covered in the review. Hence, while we are mindful that our choice of treating the great diversity of

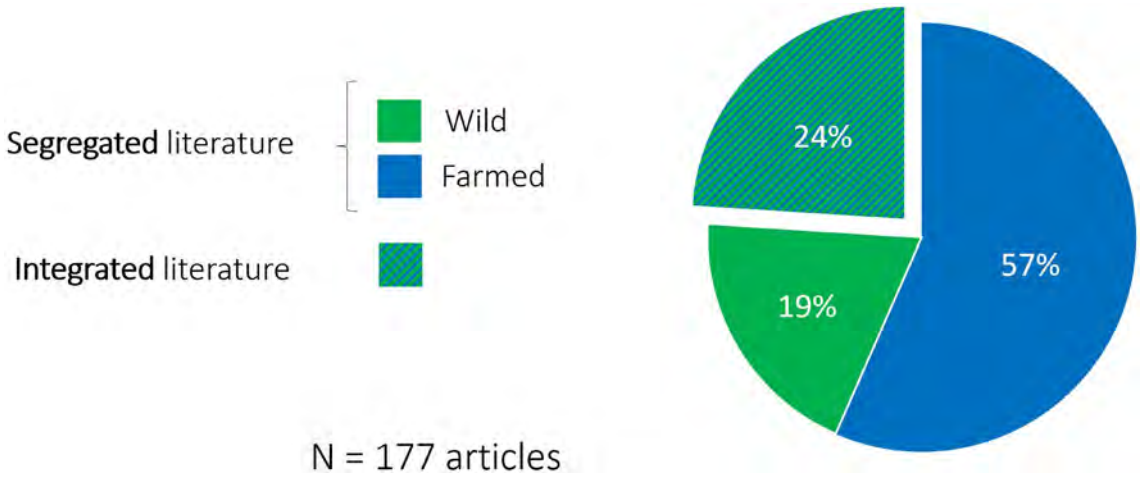

Fig. 3 Proportions of segregated and integrated articles in the sampled literature

South and Southeast Asian contexts as one group implies important simplifications, we contend that our approach paints a faithful (albeit general) description of research and development policy around freshwater fisheries and aquaculture in the region.

The third and most significant observation is that the segregated literature (i.e. analytical focus on wild or farmed fish) represents 76% of the literature sampled, while the integrated literature (analytical focus on wild and farmed fish together) represents only 24% (Fig. 3). This confirms that freshwater fish production is largely understood as either farmed or wild caught, with limited understanding of how these two modes of production relate to each other. The division also confirms the polarization of narratives associated with farmed and wild fish production and their expected contribution to food security (cf. Little et al. 2016).

In the following section we present the results of the review by food fish system components (i.e. production, provisioning and consumption). In doing so we only reference papers categorized under the respective food fish system component and not papers that, even while relevant to the observations made, are not categorised under that component.

Coverage of the segregated literature

Production

An observation shared across both the wild and farmed fish literature is the disproportionate and persistent focus on production. Nearly all (99%) the articles reviewed included analysis of production, creating a clear division between capture fisheries and aquaculture respectively (Fig. 4). This production focus was absolute from the 1970s into the 2000s. As the following shows, provision and consumption became more prevalent themes from the 2000s onwards. Nevertheless, a clear division between wild and farmed fish persists. The following outlines the main themes and topics covered under associated bodies of literature.

The starting point of our review, in the mid-1970s, coincides with a redefinition of the capture fisheries research and development agenda. While the early literature from the 1960s-1970s had focused predominantly on increasing production through improved technology and infrastructure,[3] the new agenda emerged from the recognition that resources were not endless and that small-scale operators were the most impacted by their exhaustion (Smith 1981). This new agenda, commonly labelled "small-scale fisheries" largely developed around perspectives from both coastal and freshwater fisheries. From the 1990s onwards, this literature largely put the emphasis on overfishing as the main factor driving fisheries decline (Smith 1981; Sultana and Thompson 2004; Ratner 2006). Subsequently, in the late 2000s the scope of factors driving fisheries decline expanded to include environmental degradation and fish habitat destruction derived from industrial, agricultural developments, or climate change (Allison et al. 2009; Baran and Myschowoda 2009; Beard et al. 2011).

In parallel, a body of capture fisheries literature emerged in early to mid-2000s focusing on solutions for improving the status of wild fish stocks. The literature on solutions for fisheries decline can be further divided into two main themes. In the mid-2000s a broad range of resource management options were focused on, with co-management

[3] Refer to Smith (1979) and the more recent sequel article of Pomeroy (2016) for a contextualization of the research agenda prevailing at the time.

emerging as a leading approach for promoting the empowerment of fishing communities in the management and help to address broader inter-sectoral conflicts (Thompson et al. 2003; Nielsen et al. 2004; Andrew et al. 2007). In the mid to late 2000s, this management-focused literature broadened to include more attention to the social and economic conditions of fisheries production. Most notably, this literature has moved beyond conflict resolution to include social welfare (Béné et al. 2010), resilience (Ratner and Allison 2012), human rights (Allison et al. 2012) and well-being (Weeratunge et al. 2014). This 'social-turn' in freshwater capture fisheries contrasts markedly with the early literature in placing fishing communities as centrally important for the persistence of the fisheries as a source of food security.

In contrast to capture fisheries, the aquaculture literature has persisted from the 1970s with a strong productivist agenda (Pullin and Neal 1984). Throughout this early literature, the focus on production was justified by perceptions of declining wild capture fisheries, the assumption that aquaculture would replace declining stocks, and a broader agenda to further 'the tropics' as central to the development of the sector on a global scale (Coche 1978; Pullin and Neal 1984). The alignment of aquaculture under the wider 'blue revolution' narrative emphasizes the 'untapped biophysical potential' of the sector and (reflecting green revolution rhetoric) the need to advance the production technologies and cost-efficiency of a variety of production systems. This narrative of technical efficiency has persisted in the literature as a guiding principle for farmed fish research and development in South and Southeast Asia to the present (Dey et al. 2000b, 2005b; Katiha et al 2005; Karim et al. 2016).

The focus on the technical efficiency of production is observed in the sampled literature through two further persistent narratives around Asian aquaculture. First, in line with the priorities of the three institutions studied, calls for technical efficiency have been made predominantly in relation to small-scale rural aquaculture (Dalsgaard 1997). The assumption underlying this focus is that these producers dominate the overall production in Asia and make the most direct contribution to food security (Ahmed and Lorica 2002; Dey et al. 2005a, b). Second, the focus on technical efficiency has meant that a significant proportion of the literature sampled (33%) has been on fish breeding. Associated research has concentrated on single species' yield maximization, denoting a change from earlier conceptualization of aquaculture as "an extremely diverse means of food production" (Pullin and Neal 1984, p. 227). While still including a number of species overall (see Lind et al. 2012), fish breeding research has been dominated by tilapia (Eknath et al. 1993; Khaw et al. 2008; Dey et al. 2000b; Bentsen et al. 2012); a species that now contributes over 20% of freshwater farmed fish in the region[4].

In contrast with fisheries, and the wider literature on industrial (largely marine) aquaculture in other parts of the world[5], the sampled literature on freshwater aquaculture gives limited consideration to environmental impact. This apparent gap may be explained by assumptions expressed in some papers around the limited environmental impact of production of low trophic-level freshwater carps (Prein 2002; Dey et al. 2005b). These papers assume a high efficiency of such systems, with only limited attention to the gradual intensification of carp production systems. This is particularly evident in the research around terrestrial ingredients used in their diets,[6] where the emphasis has essentially consisted in ascertaining "economically optimal" feeding rate (Tacon and Silva 1997; Karim et al. 2011).

In addition to a sustained focus on production, the sampled science-policy literature is characterised by two persistent narratives. The fisheries literature has emphasized the decline of fish resources and the need for more effective stewardship and management through the empowerment of fishing communities. The aquaculture literature, in contrast, has persisted with a narrative of unfulfilled potential and the need for improved technical efficiency. As a result of their distinct narratives, a division is also observed between the disciplines underlying these two literatures: social scientists for wild fish, and natural scientists and economists for farmed fish research. As the following sections demonstrate, this dichotomy is also apparent across other food fish system components.

Provision

Research related to provisioning is evident in papers published from 2000 onwards but represents less than 20% of the literature reviewed (Fig. 4). Hence, provisioning represents the least documented food fish system component across both the wild and farmed fish literature. Provisioning activities are commonly observed as being related to, and of importance for consumption and production, rather than being a direct analytical focus of research. Nonetheless, the sampled literature does make various assertions around the importance of provisioning for addressing development priorities for both wild and farmed fish production.

Only 11% of wild fish-related papers integrate provisioning in their analysis (Fig. 4). Although not explicitly articulated, activities associated with moving and marketing

[4] *Statistics calculated with FAO-FIGIS (http://www.fao.org/figis) for 2017.

[5] Refer to Naylor et al. (2000), or Natale et al. (2013) for a discussion on the environmental impacts of (marine) aquaculture.

[6] Refer to Pahlow et al. (2015) for a discussion on the terrestrial feed demand of (marine and freshwater) aquaculture.

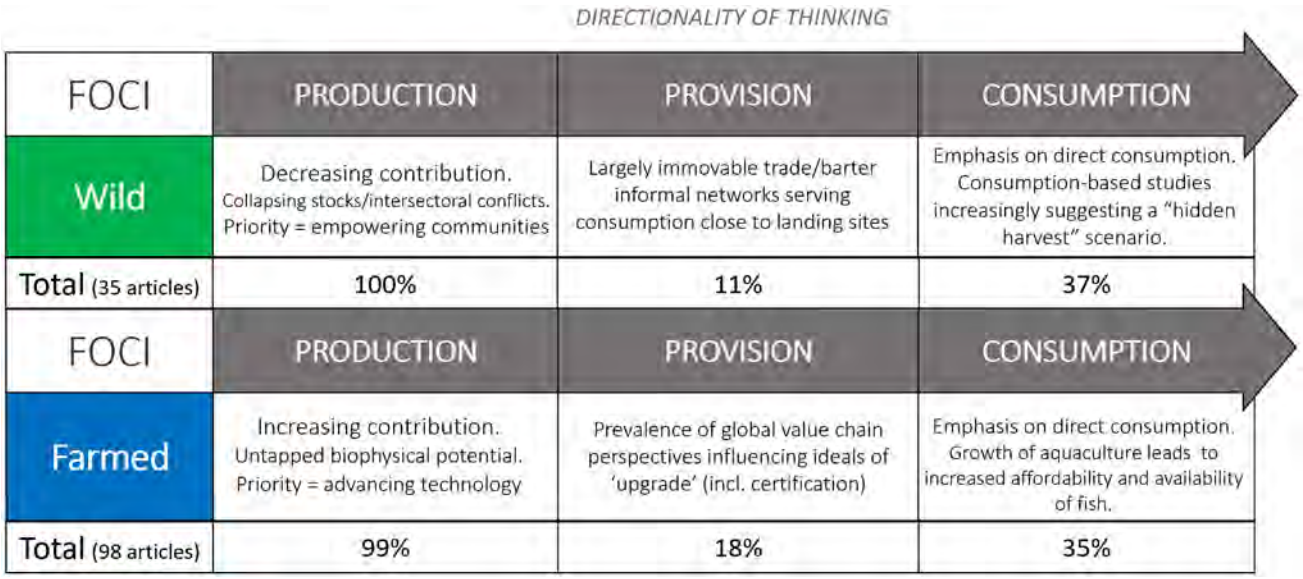

Fig. 4 Proportion of segregated articles and key messages by food fish system components

freshwater fish are often assumed to be mostly traditional and homogenous by nature and therefore not worth further examination. For example, Thompson et al. (2003) do not consider market attributes related to community-based fisheries management in Bangladesh because "they are not significantly different between inland wetlands in Bangladesh" (p. 310). This is in direct contrast to more recent research which gives greater attention to complex and fragmented informal networks of trade and bartering that shape wild fish provisioning and catches (Cooke et al. 2016). As shown in the following section, there is mounting evidence of wild fish consumption far beyond the communities that catch them, but little research has been done on the provisioning practices that distribute this food fish.

The literature on farmed fish pays relatively greater attention to provisioning, with 18% of the papers reviewed making analytical reference in some way to provisioning related activities (Fig. 4). This literature can be further divided into papers focused on global provisioning (to major export markets like the EU and US), representing 12% of the sampled papers, and provisioning activities related to domestic and regional markets, representing only 6% of the sampled papers.

The main focus of the global provisioning literature addresses broad questions around the role of aquaculture in meeting global demands for export-oriented species like shrimp and pangasius (Ahmed et al. 2008; Little et al. 2012). Building on such a global perspective, it is often implied that Asian producers should target global export markets to benefit from enhanced profits compared to domestic or regional markets (Ahmed et al. 2010; Haque et al. 2010) and ideals of 'upgrading' trajectories are essentially articulated around international trade (Ponte et al. 2014). However, a smaller proportion of the literature raises questions around the merits of international trade, especially with regards to regulation and certification aimed at improving the environmental and social performance of the sector (Bush et al. 2013; Jonell et al. 2013; Troell et al. 2014). This literature acknowledges the limits of existing regulatory tools and points towards the necessary complementarity of public and private governance to address these challenges.

Papers focused on domestic and regional provisioning have been published from 2010 onwards and highlight the growing importance of aquaculture to food security and social wellbeing. Two major themes emerge from the literature sampled. First, the papers emphasize the development of farmed fish supply chains towards the provisioning of cities (E-Jahan et al. 2010; Karim et al. 2011; Toufique and Belton 2014; Belton et al. 2016). These papers show that urbanization translates into increased demand for (farmed) fish, rendering the development of the sector largely a peri-urban phenomenon, with fast-developing supply chains and associated services.[7] Second, this literature indicates a growing attention to gender in domestic supply chains, emphasizing on the one hand the more important roles women play in farmed fish post-harvest activities compared to men, and on the other the existence of formal and informal barriers limiting equal benefits from the sector for women (Morgan et al. 2017; Kruijssen et al. 2018). These papers, however, tend to focus on gendered roles and benefits from provisioning

[7] See Bush et al. (2019) for a recent synthesis of aquaculture research on domestic and regional supply chains in the Global South.

fish rather than the performance or conduct of provisioning activities themselves, such as processing, transportation or trade.

While some food system-related themes like the effects of urbanization on farmed fish demand are emerging, the sampled literature remains largely focused on international trade, regulation and social dynamics that condition but do not explain provisioning activities. This has consequences for understanding the relative contribution of wild and farmed fish to food security beyond the sites of production, especially in Asian domestic markets. As the following section demonstrates, this also has consequences for the attention paid to fish consumption.

Consumption

Consumption is analysed substantively in 35% of the articles reviewed (Fig. 4). However, these studies only emerged from 2000 onwards, indicating a relatively late recognition of the importance of freshwater fish as food in the region. Reflecting the dearth of attention given to provisioning, consumption is commonly considered in conjunction with production, which emphasizes subsistence or semi-subsistence production and thereby overlooks the wider contributions of fish to food security. The following outlines the overarching themes covered under consumption in the literature on wild and farmed fish respectively.

In line with the overall sample, only 37% of wild fish-related articles integrate fish consumption in their analysis (Fig. 4). This overall bias can be explained by the predominant focus on production, which views fish as a resource to be conserved rather than as a food source (Hall et al. 2012). As demonstrated by Evans et al. (2011), less than 10% of studies on co-management consider fish consumption. Our review indicates that even when the wild fish literature considers consumption, the attention tends to be limited to direct or 'subsistence' consumption by fishing communities (Thompson et al. 2003; Badjeck et al. 2010). This subsistence focus also tends to reinforce assumptions that fishing communities are highly vulnerable (Allison et al. 2009; Badjeck et al. 2010), which is underpinned by the lack of knowledge on provisioning and, as such, their engagement with the wider (food) economy.

A more recent key theme in the wild fish literature is the assessment of freshwater production on the basis of consumption data (Fluet-chouinard et al. 2018). These consumption-based approaches build on a wider "hidden harvest" narrative of FAO, WorldFish and other international policy organizations[8] that advocates that up to 80% of freshwater fish landing volumes are not recorded, with the consequence that the contribution of wild fish to food security is fundamentally misunderstood (Hall et al. 2012; Youn et al. 2014). Studies focused on nutrition have also emphasized the importance of species diversity for healthy fish-based diets, which in turn reaffirms the need for production-oriented management strategies to maintain biodiversity (Nurhasan et al. 2010; Youn et al. 2014).

Also in line with the overall sample, 35% of sampled papers from the farmed fish literature cover consumption in their analysis (see Fig. 4). An overarching theme in this subset of papers, in direct support of the productivist 'blue revolution' narrative, is that farmed fish is compensating for the decreasing availability of wild fish (e.g. Ahmed and Lorica 2002; Prein 2002). Except for a few papers that explore how vulnerable (poor) consumers access fish (E-Jahan et al. 2010), the literature places considerable emphasis on increasing the overall affordability and accessibility of farmed fish supply across the region (Dey 2000; Dey et al. 2000a). This literature overwhelmingly refers to a generic category of 'fish' rather than giving details on consumer preference for different species (Morgan et al. 2017). Instead, claims of consumer preference lead to distinctions of preference that provide generalized and often unsubstantiated claims. For example, "common carp has traditionally been a preferred cultured species […] tilapia are proposed as an alternative because these fish are cheap to raise, give high yields and are also quite palatable" (Fernando and Halwart 2000, p. 45) or "prices of fish […] are the driving force that influence consumers' decision to buy a particular species" (Dey et al. 2005a, p. 105).

Similar to the wild fish literature, another persistent theme is farmed fish consumption by producers, often framed as a benefit of aquaculture development interventions (Prein 2002; Karim et al. 2011; Pant et al. 2014).[9] Following Ahmed and Lorica (2002), increased fish consumption is positioned next to two other 'linkages' (income and employment) by which aquaculture contributes to food security of producing households. Increased direct consumption is the only linkage that has been documented in the sampled literature (E-Jahan and Pemsl 2011). Claims that increased income from aquaculture increases the consumption of nutritious foods, or that the nutritional benefits brought by aquaculture extend to the hired labour, are not well supported in the sampled literature (Kawarazuka and Béné 2010). Nevertheless, these assumptions are commonly advanced to legitimatize aquaculture development interventions in the interest of food security (E-Jahan et al. 2010),

[8] See Kelleher et al. (2012) for more on the "Hidden harvest" narrative.

[9] Refer to Belton and Little (2011) for an analysis of the aquaculture development narrative in Asia.

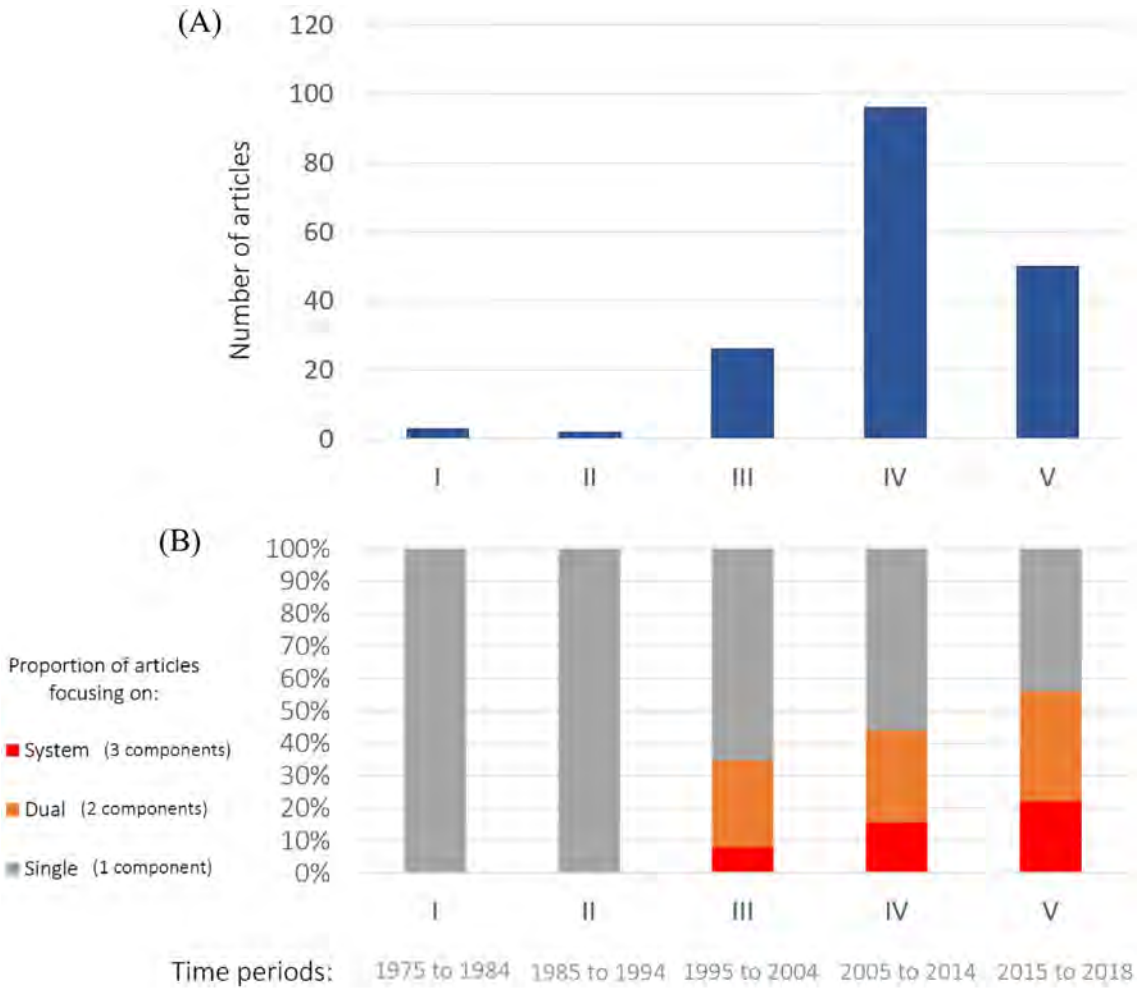

Fig. 5 **a** Number of sampled articles and **b** their proportional focus on food fish system components in the sampled literature from 1975 to 2018

including when the production target is oriented towards export (Ahmed et al. 2010).

Finally, there is a strong bias in favour of rural farmed fish consumption, despite relatively early acknowledgement of the growth and importance of urban fish consumption (Dey et al. 2000a; Ahmed and Lorica 2002). Studies that do focus on urban consumption highlight the role of higher urban purchasing power as a means of driving rural development, rather than the importance of fish consumption to urban food security (e.g. Karim et al. 2011). More recently, albeit to a lesser extent, attention has been given to the wider influence of urbanization as a key driver of aquaculture development, with attention going to the effects growing urban demand will have on both the volume and kinds of fish produced (Belton and Bush 2014).

Overall, however, the science-policy literature treats consumption in relatively limited respects, placing emphasis on direct and spatially proximate consumption rather than the wider contribution of food fish, both wild and farmed, to domestic and regional economies of South and Southeast Asia. Our comparative review of the segregated fisheries and aquaculture literature shows how this segregation has had a foundational role in the articulation of development policies associated with the two sectors.

Coverage of the integrated literature

While most papers segregate wild and farmed fish production, consumption and provisioning, a small but growing set of papers takes a more integrated perspective. In breaking down the distinction between wild and farmed fish, this literature has increasingly drawn attention to the interlinkages between production, provisioning and consumption, thereby giving rise to progressively more food system-oriented perspectives on fish (Fig. 5).

In stark contrast to the segregated literature, nearly two thirds of the articles in the integrated literature focus on

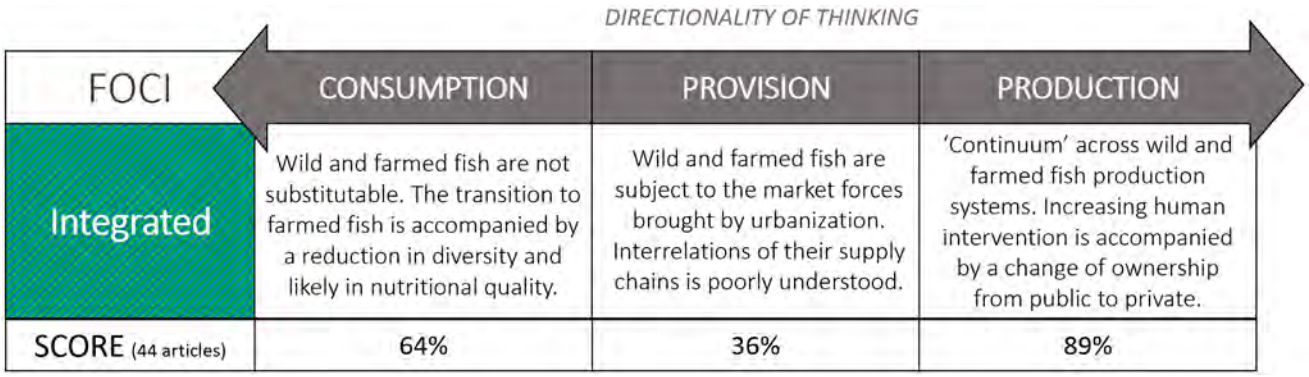

Fig. 6 Proportion of integrated articles and key messages by food fish system components

consumption as a main area of inquiry (see Fig. 6). Also, in direct contrast with the segregated literature, these papers emphasize the degree to which wild and farmed fish are not substitutable. Belton and Thilsted (2014), for example, demonstrate the complementarity of wild and farmed fish in contributing to food security in Asia and other developing regions. In doing so they challenge the prevailing policy narrative that aquaculture will gradually replace declining wild fish stocks by showing that wild fisheries continue to make an important contribution to nutrition, particularly for the most vulnerable consumers. This is supported by a number of other papers that underscore the relatively higher nutritional value of wild fish and, as such, the importance of maintaining species diversity, particularly highly nutritious small fish that are consumed whole (Welcomme et al. 2010; Kawarazuka and Béné 2011; Beveridge et al. 2013; Belton and Thilsted 2014; Youn et al. 2014; Bogard et al. 2017).

Similar to the segregated literature, relatively few papers (36%) in the sample give analytical attention to provisioning (see Fig. 6). Although the integrated literature has the merit of being more focused on regional dynamics, farmed fish in this literature is still more commonly framed as a cash crop than a food crop (Kawarazuka and Béné 2010). This tendency has contributed to steering development efforts towards the production of larger-sized fish aimed at the urban middle-classes rather than smaller and economically accessible fish aimed at poorer rural and urban consumers (Beveridge et al. 2013). While this literature emphasizes the value of wild fish for rural food security, it also recognizes that wild fish are increasingly traded to meet growing urban demand (Kawarazuka and Béné 2010). These general observations, however, lack empirical evidence and underlines a need for increased attention to how the transition to farming affects access to and use of food fish by different consumers. As argued by Toufique and Belton (2014), the greater the recognition given to fish as food in domestic markets, the more important it will be for the science-policy literature to shift the understanding of consumption beyond the producers and beyond categories of 'wild' and 'farmed'.

Like the segregated literature, 89% of papers in the integrated literature focus their analysis on production (see Fig. 6). In opposition to the segregated literature however, the integrated literature challenges the dichotomy commonly assumed between farmed and wild fish. From the late 1990s onwards, the integrated literature has emphasised a continuum based on increasing human inputs and control over freshwater fish production and increasing private ownership moving from fisheries to aquaculture (Welcomme and Bartley 1998; Lorenzen et al. 2012). More recently, Little et al. (2016) explain the origin of aquaculture by describing the transition from fishing as "a gradual process" developing in "responses to times when demands for wild foods outstripped supplies" (p. 275). Despite its analytical power to rethink freshwater fisheries and aquaculture as closely interrelated production processes, it is evident from the review that such continuum perspective has had very little influence on the science-policy literature surrounding South and Southeast Asian freshwater.

Across consumption, provision, and production the integrated literature emphasizes the different contributions of wild and farmed fish as food, highlighting their complementarity rather than their substitutability. While this perspective underlines the importance of food fish systems thinking, it also shows that further evidence is still needed on the linkages between the three food system components, especially with respect to access and use of food fish by poor consumers in both rural and urban settings.

Discussion: towards food (fish) systems thinking

Our review of the science-policy literature on freshwater fish reveals a gradual shift toward understanding freshwater fish in South and Southeast Asia from a more integrated

perspective. Historically, the science-policy literature has focused heavily on fish production and maintained a clear division between capture fisheries and aquaculture. However, attention is increasingly being paid to the provisioning and consumption of freshwater fish, and an emerging strand of 'integrated' literature is beginning to break down the dichotomy between wild caught and farmed fish. Though these emerging strands still represent a small proportion of the literature, and are not framed explicitly in terms of food systems thinking, they demonstrate the complementarity of wild and farmed fish as food, and lay the foundations for a more precise understanding of freshwater food fish in the region. We argue that the main value of the food fish systems approach, as applied to the Asian freshwater fish science-policy landscape in this review, is to reveal weaknesses and lacunae in the existing literature and identify agendas for future research.

Three points stand out. First, the science-policy literature on capture fisheries and aquaculture are heavily siloed. The two sectors are erroneously framed as separate, and in opposition, while their overlapping and highly complementary contributions to food security are rarely recognized. Second, the strongly productivist bias of the literature results in inadequate understanding of the system of provision and consumer behavior and their mutually constitutive and recursive relationships with the system of production. Moreover, a focus on specific types of production (subsistence, export) means that many important forms of production and associated systems of provision and consumption are overlooked. Third, the literature on freshwater fish largely assumes simplistic relations from production to consumption with the consequence that governance is conceived predominantly around production. Such framing ignores the multidirectional relations between the production, provision, and consumption of freshwater food fish and, as a result, falls short in leveraging other important entry points for governing food security. We address these points in greater detail below.

First, the deep disciplinary and epistemological disconnect between scientists working in freshwater fisheries and aquaculture, and the framing of the two sectors as separate and distinct policy spheres, often in competition or opposition to one another, has severely curtailed the terms in which policy-makers and researchers understand the relative roles and contributions of wild and farmed fish. In contrast, the food fish system perspective stresses the complementarity of these forms of production within the same food system, making it possible to appreciate their overlapping (albeit differentiated) contributions to food security in the region. As such, the food fish system perspective lays the ground for reconciling the siloed research agendas surrounding wild and farmed fish, suggesting multidisciplinary perspectives that combine elements from social and natural sciences. Such a reassessment notably calls for a better recognition of intermediate forms of production, that are still largely disregarded, and which understandings could help leveraging ecological synergies across wild and farmed fish production (Lynch et al. 2019). For instance, the food fish system would help moving the aquaculture research agenda beyond technical efficiency to pay greater attention to species diversity and become more sensitive to the ecology of local fish communities. By articulating a more integrated perspective on production, a food fish system perspective holds the promise to not only better tackle food security, but also to put greater emphasis on agroecological integrity rather than production efficiency alone (Eakin et al. 2016).

Second, a focus on fish production—and on specific types of production—has contributed to inadequate and distorted understandings of fish provision and consumption. Except for the literature on global value chains dealing with production for export, fish provision has been largely overlooked, creating a 'missing middle' in food fish system science-policy literature. Processing, distribution and consumption of fish, and the ways that changes in these spheres (e.g. technological and institutional innovations, new forms of retail, evolving consumption practices) ultimately shape production practices have been overlooked. Excessive attention towards export-oriented production in aquaculture has framed freshwater fish more as a global commodity for revenue generation than as a foodstuff contributing to food security in producing nations. Similarly, emphasis on the role of subsistence production in freshwater capture fisheries and aquaculture has contributed to ignoring the wider contribution of food fish to domestic and regional economies of South and Southeast Asia. As a result of these biases, understandings of fish consumption in the region fall short of grasping the socio-cultural factors that underpin where, how, and why, wild and/or farmed fish are consumed (see for e.g. Jennings et al. 2016), and their contributions to food security. In short, a food fish system perspective gives rise to clearer recognition of the specific nature of provision and consumption, implying a reconsideration of how these in turn shape and structure the system (Koc and Dahlberg 1999; Béné et al. 2019).

Third, our review demonstrates the value of understanding multidirectional interrelations between production, provisioning and consumption that make up a food fish systems approach. As such, the food fish system thinking goes beyond 'chain' approaches where the emphasis is on bi-directional flows of products and finance and where governance is predominantly perceived in terms of leveraging improvements around production (Ponte and Sturgeon 2014). In contrast, by recognizing interrelated sets of production, provision, and consumption practices, a food fish system perspective reveals multiple entry points for governing outcomes associated with food. Seen from this angle, achieving food security or sustainability requires incorporating and coordinating the

multiple ways in which these different sets interact (Ericksen 2008; Ingram 2011). In the context of rapid societal transitions such as those occurring in South and Southeast Asia, acknowledging such multi-directionality has the potential to better anticipate what changing consumer demands and systems of provision mean for the relative contributions of wild and farmed fish to consumers in the region; both vulnerable and affluent (IPES 2017).

We have articulated our food fish system approach here around freshwater fish, the marginalized bulk of food fish in the region, and argued that it makes a compelling case for advancing food systems thinking. Yet, more research is needed to complement these understandings with a food systems-based analysis of marine food fish, which is another substantial component of the regional food basket. It will be even more important for future research to move beyond these two broad aggregate categories of food fish in order to fully account for diversity within them, and better appreciate the differentiated contributions that individual species and products make to the overall food fish system (Tlusty et al. 2019). Going even further, we argue that a food fish systems thinking can be advanced by engaging with the turn to 'diet-thinking'. The latter works back from the practice of consuming meals or dishes to integrate the multiple and extended systems of ingredients (Haddad et al. 2016; Willett et al. 2019). A diet approach can also help avoid the common export bias surrounding food fish (see Belton and Bush 2014; McClanahan et al. 2015; Bush et al. 2019) by articulating the geographic scope of production through consumption and provisioning (Béné et al. 2019).

Conclusion

A partial shift towards a food fish system perspective is apparent in the freshwater fisheries and aquaculture literature in South and Southeast Asia. The approach appears to be useful in explaining and reconciling polarizing narratives surrounding freshwater food fish by questioning key assumptions around what drives their production, provisioning and consumption in the region. The science policy literature is yet to frame future directions in 'food fish systems' terms. Nevertheless, there are indications that this literature, and the organizations it represents, are starting to open up to the value of systemically linking production, provision and consumption and translating these linkages into the policy landscape. By doing so they hold the potential to shift policy towards more integrated perspectives, moving beyond the simplistic productivist narratives to better consider how food fish is distributed and consumed in the region.

There remains considerable opportunity to further develop a food fish systems approach in Asia and beyond. While food systems research has generated considerable enthusiasm in recent years, such studies are still for the most part limited to the 'temperate minority'[10] from where most academic contributors originate (see for e.g. Jennings et al. 2016). In advancing the food fish system agenda, it will be essential for academics to make sure that they account for the realities of the 'tropical majority',[9] in particular Asia, where most of the world's fish is produced and consumed (FAO 2018). In that regard, the present study should be taken as a preliminary broad-brush assessment. Because food fish systems (however global) are dependent on local conditions, further attention should be given to fine-grained place-based studies that dissect and document how complex and interrelated sets of production, provision, and consumption practices affect the availability, accessibility, and use of food fish in particular places.

Notwithstanding this ongoing shift towards food fish systems thinking, we contend that the latter needs to be more explicitly fostered and adopted by research and development actors at the center of our review. Only then will it have a substantial influence in framing how the contribution of fish to food security is understood and translated into policy in regions such as South and Southeast Asia. It is worth noting that some of the criticisms stemming from our review have been recurring. It has been over 20 years since Bailey (1988) wrote in this same journal: "international development agencies have promoted a dualistic pattern of fisheries development within the Third World […] fisheries development and resource management need to be seen as complementary aspects of a single process". To do so effectively, we have argued here for a food fish system as a promising framework for revitalizing fisheries and aquaculture development agendas towards food security.

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[10] This terminology is borrowed from Bavinck et al. (2018) to refer to the global north and the global south respectively.

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Ben Belton is a rural sociologist whose work focuses on the political economy and political ecology of aquaculture and capture fisheries development, agricultural value chains, food and nutrition security, agrarian change, poverty and social well-being. Ben Belton currently holds a joint appointment as Associate Professor of International Development at Michigan State University and Senior Scientist at WorldFish.

Australian Government
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Documenting the freshwater fisheries reform in Myanmar

Emerging policy recommendations

by Xavier Tezzo, Win Ko Ko, Hsu Mon Aung, Zizawah, Khine Thazin, and Zayar Min

Fisheries Co-management stakeholder Forum

Yangon, June 20th-21st 2019

WorldFish

DEPARTMENT OF FISHERIES MYANMAR

MYFish Myanmar Fisheries

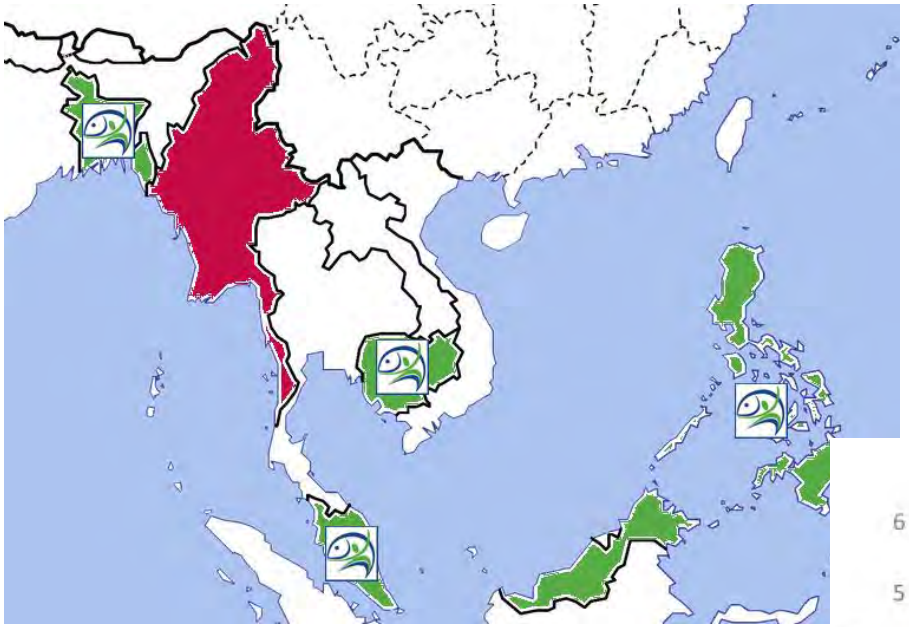
CGIAR RESEARCH PROGRAM ON Fish

OUTLINE

1. **BACKGROUND**: MYANMAR INLAND FISHERIES
2. **MYFISH 2**: GENERATING EVIDENCE ON THE REFORM
3. EMERGING **POLICY** RECOMMENDATIONS

BACKGROUND

Why is (freshwater) fish important for Myanmar?



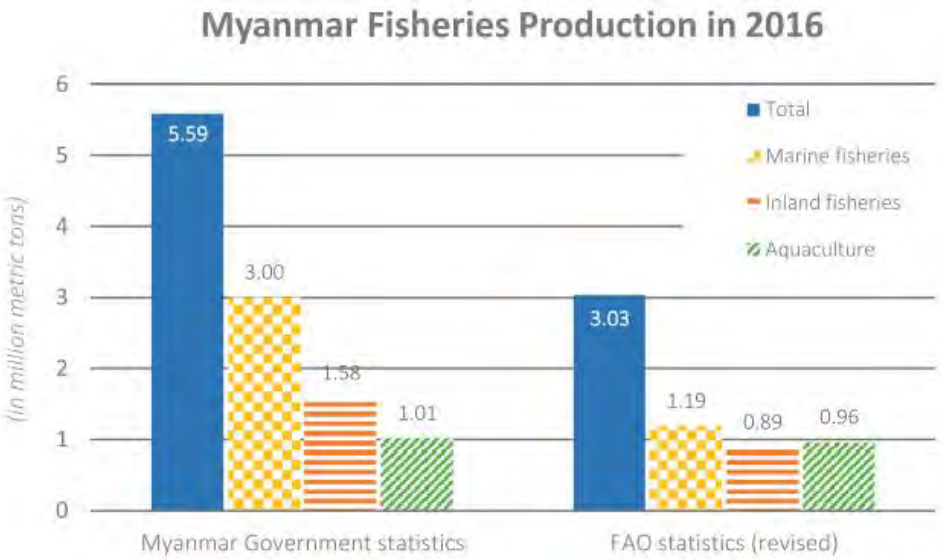
3 million MT

(export only 400,000 MT)

Fish consumption per capita

21-51 kg/person/year

23% of animal protein



BACKGROUND

Typology of freshwater fisheries governance

OPEN FISHERIES:

Water bodies that can be exploited by all individuals who possess a gear license purchased from DoF.

TENDER FISHERIES

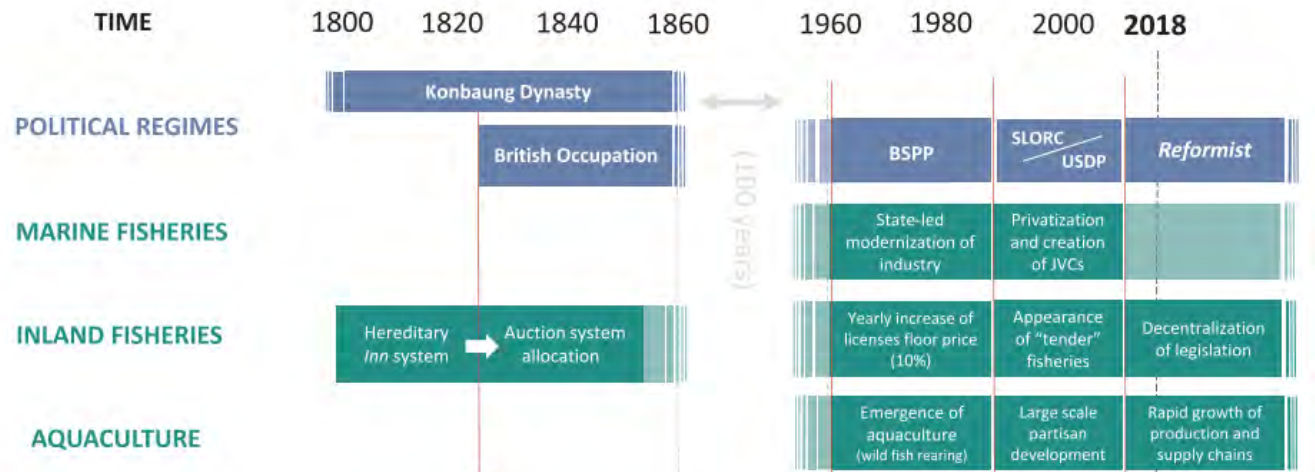
Large stationary fishing gears in specific river locations which are licensed, usually to individuals, by government through an auction system.

LEASABLE FISHERIES

Also referred to as "Inn" and correspond to usual large areas for which exclusive fishing rights are allocated by DoF through an auction system

BACKGROUND

Brief history of Myanmar fisheries legislation



18th century: Two types of fisheries at that time: *public* and *hereditable* (***"Innthugyis"***).

1869: Dr. Day recommends using the auction system for productive fisheries

1875: The *Burma Fisheries Act* introduces the auction with a *proviso* allowing outsiders

1991: *Union-level Freshwater Fisheries Law* (status quo on auction system)

2012: First *AD Freshwater Fisheries Law* (status quo on auction system)

2018: Revised *AD Delta Freshwater Fisheries Law* supports community allocation

MYFISH 2

Scientific evidence to support adaptive reform

Grasping change adaptively towards improved governance…

ACIAR

- Research existing systems
- Monitoring outcomes of fishery management
- Share data with fishers, government & partners
- Assist Governance policy

DEPARTMENT OF FISHERIES MYANMAR

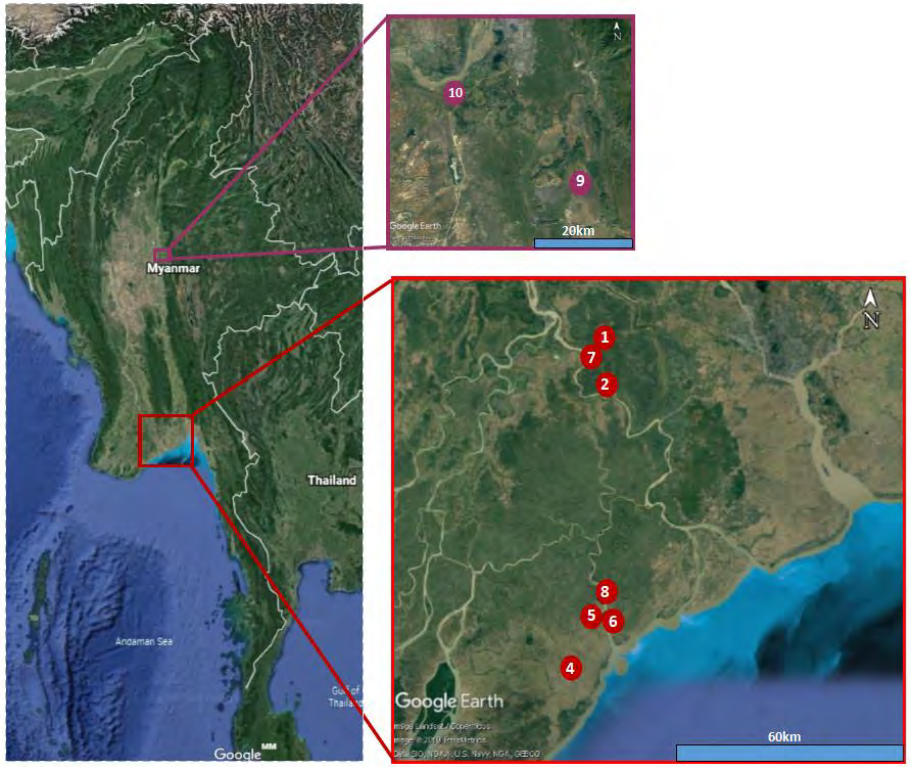
WorldFish

FRDN Fisheries Research Development Network

MYFISH 2

Characterizing existing management systems

Sampling across a variety of geographies and inland fisheries systems (AD/CDZ)



MYFISH 2

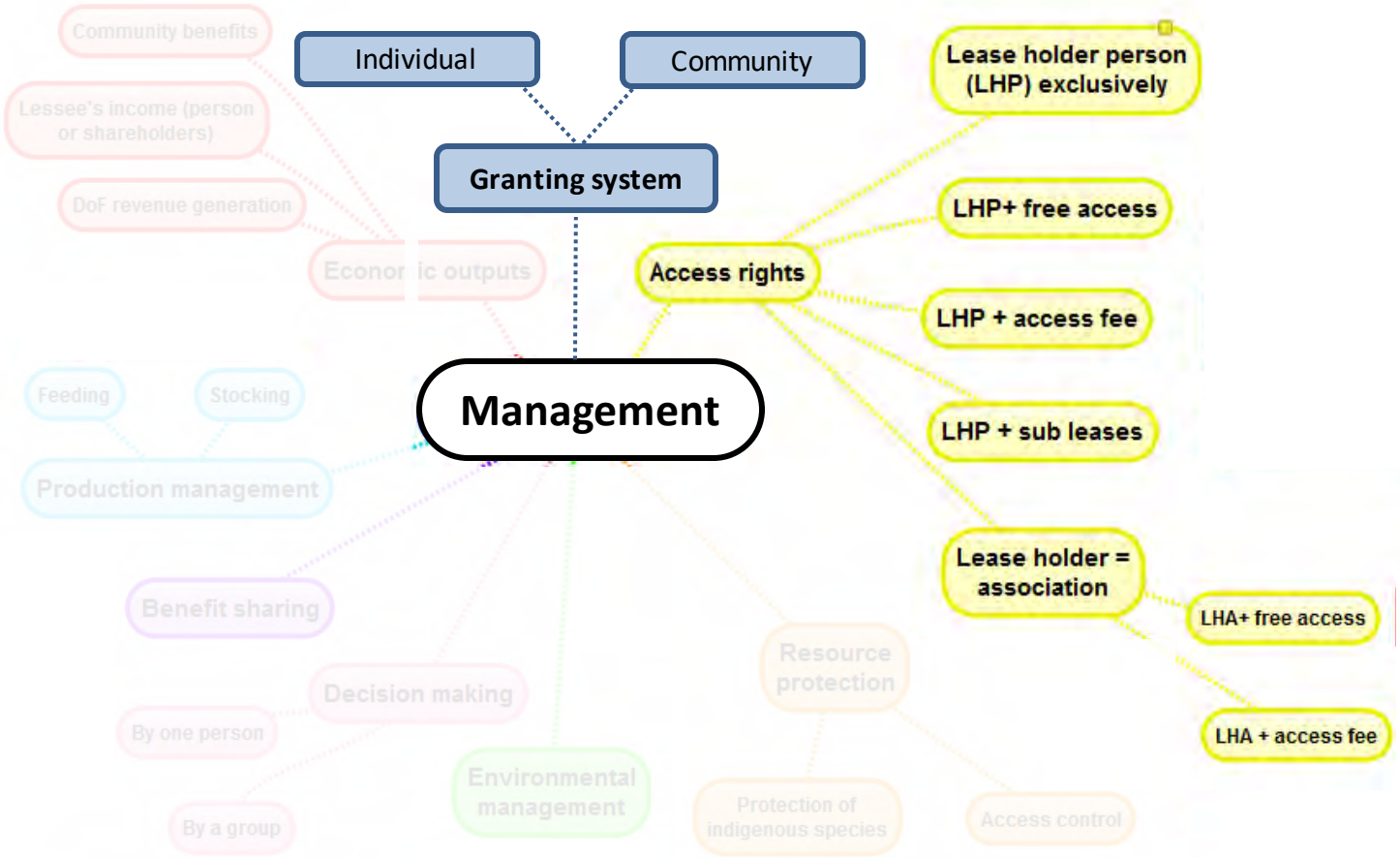
Characterizing existing management systems

Sampling across a variety of licensing systems (lease/tender, individual/community)

#	Fishery name	Township	License	Granting	Environment	CSO/NGO involvement
1	Ah Lae Met Kun	Maubin	Lease	Community	Channel	Yes
2	Auk Met Kun	Maubin	Lease	Individual	Channel	No
3	Hlaing Tar Mezali	Maubin	Lease	Community	Channel	No
4	Kyonekadon Yeyoe Gyi	Pyapon	Lease	Community	Channel	No
5	Ha Hpaung	Pyapon	Lease	Individual	Channel	No
6	Ah Char Ka Dar	Pyapon	Tender	Community	River	Yes
7	Sar Ma Lauk	Maubin	Tender	Individual	Channel	No
8	Pa Zun chuk Sat Yone	Pyapon	Tender	Individual	Coastal	No
9	Sunye Inn	Kyaukse	N/A	Community	Oxbow lake	No
10	Myint Thar Ngapat	Tada U	Lease	Individual	Oxbow lake	No

MYFISH 2

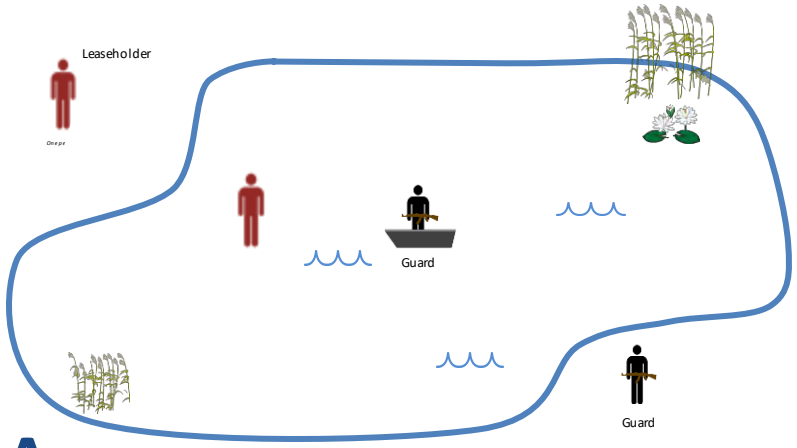
Characterizing existing management systems



MYFISH 2

Characterizing existing management systems

More complexity than expected around **granting systems** and **access rights**…



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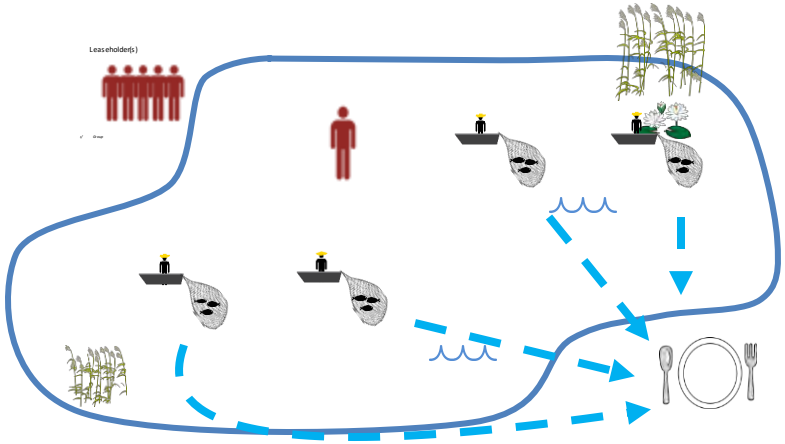
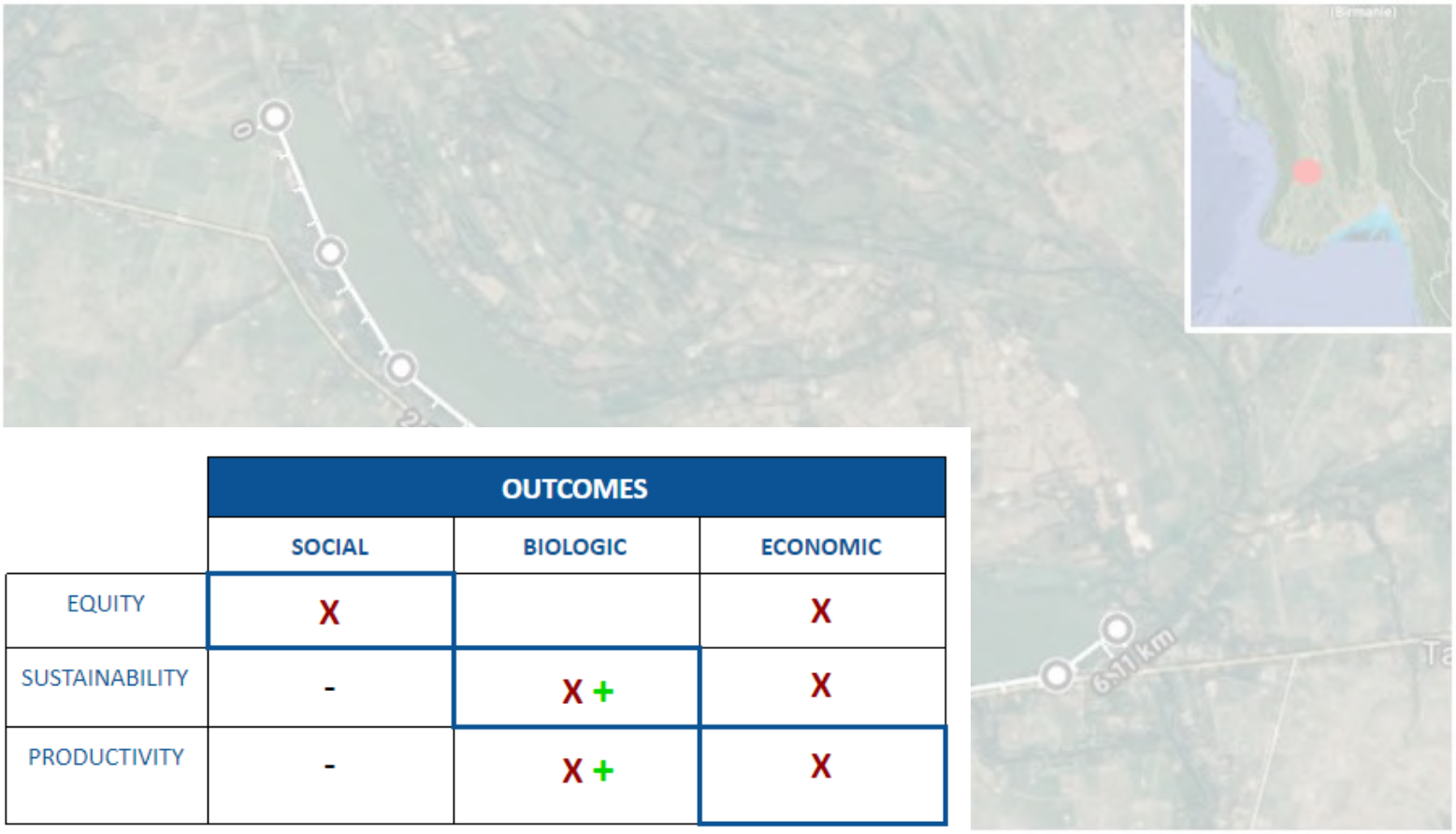


B

MYFISH 2

Assessing performances of the fisheries

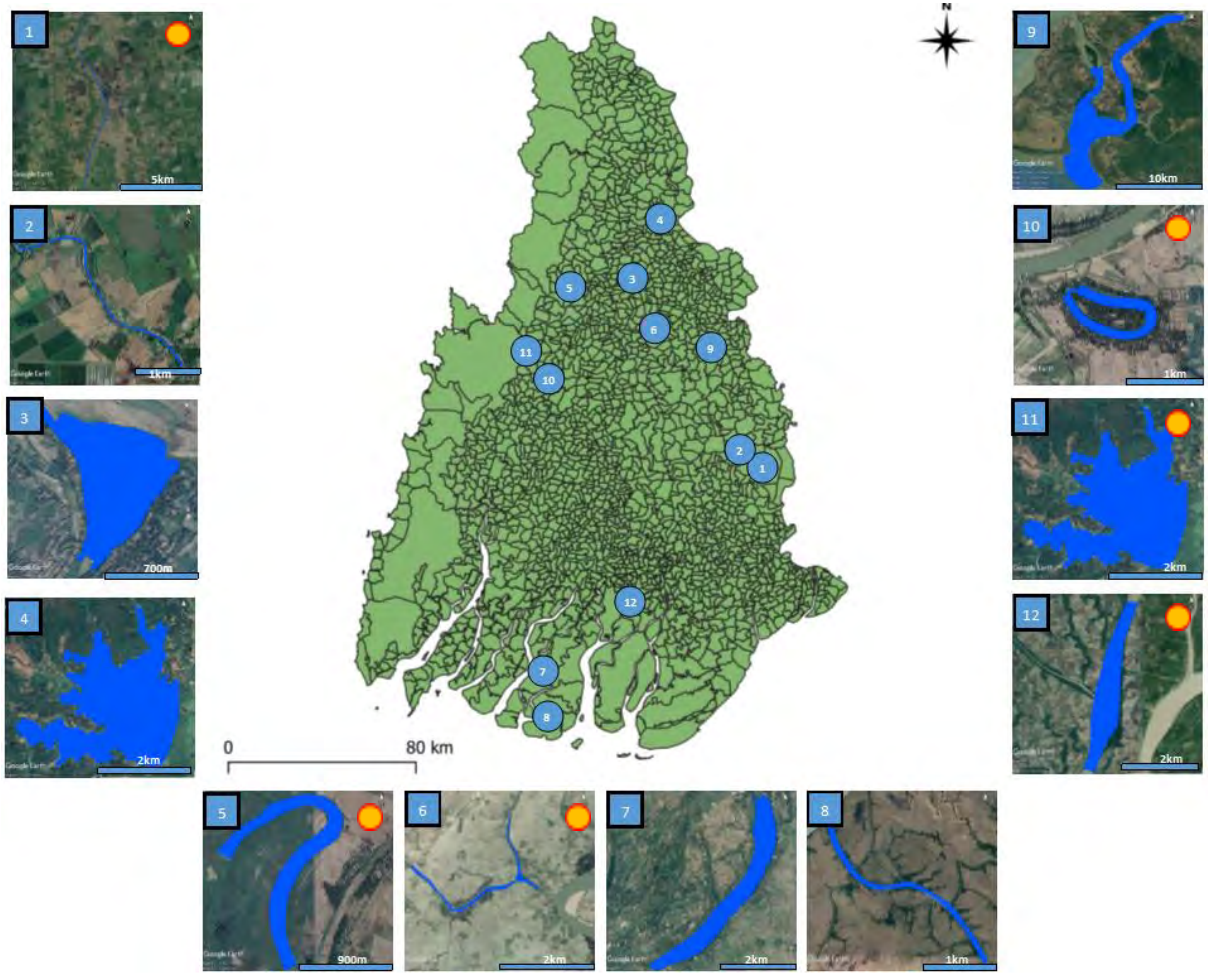


	OUTCOMES		
	SOCIAL	BIOLOGIC	ECONOMIC
EQUITY	X		X
SUSTAINABILITY	-	X +	X
PRODUCTIVITY	-	X +	X

\+ Biomonitoring X Socioeconomic monitoring & evaluation ❒ Main outcomes

MYFISH 2

Assessing performances of the fisheries



Tools:

1) Socio-economic surveys (over 900HHs)
2) Biological monitoring (fishers as surveyors)

Research teams:

WorldFish
Department of Fisheries
Yangon University
Pathein University
Dagon University
Hinthada University
Maubin University

Duration

2 years (from 2019 to 2021)

POLICY RECOMMENDATIONS

Early take-away points from our research…

- **Auction system** is threatening sustainability of inland fisheries
- Resources **management** is too often neglected in policy discussions
- Need for **resources monitoring** system to support decision-making
- Managing fisheries requires integrating **broader drivers** of change

Australian Government
Australian Centre for International Agricultural Research

Australian Aid

THANK YOU

DEPARTMENT OF FISHERIES
MYANMAR

CONTACT US:
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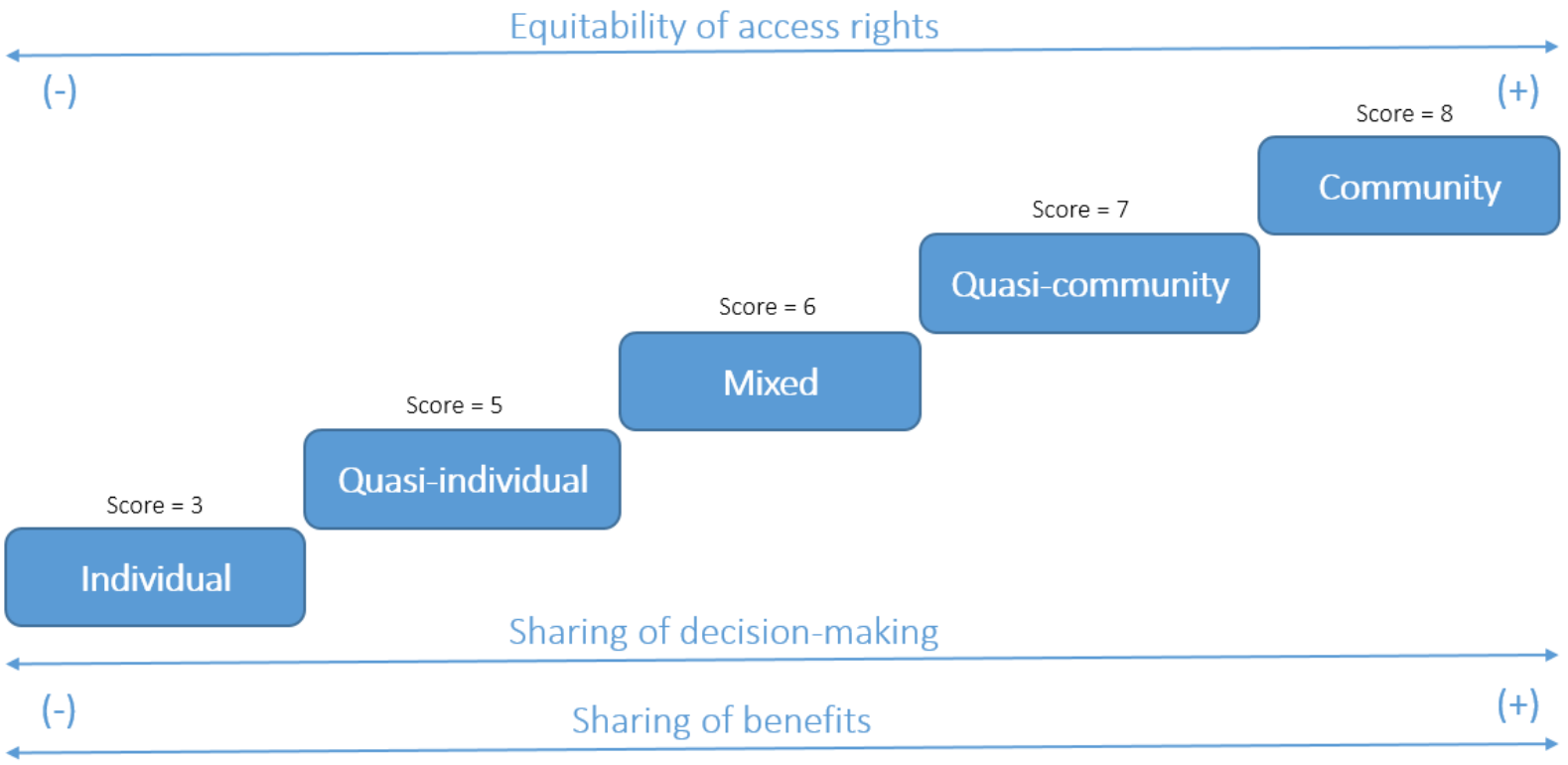
WorldFish

POLICY DISCUSSION

Recognizing a continuum of management regimes?



Exploring Women's Empowerment in Fisheries (EWEF)
A Methods Pack for a Collaborative Study on Women's Empowerment in Small-scale Fisheries.

Kristie Drucza, Katie Tavenner, Cynthia McDougall, Philippa Cohen, Wae Win Khaing and Jessica Scott

December 2020

ABSTRACT

This methods package, *Exploring Women's Empowerment in Fisheries* (EWEF), was developed to fill the gap in assessments of women's empowerment by eliciting framings that capture, and emphasise, local women's understandings of what constitutes empowerment in small-scale fisheries (SSF). EWEF shifts the discourse around empowerment away from narrowly defined economic measures to a more nuanced, intersectional and context-specific mode of assessment. It also captures women's aspirations to elucidate where they want to go and how WorldFish, and other partners, might assist with enhancing women's self-defined strategic freedoms. The EWEF methodology also shifts the discourse around empowerment away from an academic exercise that extracts information from participants to one that empowers women through the process of collecting and analysing the data, and enables the application of the results by key stakeholders.

WorldFish commissioned EWEF in response to growing momentum around sustainable aquatic development pathways and the organization's commitment to not leave women behind in this sector. WorldFish's mission is to reduce poverty and hunger by improving fisheries and aquaculture. Gender equality is integral to WorldFish achieving its goals and advancing Agenda 2030.

This document provides a complete package of the EWEF methodology including research questions, conceptual frameworks, study design, data analyses plans, and recommendations for application. The EWEF will inform public and private sector policy and research for development investments in terms of current forms and degrees of empowerment as both process and outcome for different rural and peri-urban women, as well trends, and constraining and enabling factors.

Table of Contents

Authors
Kristie Drucza, PhD; Katie Tavenner, PhD; Cynthia McDougall, PhD; Philippa Cohen, PhD; Wae Win Khaing; and Jessica Scott.

Author contributions
KT, CM, PC and KD contributed to conception and design of the study. KT and KD led the design of individual methods with significant input from CM, JS, WW and PC. KD wrote the methods package with input from CM, PC and KT. All authors contributed to revisions, and have read, and approved the published version.

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Acknowledgements
This work was undertaken as part of the CGIAR Research Program on Fish Agri-Food Systems (FISH) led by WorldFish. The program is supported by contributors to the CGIAR Trust Fund. We thank the WorldFish Myanmar Office for their assistance in facilitating this work, including Mark Dubois for his policy insights and Aung Hsu Mon for her translation, enumeration and facilitation of qualitative data collection in the pre-pilot, phase I, and phase II of the study.

Cover photo credit: Local fish market in Ayeyarwady Delta, Myanmar. Photo by Jharendu Pant, 2012.

Acronyms and Abbreviations

ANOVA	Analysis of Variance
CGIAR	Consortium of International Agricultural Research Centres
CRP	CGIAR Research Program
EWEF	Exploring Women's Empowerment in Fisheries
FAO	Food and Agriculture Organization
FGDs	Focus Group Discussions
GBA+	Gender Based Analysis Plus
GTA	Gender Transformative Approach
IDI	In-depth Interviews
KIIIs	Key Informant Individual Interviews
MRV	Monitoring, Reporting and Verification
NSPAW	National Strategic Plan for the Advancement of Women
OM	Outcome Mapping
PRA	Participatory Rural Appraisal
R & D	Research and Development
SSF	Small -Scale Fisheries
SSIs	Semi-Structured Interviews
VCD	Value Chain Development
WF	WorldFish
WIF	Women in Fisheries

ABOUT THE METHODS PACK

Policy and development efforts to expand women's equitable participation in small-scale fisheries (SSF) governance and livelihoods are growing as a means of enhancing outcomes from the sector. These efforts are linked to the Sustainable Development Goals (SDGs), along with the acknowledgment that gender data gaps are critical to making the paid and unpaid contributions of women to the fisheries sector more visible. But it is not only this data gap that needs to be addressed. Measuring women's empowerment is fraught with complexities associated with its misconception (often seen as interchangeable with participation, capacity, income or nutrition outcomes), and the way it is often assessed according to indexes developed from a different cultural perspective, and usually only offers a snapshot in time. Consequently, women's empowerment tends to be weakly assessed and evidenced and, arguably, remains elusive as an outcome. WorldFish's mission is to reduce poverty and hunger by improving fisheries and aquaculture. Gender equality is integral to WorldFish achieving its goals and advancing Agenda 2030. The organization has a responsibility to its partners to capture and communicate the impact of its work on men and women, girls and boys and communities at large. Moreover, gender equality contributes to inclusive growth and sustainable development (Madgavkar 2020). WorldFish commissioned this methods pack - *Exploring Women's Empowerment in Fisheries* (EWEF) - in response to growing momentum around sustainable aquatic development pathways and the organization's commitment to not leave women behind in this sector.

THE PURPOSE OF THE METHODS PACK

EWEF was developed to fill the gap in assessments of women's empowerment by eliciting framings that capture, and take seriously, local women's understandings of what constitutes empowerment in SSF. This methodology shifts the discourse around empowerment away from narrowly defined economic measures to a more nuanced, intersectional and context-specific mode of assessment. It also captures women's aspirations to elucidate where they want to go and how WorldFish and other partners might assist with enhancing women's self-defined strategic freedoms.

The study of, and advocacy for, women's empowerment is necessary because the causes and consequences of low levels of empowerment limit women's opportunities (Malhotra and Schuler, 2005) and while many policies and programs aim to increase empowerment (Alsop and Heinsohn, 2005), evidence of their success is lacking (Springer and Drucza 2019). The power relations surrounding the women respondents across spheres/levels and value chain nodes is a core part of this methodology which builds on and complements existing WorldFish studies (such as Choudhury et al. 2017, Sari et al. 2017) and adapted assessment tools, such as the WEAI-adapted Women's Empowerment in Fisheries Index (WEFI) tool. From a research for development perspective, this methodology facilitates greater awareness of what women's empowerment is and is not in a given context, and importantly sets a new standard through which researchers can 'claim women's empowerment.'

WHO CAN USE THE METHODS PACK

The methodology presented in this methods pack is intended for a variety of users interested in measuring women's empowerment. It will be particularly useful to policymakers, researchers and program manager and technical advisers who require:

- insights on how women's empowerment is implicated in emerging fish system policies and programs,
- evidence of the risks of not empowering women,
- interventions on how to safeguard against women's disempowerment, and
- maximize the opportunities for women's empowerment in small-scale fisheries.

This document provides a complete package of the EWEF methodology including research questions, conceptual frameworks, study design, data analyses plans, and recommendations for application. While EWEF is meant to provide a generic blueprint for carrying out the scalable case study research design described herein, the methodology will need to be adapted to context and purpose. It is our hope that you learn more about gender norms and power relationships in SSF from using the package.

NOTE TO READER

WorldFish is interested in receiving feedback to help improve the EWEF methodology. Please send questions, comments and experiences to C.McDougall@cgiar.org. Together let's make measuring women's empowerment a more nuanced, intersectional, endogenous and context specific mode of assessment.
The glossary should be read by all as it contains important definitions and should especially be read by those who are not gender experts.

Glossary

Agency refers to the capacity of individuals to act independently and to make their own free choices. Related to the concept of empowerment, agency refers to individual and collective capacities (knowledge and skills), attitudes, critical reflection, assets, actions, and access to services (Hillenbrand et al. 2015: 10)

Endogenous notions and strategies of women's empowerment refer to those that are 'derived internally' e.g., are locally defined and relevant to women's lived realities. By contrast, exogenous notions/strategies of women's empowerment that are externally defined by 'outside development actors' and assume universal relevance to women's lives (Tavenner and Crane, forthcoming). As described by Garba (1999:31), endogenous empowerment is a *bottom-up* dynamic process, in contrast to exogenous that is *top down*. While external actors can facilitate empowerment, the notion of empowerment itself must be locally defined.

Gender analysis is a systematic analytical process for organizing, collecting, analysing and interpreting qualitative and quantitative information that examines gender relations in a particular context, ranging from households to communities to nations. The key elements of gender analysis are understanding cultures (especially underlying roles, values, norms and beliefs), power and relationships (access, control and decision-making over time, assets and resources; workloads; needs; empowerment; vulnerability; etc.), at different or multiple scales (Mehar and McDougall, 2017).

Gender equality refers to "equal rights, responsibilities and opportunities of women and men and girls and boys" and is a precondition to "improve the development process by putting social concerns at the centre" (UN, 2001). It is characterized by equal participation of women and men in decision-making, equal ability to exercise their human rights, equal access to and control of resources and the benefits of development, and equal opportunities in employment and in all other aspects of their livelihoods (Huyer et al., 2016)

Gender equity means being fair to women and men. To ensure fairness, measures are often needed to compensate for historical and social disadvantages that prevent women and men from otherwise operating as equals. Equity leads to equality (Government of Canada, 2020).

Gender relations can be understood as the rules, traditions, and social relationships in societies and cultures that together determine what is considered 'masculine' or 'feminine' and how power is allocated between and used differently by women and men (Foskey, 2006).

Intersectionality as an applied analytic concept has been used to understand how different axes of experience and identity interact to produce different effects that cannot be explained by analysing single categories (Clement et al., 2019). Beyond the analysis of individual-level and intrahousehold relationships, intersectionality can be used to analyse structures of power at multiple scales (global, national, and local) and institutions (communities, markets, and management regimes) (Mohanty, 2003). For Colfer et al (2018) intersectionality is about 'The influences of multiple identities in a person as these interact with marginalizing and empowering structures, norms and narrative.'

Norms are "rules and standards that are understood by members of a group, and that guide or constrain social behaviours without the force of law" (Cialdini and Trost, 1998: 152), and often relate to a perceived social pressure to engage or not engage in specific behaviours (Ajzen, 1991). Cristina Bicchieri (2017) determined that what *people think*, can be different to how they act, or appear in public. By exploring the following types of normative data, along with establishing one's 'reference group' (the people who you please) harmful social norms can be overcome:

- Personal normative beliefs – what do you think?

- Behaviours – what do you do?
- Empirical expectations – what do others do?
- Normative expectations – what do you think others think you should do?
- Sanctions/Policing – how are norms enforced?

Pathways to empowerment is a term that originated from a five-year research project lead by the Institute of Development Studies (see Kabeer 2011; Eyben 2011; Darkwah and Tsikata 2009 and 2011). The research found that there were different avenues to how women became empowered and research had to study social, political and economic empowerment in combination with policy and legislation, along with locus of control, to understand mutually reinforcing dimensions (pathways) that led to increased opportunities for empowerment for women in different contexts. As Cornwall (2016:345), writes

> The process of empowerment can usefully be captured in the metaphor of a journey travelled along pathways, one on which women can travel alone or in the company of others, through terrain that may be pitted with thorny thickets, fast-flowing rivers, mud and marshes, and along paths that can double-back on themselves, meander on winding side-routes and lead to dead-ends, as well as opening up new vistas, expanding horizons and extending possibilities.

Power can be a positive or negative social good. For Batliwala (1994) power is defined 'as control over material assets, intellectual resources, and ideology.' Rowland (1997) conceptualizes five different kinds of power: power within, power with, power to, power over and power through. *Power within* refers to women's and men's consciousness – internal and psychological resources [self-efficacy, self-esteem and self-confidence], aspirations and internal beliefs (Hillenbrand et al, 2015: 11). *Power with* refers to collective action and group strength, social capital, networks, and solidarity, and equitable household decision-making and spousal support (Ibid, 11). *Power to* refers to women's and men's power to act and to realize one's aspirations, and includes transformative capabilities and abilities, including knowledge and skills, awareness and conscientization, nutrition, health, and bodily integrity (Ibid, 35). *Power Over* refers to control over resources, services, and others' lives – these include control over income, assets and resources; control over labour; land; and control over others – mobility/gender-based violence (Ibid, 23-31). *Power through* refers to power mediated by forces beyond personal agency and relationships, including fatalism (locus of control) and informal (norms and stereotypes) and formal structural factors (policy) (Galiè and Farnworth, 2019).

Women's empowerment includes equal access and participation, but also extends to the ability of women to assert their rights or interests and to make strategic life choices. It is a much debated topic. Eerdewijk's, (2017) definition gets closer to our understanding of empowerment: 'the expansion of choice and the strengthening of voice through the transformation of power relations, so women and girls have more control over their lives and futures.' As such there are different factors and pathways towards and away from empowerment – it is not a destination but a journey that rarely has a linear trajectory.

1. Introduction to the Methods Package

Food systems have deeply rooted structural inequalities and barriers that need to be addressed for women to benefit on par with men. Globally, women play a crucial role throughout fish value chains, with the Food and Agriculture Organization (FAO) reporting citations from many sources that one out of every two workers in the primary and secondary fisheries and aquaculture sectors, is a woman (FAO, 2020). However, measuring women's empowerment (which is often defined interchangeably with participation, capacity, income or nutrition outcomes) is fraught with complexities. These complexities often arise because of misconceptions around the way indexes developed from a different cultural perspective are used to assess empowerment. Additionally, multiple methods such as WEFI[1] and WEAI[2] provide a snapshot in time of women's empowerment. How to empower women in small-scales fisheries (SSF) over time requires empirical exploration, along with how to measure that process.

WorldFish and Includovate teamed up in late 2019 to examine local women's understandings of what constitutes empowerment through a case study in SSF. This package presents the methodology developed from that process. According to Eerdewijk (2017) empowerment is: 'the expansion of choice and the strengthening of voice through the transformation of power relations, so women and girls have more control over their lives and futures.' In this methodology empowerment is conceptualized as both a process and an outcome that varies by place and is influenced by other intersectional categories. This methodology adopts a nuanced, intersectional and place-based mode of assessment than traditional economic assessments and indexes in order to prioritize empowerment pathways identified by respondents. This methodology and methods package addresses existing literature gaps, while applying the lessons learned from the literature review completed for this study in order to measure women's empowerment in SSF.

The structure of the methods package is as follows, the first section briefly presents findings from the literature review and how the EWEF builds upon the gaps identified. The methodological approach and framing follows which outlines the conceptual framework, the research questions and design. There are three research phases and the tools used in each phase are outlined in detail, including an explanation of how to use the tools, an outline on their purpose, the time it takes to complete, strengths and weaknesses, and informed consent statements.

2. Literature review on women's empowerment in SSF

In addition to the general women's empowerment literature, several studies have focused on women's empowerment in SSF (FAO, 2017c, FAO, 2017a, FAO, 2016, Salim and Geetha, 2013). Calhoun et al. (2016) call for utilizing a holistic approach to studying women's empowerment in SSF that includes an understanding of the intersection between the dynamics of fisheries management and women's participation within fishing, and community resilience over time. In Oregon, USA, Calhoun, et al. (2016) found that women contribute to the well-being, resilience, and adaptive capacity of the state's evolving commercial fishing industry. In a low-income context, the Pacific islands, Harper et al. (2013) similarly found that recognizing and quantifying the role of women in fisheries has profound implications for management, poverty alleviation and development policy.

[1] The Women's Empowerment in Fisheries Index (WEFI) is a new tool adapted from the pro-WEAI (Coles et al., 2018; Coles et al., 2020) that captures information on household decision making around fish-related activities, including fishing, processing, storage, transportation and marketing, access to productive resources related to fisheries and fisheries extension services, leadership, time allocation and attitudes towards men's and women's activities in the fish value chain.

[2] The Women's Empowerment in Agriculture Index (Alkire et al. 2013) measures women's empowerment in five domains: decisions about agricultural production; access to and decision-making power about productive resources, control of use of income, leadership in the community, and time allocation. The index also measures the percentage of women whose empowerment 'achievements' are at least as high as men in their households, and for women lacking parity, the relative empowerment gap with respect to the male in their household.

While most fisheries related empowerment, research is done at a specific node of value chains, Salim and Geetha (2013) studied four occupational groups – fish retailers, fish vendors, dry fish makers, and value-added fish producers. They revealed that the highest level of gender discrimination faced by female respondents across the four different occupational groups was in handling, transporting, and storing bulk quantities of fish resources. Meanwhile, women working in value-addition (producers) followed by retailers for the dry fish makers and vendors, had the most empowerment, emphasizing the need to compare value chain nodes in future studies. Moreover, Cole, et al., (2018) found that even within a node (in this case the postharvest value chain node) women can be more or less empowered and can disproportionately experience postharvest losses because of time constraints, a lack of decision-making powers and access to processing, storage, and handling technologies.

Literature relating to a given node within larger scales is limited to policy or published literature reviews (Kawarazuka et al., 2017, FAO, 2017b). This limits the ability to contextualise any research findings to the local context. For Kruijssen, et al. (2018) the evidence indicates the need for research to elucidate practical ways to increase women's engagement in and returns from aquaculture value chains. This would include addressing formal and informal barriers to women's control over assets, including gender norms that reproduce inequality and exclusion. Robust studies of aquaculture and gender should measure any changes in equality at the levels of the couple, the household, and the community (Underwood, Leddy and Morgan 2014). Thus, there is a need to fill the gaps in the broader literature and in the SSF/aquaculture literature pertaining to women's empowerment.

The literature review for this assignment found a number of gaps and lessons learnt that have been incorporated into this methodology as outlined in Table 1. EWEF also builds upon the twelve key findings from the multi-year pathway to women's empowerment research project (Kabeer 2011).

Table 1 Methodological limitations and lessons for measuring women's empowerment

Literature gaps/lessons learnt	Solution provided by the EWEF methodology
Malhotra & Schuler (2005) discuss the need to reconcile universal perspectives with the realities and values of those whose empowerment is at issue, and to take into account the evolving meanings and correlates of empowerment in specific contexts.	Adopts an endogenous approach whereby empowerment is seen as a bottom-up, locally defined dynamic process in contrast to a top down, exogenous process.
Mayoux & Chambers (2005) measures what is convenient rather than what's important (for example, the proxy of 'women's participation in meetings' to signify their empowerment or 'gender success' in a project).	Identifies how women understand empowerment and what it means to them. If participation in a meeting is empowering for them, then the methodology tries to understand why this meeting/ participation is important.
Gill's (1993) use of conventional survey assume 'universalist development goals' for empowerment especially within agrarian and rural contexts.	Empowerment is conceptualized as a process, not an end goal/destination.
Anthias (2012) problematizes binary 'sex' in women's empowerment indices. The reduction of women and men to dualistic categories ignores the intersections of race, age, ethnicity, class/cast that are historically and socially constructed and geographically (locally) contingent. Hillenbrand, Karim, Mohanraj, and Wu, D (2015) Understanding and measuring changes in empowerment entails an examination of the multiple manifestations of power and how they interact to create unequal outcomes and aim to capture the critical intersections of gender, race, class and sexuality etc.	Explores power structures and relational experiences across levels/scales (individual, household, community, policy) and institutions (markets, community governance bodies) as well as place (urban, rural), age, marital status, position in value chain, migrant.
Some empowerment researchers understand power as a zero-sum game whereby women and men always (or should) make decisions individually, ignoring areas of jointness, negotiation, and complementary responsibilities (see Stoian et al. 2018).	Considers what decision-making means for the respondent, how it is done and if they want more or less decision-making power, without assuming that individual decision making is the primary goal.
Comparing life history data to the results of the abbreviated version of the WEAI (A-WEAI), Stoian et al., (2018) found contradictions in regard to group membership, labour burden, control over land and water resources, and decision-making at the household level and argue for the use of mixed methods because a quantitative index cannot capture enough nuanced understanding of empowerment.	Uses a mixed methods approach to benefit from complementarity between methods. Methods include a survey inspired by the WEAI and WEFI combined with qualitative methods to document respondents' life journey. The data across different instruments is analysed collectively to build the picture of women's pathways towards and away from empowerment.
Agarwala & Lynch, (2006) found that autonomy has multi-dimensional aspects that can vary by the categories used. Freedom from violence, participation in non-economic family decisions, community involvement, and participation in household economic decisions are important but are not well captured in existing surveys.	Applies a multidimensional approach to measuring autonomy along with an iterative approach in order for one instrument to inform the development of the questions asked in the other instruments.
Sandberg & Rafail (2013). Using the preferred measurement model of autonomy (e.g., over household decision-making, the acceptability of domestic abuse and freedom of	Does not only rely upon autonomy as a means to assess empowerment and does not assume that autonomy is the only means to empowerment. Instead,

movement) were insufficient in capturing the structure of individual autonomy in India. Ultimately, longitudinal data for robust comparisons of women's autonomy across time is required. Hillenbrand, Karim, Mohanraj, and Wu, D (2015) changes are often emergent rather than linear.	the EWEF enables women to self-define what equates to empowerment. By completing a case study comparative analysis and collecting longitudinal data over time, this study anticipates being able to eventually develop a comparative measure.
Pratley (2016). Measurements for women's empowerment must include indicators on psychological, legal, and political dimensions of women's empowerment and development of a comprehensive conceptual framework that can guide research and policy making.	Uses a comprehensive conceptual framework and measures empowerment across levels/scales.
Kaneer (1999a). A three-dimensional conceptual framework for thinking about women's empowerment is required: 'resources' as part of the preconditions of empowerment; 'agency' as an aspect of process; and 'achievements' as a measure of outcomes.	Kabeer's framework was incorporated into the original pilot and has since been revised and incorporated into a power/pathway framework. Resources, and agency are clearly mentioned in the power framework. However, achievement is left as a subjective experience in order to capture women's own understanding of their achievement without it being related to outcomes. This reinforces the idea of empowerment as a journey and not an outcome.
Sraboni, E., Malapit, H.J., Quisumbing, A. R., and A.U. Ahmed (2014). elasticities analysis is not good at accounting for intersectional analysis or identifying how increases in underlying variables can be achieved.	This methodology does not use elasticities analysis. Instead, it uses an iterative design approach to developing a holistic understanding of women's own definition for, and a manifestation of, empowerment.
Doss (2017) focus on the structural sources of inequality rather than on simplified metrics of women as beneficiaries that have little to no emphasis on redressing gender imbalances. Taylor, G. and P. Pereznieto (2014) only 30 % of evaluations applied a holistic contextual gender analysis approach to WGEE that captured gender norms, roles and relations. The remainder narrowly focused on change only in terms on women's economic advancement, which relied on stereotypes of women's activities.	The EWEF methodology checks, rather than assumes which indicators matter to women and ensures that power and structural exclusion are incorporated into the design and instruments.
Levtov, Barker, Contreras-Urbina, Heilman and Verma (2014) There is a close link between equitable attitudes and practices. How boys learn and internalize equitable or inequitable norms in their childhood home (and presumably, other settings) influences their attitudes as adult men. Researchers should be aware of socially desirable responses	Uses individual interviews and focus group discussions structured in a politically-sensitive, power-sensitive way, to explore individuals' understanding of empowerment and norms and how inequitable attitudes are formed and manifested.

when conducting empirical investigation and should delve in depth into the specific context in each setting.	
Richardson (2017) identifies the gap that researchers should draw upon theory to construct measurement models (e.g., using theory to construct dimensions of empowerment and selection of indicators). Researchers should collect comprehensive empowerment information (e.g., supplementing quantitative measures with qualitative interviews to learn how and why changes took place).	Starts with theory, then constructs ways to measure empowerment and uses mixed methods to understand why and how changes took place.
O'Hara, C. and F. Clement (2018) Using a qualitative measure of 'critical consciousness' enriched the analysis of the relationships between women's agency and empowerment using the WEAI instrument. Using critical consciousness helped locate the meaning of empowerment within the broader cultural context that shaped the values, meanings, and identities attached to 'empowerment' metrics, and how these influenced the roles of women and men in the food system.	Critical consciousness (the ability to recognize inequality and compare one's position to others in their community) is included in EWEF via the ladder of power and freedom tool.
Seymour and Peterman (2018) greater investments by researchers—unpacking, interrogating, and innovating around measurement in different contexts—are still needed to understand how measurement matters for making gendered-programmatic and policy recommendations, and to better contribute to reducing gender inequalities and enhancing the empowerment and agency of all individuals. Hillenbrand, Karim, Mohanraj, and Wu, D (2015) embrace complexity and context- specificity.	Avoids neat indexes and instead embraces complexity and context specificity, which enables greater depth rather than breadth. Transferable and informative but not necessarily generalizable at this stage of the methodology's development.

3. Methodological Framing and Approach

WorldFish (under the FISH program) and Includovate partnered to develop and pilot a methodology that would address the gaps identified in the women's empowerment literature and apply the lessons learned. The EWEF methodology has evolved through an iterative process of learning and reflection with respondents and research participants, including enumerators and other stakeholders involved in the case-study in Myanmar. Four frameworks were used initially to conceptualize empowerment, and these were melded into one as a result of the data collected during the pilot in Myanmar.

Box 2: The pilot

Myanmar was the pilot country for developing this bespoke methods package on EWEF. Seventy percent of the country's 51 million people are engaged in agriculture, including fisheries (Aregu, 2017). Myanmar is among the top 10 fish-producing nations, yet pervasive gendered inequalities, including access to productive assets, information and trainings in fisheries, threatens the growth, sustainability and success for women engaged in the SSF sector (ibid). And yet, despite these inequalities, women dominate the post-harvest sectors of the SSF sector in selling and processing activities, and generally control the commensurate income from the sale of fish and fish products. However, these gender power dynamics may well change under increasing efforts to integrate rice, a male-dominated agricultural activity, with fish. Understanding the gender power dynamics underpinning these trends is crucial to identifying the potential risks, safeguards and recommended policy processes to ensure women's empowerment is not jeopardized in the transition to integrated rice-fish production systems in Myanmar. See policy brief and research report for more information on the pilot's phases and sample size.

3.1 Conceptual Framework

The EWEF methodology is informed by a conceptual framework (Fig 1) adapted from the pilot and draws upon Colfer et al's (2018) definition of intersectionality. Intersectionality is a is a key analytical framework in this study given its role in defining empowerment.

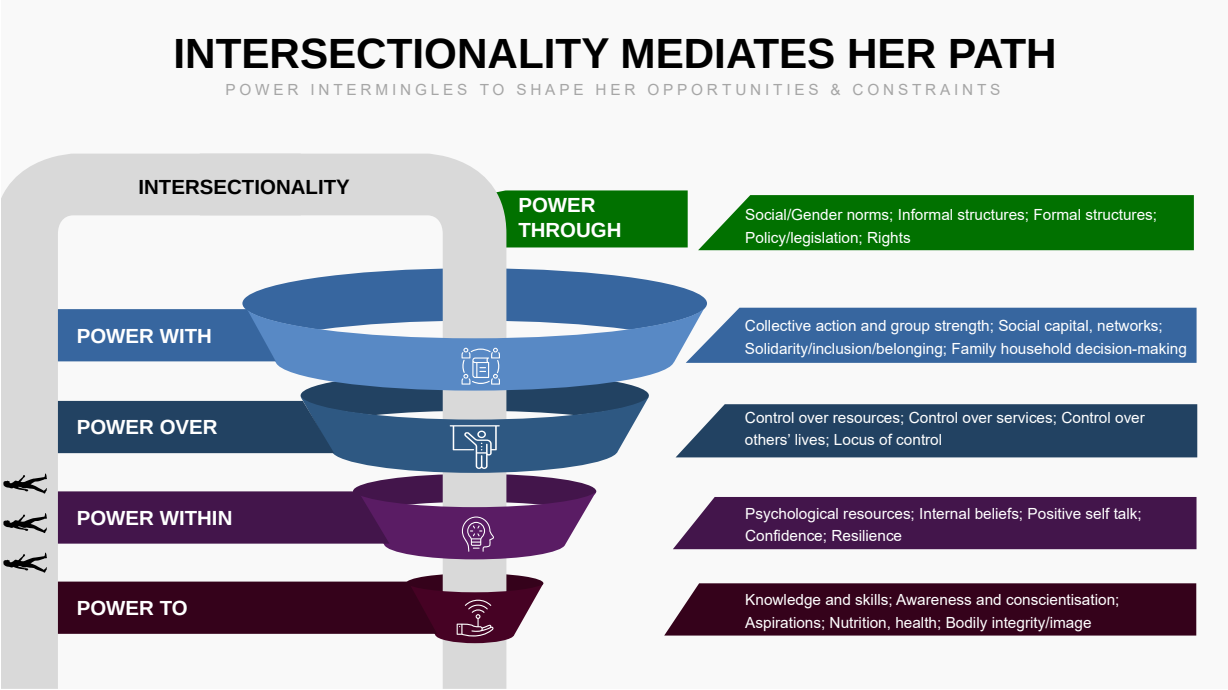


Figure 1 Conceptual framework for the WESSF

As Fig 1 shows, the pathway to women's empowerment is a non-linear, iterative journey mediated by the way's intersectionality intermingles with the different types of power and characterized by multiple obstacles and opportunities. Mutually reinforcing pathways can lead to increased opportunities for empowerment for women in different contexts. This becomes clear when applying the four types of power identified by Hillenbrand et al. (2015):

A) **Power within** (men's and women's consciousness) – internal and psychological resources (self-efficacy, self-esteem, and self-confidence), and internal beliefs
B) **Power to** (men's and women's access to resources and opportunities) – knowledge and skills, and awareness and conscientisation; nutrition; bodily integrity; aspirations
C) **Power with** collective action, group strength, household harmony and decision making
D) **Power over** control over the agenda, resources, income, labour, land, others (mobility/gender-based violence)
E) The EWEF adds **power through** to these four types of power.

Galiè & Farnworth (2019) identified **power through** to be a type of power mediated by others (based on inter-personal relations and norms) or by association with significant others (including children/spouse), through community norms and judgement, and through policy and legislation. This fifth type of power is necessary to include in this framework for it emphasises the role of the enabling environment in shaping women's opportunities and the way women can be empowered by the status of their kin.

While Figure 1 depicts the different types of power separately, in practice they intersect and intermingle. While these types of power have been written about and studied before, the pilot tested what criteria/topic mattered for each category.

A second key component the framework explored was locus of control. This concept was grappled with due to the Buddhist concept of karma[3] that arose during the pilot study in Myanmar. An internal locus of control strongly influences the amount of effort and persistence one may employ to achieve their chosen options (Lefcourt 1982), but a belief in an external locus of control (such as God, destiny or luck) can also reinforce a sense of empowerment when times get tough. It was hard to place locus of control in the framework at first because it seems to influence other pathways potentially positively or negatively. While locus of control is often reported as inter-related with issues of self-esteem, and achievements (education and economic status) (power within) (Devkota et al., 2018), it is also associated with power through as it concerns the enabling environment and norms. In the EWEF conceptual framework, locus of control is about power over, for it can shape one's worldview so much that it can influence aspirations and the opportunities pursued. Aspirations was another difficult factor to place on the empowerment pathway because it stimulates, and can be stimulated by, other factors. Ultimately, the framework shows that a woman can be empowered and disempowered by similar factors depending on their Intersectional identify and how this interacts with the different types of power. Empowering women involves expanding their freedoms and choice in a positive trajectory.

3.2 Research Questions

The following six research questions have been adapted from the results of the pilot:

- 1.a. To what extent are different categories of women currently empowered or disempowered in relation to which types of power in which node of the given SSF system?
- 1.b. How does women's empowerment compare to men's empowerment in this context and system?

3 Karma is redistributive because good and bad behaviour will incur reward and punishment. In Buddhism the laws of karma is transpersonal because they function across lifetimes and modes of existence. Thus, one could reap the reward of good behaviour in a past life during one's current life. See: Finnigan (2020).

- 2.a. What are the enabling and constraining factors that amplify or stifle empowerment as a process in the given SSF context?
- 2.b. What pathways have led to increased empowerment in the past and what might work in the future?

- 3.a. To what extent do current fisheries development policies, strategies, and programs contribute to or constrain empowerment for different categories of women?
- 3.b. How can the enabling factors be amplified, and the constraining factors and risks to empowerment pathways for diverse women be mitigated?'

These research questions and the EWEF methodology shifts the discourse around empowerment away from narrowly defined economic measures to a more nuanced, intersectional, endogenous and location specific assessment, and away from an academic exercise that extracts information from participants to one that empowers women through the process of collecting the data, and enables application of the results by key stakeholders.

3.3 Research Design

a) Integrated Design Approach

This methodology embraces complexity and context specificity by using an integrated design approach. This is a methodology that aims for depth rather than breadth. It is replicable, transferable and informative with an emphasis on local applications. While there are three distinct phases, the study is designed in line with design thinking. Iterations and reflection are needed to arrive at an endogenous notion of empowerment that is triangulated.

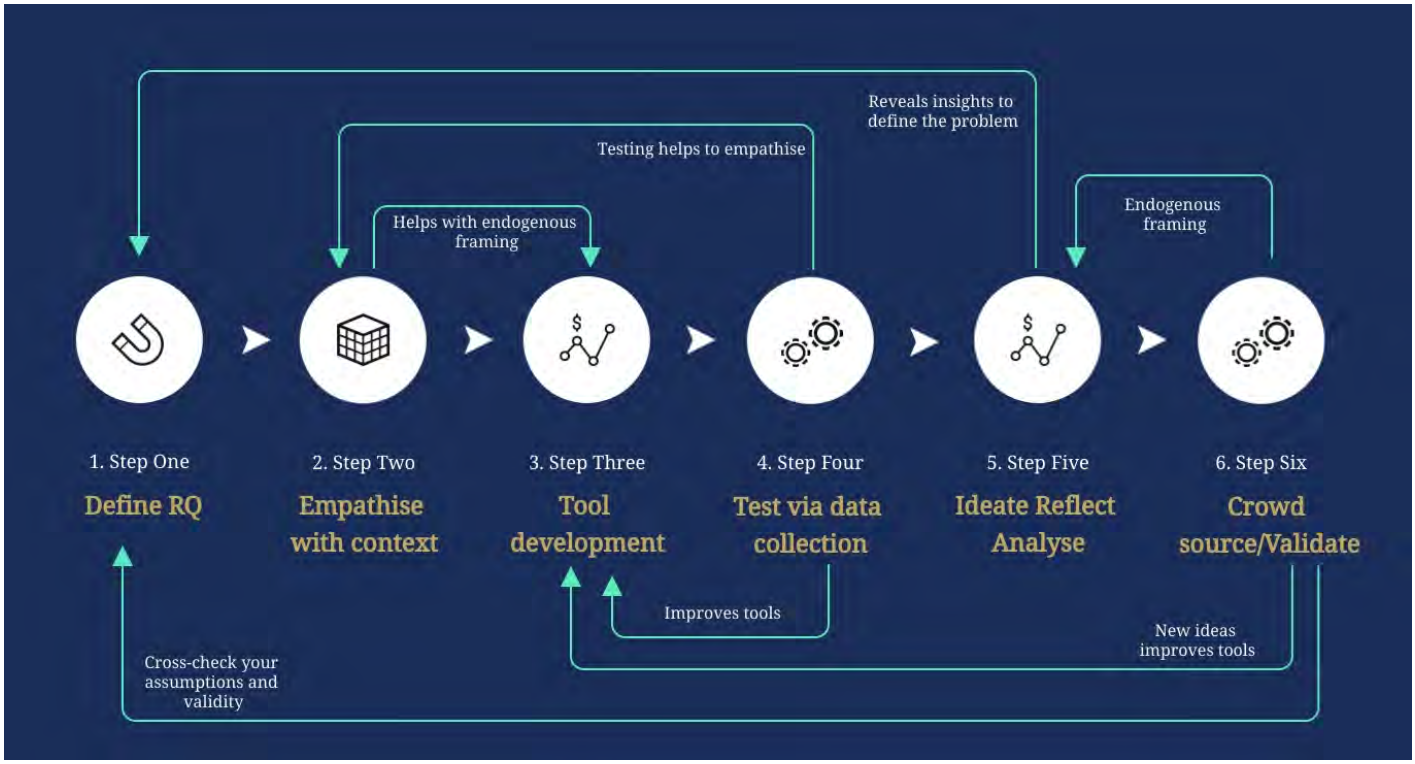


Figure 2 Integrated research design

b) Combining Qualitative and Quantitative Data

The approach of combining qualitative (e.g., narratives, images) and quantitative (e.g., numeric) data – commonly known as a 'mixed methods' approach – was chosen as a way to capture the complexities of the different dimensions of empowerment. A mixed methods approach also ensures that the limitations of each method are counter-balanced, so the relative strengths and weaknesses of a given method have a complimentary point of triangulation. As outlined by Vondal (2010) the purpose of combining data builds on four cornerstones:

- Enriching: using qualitative work to identify issues or obtain information on variables not obtained by quantitative surveys.
- Examining: generating hypotheses from qualitative work to be tested through the quantitative approach.
- Explaining: using qualitative data to understand unanticipated results from quantitative data.
- Triangulation (confirming; reinforcing; rejecting): verifying or rejecting results from quantitative data using qualitative data (or vice versa).

Table 2 presents an overview of the type of qualitative and quantitative data to be collected to address the study's research questions.

Table 2 Examples of qualitative and quantitative data to address research questions on WESSF

Qualitative data	Quantitative Data
Comparative data on where women and men are involved in different nodes of SSF value chains **(RQ1a)**	Contextual data using national level statistics on GBV/other proxies **(RQ3a)**
Women's and men's perceptions of the meaning of empowerment **(RQ1a, 1b, 2a, 2b)**	Numeric measures of the exogenous and endogenous empowerment factors identified **(RQ1-3)**
Perceptions of relative empowerment between women and men **(RQ1b)**	Numeric measures of attitudes towards gender, cultural and market norms **(RQ1a, 2a)**
Establishing which form of power are most pertinent to women in the case study context **(RQ1a, 2a, 2b)**	'How much empowerment' for women and men in different nodes of SSF value chains **(RQ1a)**
Women's and men's experiences of empowerment/disempowerment and reflections/predictions of constraining and enabling factors **(RQ1a, 2a, 2b)**	Numeric measures of the relationships between predictive variables for empowerment/disempowerment **(RQ1a, 2a, 2b)**
Women's and men's pathways to empowerment and aspirations over time **(RQ2a, 2b)**	Numerical measures of self-efficacy, aspirations and perceived control over one's life and power and freedom overall and overtime **(RQ1a, 2a 2b)**
Processes of empowerment within certain contexts based on intersecting dimensions of vulnerabilities/inequalities **(RQ1a, 1b, 2a 2b)**	Numerical measures of the intersecting dimensions of vulnerabilities/inequalities and relationships /patterns among/between groups **(RQ2a, 2b)**
Gendered implications of the different development policies and strategies / Existing synopsis of existing development policies and strategies **(RQ3a, 3b)**	Numerical measures of the perceived impacts of future changes to the SSF system **(RQ3a)**

c) Additional layers of triangulation, depth, and validity

Reflexive learning is a critical aspect of feminist methodologies as it inherently acknowledges that the researcher's empowerment cannot be separated from the researched – they are mutually reinforcing. Power and learning are intertwined and are deliberately linked in this methodology.

In qualitative research, subjectivity can be a risk. Managing subjectivity is good for research rigour. The way this methodology mitigates the risk of subjectivity is by having regular reflection points where the researcher notes key terms used by participants and even maps their reality, reflects on the research process and what has been observed and learnt, and checks their assumption with the study population to avoid extrapolation. An endogenous framing trumps an external framing but the two should be compared. The cognitive testing and validation processes serves a similar purpose for the quantitative component of the study.

Reflecting critically on the researchers own experience of the intersecting identities that affect the research process and how their behaviour may have reinforced certain biases and relationships of power, will enrich the study's intersectional lens and help avoid the pitfalls inherent in studies where researchers hold all the power. EWEF builds on a number of tools that are designed to disrupt the traditional researcher/ expert/extractor of information role. This is essential for securing an endogenous understanding of how local women perceive their empowerment. By doing this EWEF compares "apples to apples" or compares local women to their own conception of empowerment in order to not disempower or objectify the women. EWEF acknowledges that agency is a complex scale, and that research has the ability to disempower and present women to hold less agency than how they understand the situation.

In feminist literature there has been a lot of debate around sex workers and whether they are empowered or disempowered. With some authors arguing that they have no choice and therefore are exploited, and others arguing that within patriarchy there are still choices to make, such as not to starve or die, to leave one's husband, to have her kids educated, to sacrifice her own status for that of her children's, and so forth. While women may have limited choices (e.g., they cannot migrate, or be educated, or get a different income source), they still have some choices. Downplaying the limited choices women have denies women their agency, twice.

There is a fine balance here. In bargaining with patriarchy Kandiyoti (1998) shows that women living in patriarchal households can do things that advance their position (power through), but these tended to be viewed by Western researchers as a reinforcement of patriarchy, rather than small sites of protest. The value of EWEF is that it is designed to continually remind the researcher to situate women within their own endogenous understanding of empowerment and then frame this by the overall study's findings, to ensure women are not left with limited choices for advancement.

Each phase of EWEF includes tools to ensure that endogenous framing and a participatory and reflective study process occurs. These tools which include market transect walks, field journals, reflection diaries, and outcome mapping, help the researcher to reflect on their position as a researcher and on the participants' own understanding of empowerment, their context and the possible outcomes within their context.

d) Case Study Design

This methods package utilizes a mixed methods case study research design**.** Case studies are useful in generating detailed research about a specific site which can be used to add to broader theoretical understandings and identify underlying issues (Newing 2011). The case study design herein can be used comparatively with other cases to build theoretical understanding of women's empowerment in SSF across countries, regions, and localities.

e) Research in phases

Building on the limitations and gaps of the empowerment literature, the EWEF methodology addresses these limitations through offering fortified methodological tools and strategies that seek to capture complexity and context specificity. By adopting a phased research approach, researchers build on data previously collected and incrementally develop a deepening picture of empowerment in a certain context. Figure 3 outlines the research phases and the tools used.

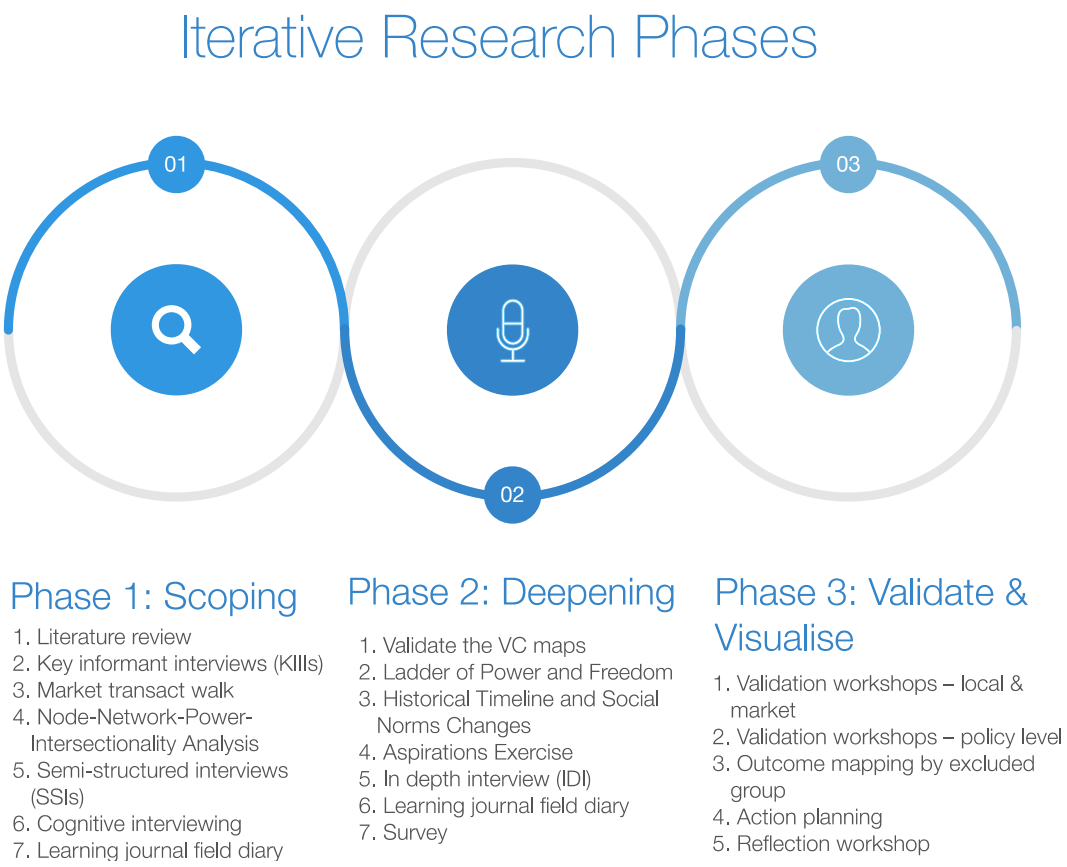


Figure 3 Research Phases

While this methods pack is seen as a complete package, the phases are designed to emphasize how researchers should build upon previous data collected and their experience as researchers. A phased approach also allows researchers to refine the tools by, for example, incorporating local phrases, concepts and ideas for a deeper, more endogenous understanding of issues and improves data quality by allowing researchers to build up layers of knowledge on women's empowerment. A sequential approach to data collection means that one type of data is collected and used to inform the next phase of data collection which also contributes to data triangulation.

Each of the three research phases in the EWEF methodology: scoping, deepening and validating, has a distinct and clear purpose as described below:

Scoping Phase

The purpose of the scoping phase is to lay the study's foundation by:

- identifying and building upon the literature gaps.
- understanding the context, recent changes, local phrases and expressions.
- mapping value chains, market place and power relations.
- reflecting on intersectionality.

- identifying interested/knowledgeable informants who can participate in the next phase of data collection.
- checking cognition of survey questions, and key terms such as empowerment.
- understanding the skills required for this type of research
- determining sample sizes; and,
- learning what is needed to build rapport with different types of people in different nodes of the VC.

The EWSF methodology provides a suite of tools for the scoping phase designed to provide broad contextual information on the SSF under review for each individual case. Table 3 outlines the tools in the scoping phase by the type of data it collects. The scoping phase also informs the adaptation of other tools, phases and research design. Gathering first-hand narratives from the most important actors in the SSF value chains during the scoping phase will directly inform what types of respondents are needed in subsequent phases, as well as key terms to help probe more deeply during the next data collection process. As such all tools in the scoping phase may contain information that helps to answer the research questions.

Table 3 Scoping Phase tools and type of data

Scoping Phase	Mapping/ visualization	Quantitative	Story/ conversation	Reflection	Planning	Triangulation
SP1: literature review					x	x
SP2: KIIs			x			
SP3 Market transect walk	x					
SP4 NNPIA	x			x		
SP5 SSI			x			
SP6 Cognitive Interviews		x		x	x	
SP7 field diary				x	x	

Table 3 provides a summary of the tools in the scoping phase and their use. Tool-specific information on adaptations, tips and tricks for using the tool, analysing and interpreting the data appear at section 4.

Deepening Phase

The purpose of the deepening phase is to build upon what is known and explore empowerment more deeply by understanding what contributed to empowerment and disempowerment. This is done by:

- validating the VC nodes and maps made in the piloting phase.
- collecting qualitative descriptive data that inform cases studies of journeys within and along different VC nodes.
- analysing the power relations between and within households, different market actors and VC nodes.
- identifying the winners and losers from policy changes, the status quo and modernisation implications.
- assessing women's own conceptualisation of empowerment, where they see themselves and others, and what women themselves see as the factors that lead to their empowerment
- mapping the pathways towards and away from empowerment an endogenous framings of empowerment.

- collecting survey data as a means of triangulating and quantifying trends

The tools for the deepening phase consists of a suite of advanced qualitative tools designed to deepen the dataset around the research questions. These tools facilitate further probing beyond the scoping phase into what ways different categories of women are currently empowered/disempowered in the SSF system under study, and how this compares to men's empowerment and what they identify as the enabling and constraining factors for empowerment, and how they manifest and are amplified or stifled along the way. More on how to analyse this data appears in the analysis section.

Deepening Phase	Mapping/ visualisation	Quantitative	Story/ conversation	Reflection	Planning	Triangulation
DP1: Validate VC map	x			x		
DP2: Ladder of Power and freedom	x		x	x		
DP3: Historical timeline and SN	x		x	x		
DP4 Aspirations			x	x		
DP5 IDI			x			
DP6 Learning journal/field diary				x	x	
DP7 Survey		x				

Table 4 Deepening Phase tools and type of data

Validating Phase

The validation process will help to avoid any exogenous lenses overlaying women's own understanding of their strategic freedoms and empowerment. It is designed to help participants apply the study's findings to their own work.

The purpose of the validating phase

- To reality check the analysis.
- validate the potential for changing unequal systems.
- maintain an endogenous understanding of empowerment and the research findings.
- To co-create an action plan for change.
- To build out the tools and method further.

Validation Phase	Mapping/ visualisation	Quantitative	Story/ conversation	Reflection	Planning	Triangulation
VP1: Validation workshop local				x		x
VP2: Validation workshop policy level				x		x
VP3: Outcome mapping	x			x		
VP4: Action planning	x				x	
VP5: Reflection workshop				x	x	

Table 5 Validating Phase tools and type of data

4. Data Collection Tools

The content of this section presents the tools used in the study by phases: scoping, deepening and validating. Collectively these phases present the tools of the EWEF study.

4.1 Scoping Phase Pack of Tools

As shown in Figure 4, Phase 1 of the iterative research phases – the Scoping Phase (SP) – begins with a literature review. The objective of each tool is explained in the relevant section. Table 6 summarise the scoping phase tools, the number and type of respondent and the time it takes to complete the tool.

Table 6 Scoping Phase Methods Summary

Tool	No. and type of respondents	Time it takes
SP1: Literature review	N/A	10-15 days total
SP2: KIIs	4-6 SSF stakeholders in urban area (e.g., fisheries staff, extension officers, licence providers, market managers, other fish stakeholders)	45-60 minutes per KII
SP3 Market transect walk	3 informants: a market leader, a female seller, and a male seller	30 - 45 minutes per respondent plus map making
SP4 NNPIA	1 male and 1 female FGD per value chain node, 6-15 participants per FGD	Activity 1: 1 hour Activity 2: 1.5 hour
SP5 SSI	The sample size should be 4 women and 4 men (2 urban men and 2 urban women and 2 rural men and 2 rural women per value chain node).	1 hour
SP6 Cognitive Interviews	3 women and 3 men engaged in the SSF	1 hour
SP7 Learning journal field diary	Can be done alone or in a group. Should be completed each day of data collection	Will take between 5-30 minutes per evening

Scoping Phase Tool 1: Literature Review

In this methods package, the literature review addresses Research Question 1 by providing information on the overall gender dynamics and different value chain nodes in the relevant SSF within the case study design. The data gathered could include contextual data using national level statistics, where possible, and comparative data on women and men involved in different nodes of the value chain.

LITERATURE REVIEW	
Purpose	To contextualize the research study in the relevant literature and situate its novelty to prevent duplication and put forward why further study is justified. Also, to inform the adaptation of the key informant interviews, questionnaires in the scoping phase, and across other future tools/phases by providing more context-specific information (e.g., what has the literature identified as the most important nodes of the value chain and gendered power dynamics therein that could influence the selection of respondents by profession?)
Respondents	Principal investigator and research team
Sampling	A minimum of 10 sources for a regional/country focus (if available) and 10 sources related to women's empowerment with a substantive focus on recent publications (<2 years old) is recommended.
Type of Data and Info	Contextual data using national level statistics, where possible, and comparative quantitative or qualitative data on women and men involved in different nodes of the value chains.
Strengths of The Tool	Obtaining the most relevant and current information regarding the SSF case study and understanding new findings in the broader field of women's empowerment scholarship to appropriately situate the research and inform the adaptation of the tools to the local context.
Weaknesses of The Tool	The scope of the review may be limited by search terms and eligibility criteria. When using academic databases, only articles of which the abstracts are searchable would be included, which might limit the scope of the results obtained.

Table 7 Summary of the Literature Review Details

A. Circumstances

The literature review should be undertaken for each study to achieve the following:

- identify formative research, key researchers, and research methodologies for assessing and measuring women's empowerment in development interventions and women's empowerment potentially within the (SSF) sector and/or geographical focus to support the national statistics as discussed below
- identify similarities and differences in methodologies of previous studies, and where possible, the summarize research and development outcomes; and
- identify limitations in previous scholarship and opportunities for new areas of investigation: gaps in research, conflicts/contradictions in previous studies and questions emerging from research. New empirical discoveries, conceptual frameworks and theories are constantly emerging in the rapidly expanding field of gender and fisheries, and it is crucial that researchers are on top of the most recent and relevant publications.

B. Facilitating and Conducting the tool

Establish search terms

Search terms that can be used include: agency, aquatic agricultural systems, aquaculture, capacity, civil society, constraint, culture, decision-making, development, development interventions, diversity, division of labour, domestic sphere, empowerment, entrepreneurs, equality, equity, feminism, feminist, food security, households, headship, inclusion, identity, inequality, international development, intersectionality, livelihood, lived experience, local ecology, marginalization, markets, market systems, masculinity, masculinities, mobility, natural resources, norms, nutrition, participation, patriarchy, performance, policy environment, political ecology, postcolonialism, poverty, private, public, resistance, resilience, rights, rural development, rural women, sex, smallholder farmers, social roles, social inclusion, socio-economic, sustainable development, systems governance, value chains, women in agriculture.

Set the Date Range

Date ranges will vary for sources with a regional/national focus and should not be chosen arbitrarily (e.g., past 10 years could work in some cases, but it is important to balance timely knowledge with sufficient resources for review. In other cases, it may be prudent to start with 5 years and then expand if needed (while documenting reasons for these decisions). Date ranges should be meaningful, so deciding to review sources after a certain date where a significant change has occurred in the SSF system under review could assist in determining the relevance of data for the study. For this project we limited the literature to 2013 onwards because of a notable upswing in the number of publications beginning in 2013, indicating a renewed interest in the field.

Establish Inclusion and Exclusion Criteria

Key selection and exclusion criteria before undertaking the literature review should be developed along a minimum of two source categories:

i. sources with a regional/national focus and
ii. sources with a substantive/topical focus on women's empowerment in fisheries.

For an example, please refer to the Myanmar Pilot Study presented in the text box below.

Myanmar Pilot Study: Key Selection and Exclusion Criteria			
Category	Selection criteria	Exclusion criteria	Selection 'wild cards'
Regional focus	"Asia", "Africa", "Pacific" (e.g., SSF fisheries focused regions)	Non-SSF fisheries regions	Sources which demonstrate innovative gender relations research in non-SSF fisheries regions
Substantive focus	"Gender"/ "empowerment"/ "fish/fisheries"/ "small scale fisheries" **also see additional search terms*	No reference to gender, empowerment, or social inclusivity	Specific resources shared by project partners

Table 8 Example showing selection and exclusion criteria for Myanmar Pilot Study

Choose your databases

The literature review should canvass both peer-reviewed and secondary/grey/unpublished sources using databases such as Google Scholar, ProQuest, JSTOR, SAGE Journals online, Taylor & Francis Online Journals, Wiley Online Library, and the CGIAR Collaborative Platform for Gender Research publications database.

C. Adaptations

Adaptations are possible around the key selection and exclusion criteria, especially in regard to widening the scope of the substantive foci of the study (for example, if a study wanted to evaluate women's empowerment in a specific type of SSF system e.g., rice-fish, aquaculture, formal/informal value chains). Table 2 includes the search terms used in the Myanmar Pilot Study as an example.

D. Tips and Tricks for Using the Tool

A literature review should meet the following guidelines:

- Be organized around and directly related to the study's research questions
- Synthesize the results into a summary of what has been confirmed and emergent gaps in the literature
- Identify areas of controversy and conflicting views in the literature
- Formulate questions that need further research
- For additional literature review writing tips, visit the University of Toronto Writing Centre available at: https://advice.writing.utoronto.ca/types-of-writing/literature-review/.

E. Analysing the data

Data from the literature review can be organized and analysed by key themes (topical and methodological), including by the methodological implications for studying women's empowerment in fisheries, contributions to the existing literature, and identifying previous studies' limitations. Guiding questions for the literature are:

- What is currently known as to the gender power relations in the SSF system?
- What are women's and men's roles and activities at different nodes in the value chain?

F. Interpreting the data

In interpreting the literature review data, the researcher should evaluate the credibility and authority of the source to use the best quality references (for example, grey literature produced by a donor organisation is not considered to be as objective and rigorous as a peer reviewed journal article). In interpreting the data, the researcher should assess to what extent the existing data can address their specific research questions, and to decide on whether and how to collect more data (e.g., through widening the scope of the existing literature review and/or by selecting other tools.

Scoping Phase Tool 2: Urban Key Informant Interviews

Key informant interviews are often done with people who are knowledgeable about the topic, in this case SSF. They enable the researcher to quickly set the context and to understand the dynamics of the sector.

KEY INFORMANT INTERVIEWS (KIIs)	
Purpose	To identify the different nodes of the fish value chain that the fish travels through and explore the socially embedded gendered norms and market relationships that mediate women's work within the broader context of the SSF system through the understanding of department of fisheries staff, extension officers, licence providers, market managers, other fish stakeholders.
Respondents	4-6 SSF stakeholders in urban area (e.g., fisheries staff, extension officers, licence providers, market managers, other fish stakeholders)
Sampling	Sampling size should be largely determined by the value chain size (nodes) and the saturation point required to collect the information needed to understand each node.
Type of Data and Info	Qualitative data on the emergent gender issues in the value chain, including the socially embedded gendered norms and market relationships that mediate women's work.
Strengths of The Tool	Identifies the context-specific, key gender issues in a given fish value chain. Ability to obtain information on women's challenges, opportunities and relationships in the fish sector. Can help to identify power relationships outside the market place that may affect the market place and women's empowerment.
Weaknesses of The Tool	Can be time consuming and difficult to arrange KIIs at suitable times for various fish value chain actors due to the location of their jobs (e.g., working in a busy, loud marketplace), power dynamics (not being able to interview women fish vendors alone if accompanied by an older relative; or due to women's triple labour burden).

Table 9 Summary of the KII's Details

A. Circumstances

The KII research team should consist of one interviewer and one notetaker. Materials such as an audio recorder, notebook, and a pen as well as an electronic device for manual notes should be used for accurate data collection.

B. Facilitating and conducting the KIIs

Introduce the purpose of the study to each KII and obtain informed consent for both interviewed and audio-recording. After obtaining informed consent the following table should be filled out by the notetaker:

KII Code (numerical)	
Date (dd/mm/yyyy)	
Name of location (market type/village)	
Rural/Urban	
Name of Interviewee	
Age/Sex	
Marital Status	
Type of Business/Profession	

Table 10 Example of table for record of information

The following relevant questions should be asked:

Fish value chain

We need to know if processing is done before reaching the city, or where/how

1. What type of fish are sold in the city from the SSF?
2. Which market in [insert city name] sells the most SSF fish?
   - Probe: Who runs this market? Where do the fish come from (type of transport and location)? Why does it sell the most SSF fish? What proportion of the market's sales come from the SSF? (what other fish/fish products are sold there?)
3. Who are the key stakeholders in the fish markets of [insert city name]?
   - Probe: Is there any tension/conflict between stakeholders? Which stakeholders work well together (or are in an alliance?) Are there any monopoly type relationships? Any anti-competitive behaviour?
4. Where is SSF fish processing mainly done?
   - Probe: Which processing unit is the most successful? Who owns the processing unit?
   - Probe: Who are the key stakeholders for fish processing? Is there any tension/conflict or any alliances between stakeholders?
5. Do you need to have a license to work in the SSF fish industry?
   a) If so, how do you apply for the license?
   b) Are certain people restricted from getting a license? Why?
6. Are there any other rules/regulations for people who work in fish?
   a) Who usually breaks rules/laws, and what are the consequences for breaking rules/laws?
   b) What are the SSF fish seasons or any seasonality issues worth mentioning?

Women in Fish

7. As sellers, do women get a fair price for their fish compared to men? Why/why not?
8. As suppliers, do women get a fair price for their fish compared to men? Why/why not?
9. As consumers, do women get a fair price for their fish compared to men? Why/why not?
10. What safety issues affect women in different nodes (compared to men)?
11. Are there any observable gender differences in the markets (do men sell at one market more than another?)
12. What are some of the factors that enable women to participate and thrive in the fish markets (e.g., access to credit, collective bargaining power, training, secure payments)?
13. What are some of the constraining factors that prevent women from participating and thriving in the fish markets (transportation, long hours, no day care, etc.,)
14. How can the enabling factors be amplified?
15. How can the constraining factors be mitigated?
16. Anything else I should know about women's role in other nodes of the fish value chain?

Groups

17. How are fish retailers organized (in x market, or in x location/node)?
    - Are there trading groups? If so, who typically joins them?
    - What are your perceptions of these groups? (helpful? Nuisance?)

Policy and Market Changes for Fish

18. In the last 4 years, what have been the major fisheries and development policies and strategies (public, private, civil society) in the given SSF system?
19. What other policies and strategies are you anticipating in the next 1-4 years?

20. Do you know which of these policy/strategy changes will have a bigger/better impact on women compared to men who work in the fish vale chain (probe: how? Was a study done/is it a guess/assumption?)

Final words

21. If you had the choice, what VC node would you work in? which node would you never want to work in and why?
22. Which actors in the fish value chain make the most money? Why?
23. Are there any knowledgeable individuals that you think I should speak to about women's role in the SSF value chain?
24. Is there anything extra you would like to ask or tell me?

C. Adaptations

Adaptations to the KII questionnaire tool could be made around the specific node of the SSF value chain targeted for the study (e.g., if a study wanted to specifically investigate fish wholesalers or more specific types of work within fish retailing (e.g., fish skinners, accountants, and storefront managers), questions could be re-framed (e.g., what constraints do you face in your current role as a fish retailer?)

D. Tips and Tricks for Using the Tool

Tip: Interviewing at a 'place of work' can be difficult in loud and busy marketplaces, or when a vendor is in the middle of a shift/currently working. Try introducing the purpose of the study and asking them if they would be interested in participating now or at another time/place that would be better suited to their schedule and location.

E. Analysing the data

The data collected through KIIs should illustrate the roles of different market players (retailers, wholesalers and collectors) and the gendered power relations and space/place-based issues (including safety and seasonality) that mediate player engagement with the SSF sector. Guiding questions for the analysis are:

- What are the emergent gender issues in the SSF system/value chain/node?
- What are the relevant gender norms and market relationships that mediate women's and men's work in the SSF? In what node?
- What is the nature of market relationships? Where does the most exploitation or monopolies occur? Where are women located?
- How well do the respondents understand the challenges facing women and the implications policy changes will have on women?

F. Interpreting the data

In interpreting and presenting the results of the KIIs, the researcher should prioritize representing the trends and variations found. In addition to the researcher's own analysis, the expectation is to also draw upon direct quotations were possible to express the emergent findings and to give greater voice to research participants themselves in representing the issues. The anecdotes/comments of certain VC actors and their capacity should be captured and can be triangulated during the next phase of data collection.

Tip: Make sure you get ethics clearance before you do any further data collection. If you are affiliated with a research institute or university, you may have an Internal Review Board (IRB) with its own specific requirements and processes. All researchers must check the applicable laws, regulations, and guidelines of their study country/countries and adhere accordingly to their ethics requirements.

For more information on ethics clearance and ethics certification and training programs, please visit the below resources:
CITI Program offers a comprehensive online course in ethics certification for Human Subjects Research (HSR): https://about.citiprogram.org/en/homepage/.
The National Science Foundation (NSF) provides a comprehensive list of guidelines for conducting ethical social scientific research that maximizes informed consent and limits harm: https://www.nsf.gov/bfa/dias/policy/hsfaqs.jsp#egraphy
The Office of Human Research Protections (OHRP) publishes the International Compilation of Human Research Standards, a listing of over 1,000 laws, regulations, and guidelines on human research protections in 133 countries and several international organizations: https://www.hhs.gov/ohrp/international/compilation-human-research-standards/index.html

G. Informed consent statement

ORAL INFORMED CONSENT
Key Informant Interviews

Exploring Women's Empowerment in Small-Scale Fisheries (EWEF)

Client: WorldFish
Evaluation firm: Includovate
Lead evaluator: Dr. Kristie Drucza kristie@includovate.com

Thank you for the opportunity to speak with you. My name is …… I am from a research incubator called Includovate which is a social enterprise that innovates for inclusion. WorldFish has contracted Includovate to conduct a collaborative study on women's empowerment in small-scale fisheries (SSF). We would like to interview you about your experiences within the industry.

Ideally, we wanted to meet you and ask these questions face to face. But we cannot visit you because of COVID-19. However, your views and opinions are still very important for us, hence we are asking you these questions over the phone. We hope that things will go back to normal very soon, and that one day we will get to meet you in person.

We received your contact details through WorldFish who commissioned this methodology because momentum around sustainable aquatic development pathways is growing and because WorldFish does not want to exclude women participants. They may have received your details from their own contacts and networks. You have been chosen to be interviewed because you are considered a SSF stakeholder in an urban area (e.g., fisheries staff, extension officers, licence providers, market managers, or other fish stakeholders). We will ask you questions related to the fish value chain and explore the socially embedded gendered norms and market relationships that mediate women's work within the broader context of the SSF system.

We ask for your support by answering questions as honestly and fully as possible – there are no right or wrong answers. We just want to know your actual experiences, opinions, and the challenges you face in order to understand how to improve the program. Your answers will be completely confidential. During the interview, we will be taking notes, and with your permission, we would like to audio record the discussion. These materials will be kept completely confidential and any personal identifying information will not be used in any reports, publications, or presentations resultant from this research.

Demographic questions and the responses to any gendered questions will only be used for disaggregation and cannot be tracked back to the respondent.

Although you may not directly benefit from taking part in this study, the information you provide may lead to improved understanding of the SSF industry and any gendered issues, norms and challenges faced specifically by women participants. The interview will take approximately 1 hour, and you will not be compensated for your time. There is no anticipated discomfort for those contributing to this study. If you agree to participate, you can choose to stop at any time or to skip any topics you do not want to answer. Your participation is entirely voluntary.

Do you have any questions about the study or what I have said?
If, in the future, you have any questions or concerns regarding the study and the interview, or if you wish to add additional details, we welcome you to contact Dr Sujata Ganguly who acts as Chair of Includovate's internal ethical review board is sujata@includovate.com. We will leave one copy of this form with you, so that you will have a record of this contact information and about the study.

Do you agree to participate in this study?
[If YES, indicate below that the oral informed consent has been obtained. Then proceed with the question below regarding audio recording. If they refuse, thank them for their time and cancel the interview.]

□ Oral informed consent received

Do you agree to be audio recorded?
[If YES, indicate below. If participant responds "NO", proceed with the interview without recording.]

□ Consent to audio record interview received

Signature of interviewer: _____ Date: _____/_____/_____

Location of respondent:_____

Mode of interview: (e.g., face to face, telephone, zoom) _____

Background information:
WorldFish's mission is to reduce poverty and hunger by improving fisheries and aquaculture. Gender equality is integral to World Fish achieving its goals and advancing #Agenda2030. World Fish has a responsibility to its partners to capture and communicate the impact of its work on men and women, girls and boys and communities at large. Moreover, gender equality contributes to inclusive growth and sustainable development (Madgavkar 2020). The study of, and advocacy for, women's empowerment is necessary because the causes and consequences of low levels of empowerment can be found to limit women's opportunities (Malhotra and Schuler, 2005) and many policies and programs aim to increase empowerment (Alsop and Heinsohn, 2005) but evidence of their success is lacking (Springer and Drucza 2019). From a research for development perspective, this research facilitates greater awareness of what women's empowerment is and is not in a given context, and importantly sets a new standard regarding the quality through which researchers can 'claim women's empowerment.' WorldFish is dedicated to ensuring the alleviating of women as an excluded group in the SSF industry to be improved and made equal.

Scoping Phase Tool 3: Market Transect Walk

Transect walks are a participatory method whereby respondents (or community members, or in this case, market actors) walk the researcher from one point in the market to another and discuss their observations on the way (Mahiri, 1998). Finding representatives from all parts of the market willing to speak to you publicly about the market can be challenging (along with gaining ethical clearance as the ability to guarantee anonymity in such a public activity is not possible). A way to mitigate this is by having several groups do the same transect walk. Their experiences can be compared later and validated if need be.

MARKET TRANSECT WALK	
Purpose	To develop a visual map of the main fish markets from the perspective of different actors (with different power relationships). The information will help inform the value chain analysis and understand the different perspectives and power relationships between market actors. The map can be a useful reference that will assist understanding at different stages of the research and can be used to help triangulate future findings, as well as help the researcher adopt the perspective and terms used by the respondents.
Respondents	3 a market leader, a female seller, and a male seller
Sampling	The manager of the market visited should be chosen, or the next in charge, and one female stall owner (seller) and one male store owner (seller). These can be selected based upon first to make eye contact and willingness to spend 30 minutes walking around the market. Ask members of the public along the way their thoughts and opinions if they like a particular stall and why they chose that location to shop.
Type of Data and Info	Participatory visual map with labels that offers a deeper understanding of the market space and participants
Strengths of The Tool	Helps to explain the dynamics/features of a marketplace and can reveal major problems from the perspective of different actors. It can also aid with creating a visual record of the marketplace and triangulation of other data and allow for observation-based market improvement.
Weaknesses of The Tool	Mainly covers the 'observable' situation and requires expert probing to understand hidden dynamics such as power. Best used as an entry point for more in-depth analysis. Can only show a limited snapshot at one point in time/season of local realities (Chambers, 1997).

Table 11 Summary of the Market Transect Walk

A. Circumstances

The transect walk should have one interviewer and one notetaker. Materials such as a notebook and a pen as well as an electronic device for manual notes must be provided for accurate data collection. The target population of a market transect walk are the market stakeholders such as the market manager and sellers of fish. The sample size should be three per market.

Code (numerical)	
Date (dd/mm/yyyy)	
Name of location (market type/village)	
Rural/Urban	
Name of Interviewee	
Age/Sex	

Marital Status	
Type of Business/Profession	
Duration of business in the market (managing/selling)	

Table 12 Example of table for record of information

B. Facilitating and Conducting the Market Transect Walk

1. Develop criteria for observation. The below is a suggested list :
   - Public transit access points, street commerce
   - Public spaces/cafes/common areas
   - Sorting, storage bays
   - Where the manager sits
   - Where money is kept, ATM, phone cards sold, etc.
   - Sanitation (e.g., water, sewerage, garbage collection and blockage points)
   - Lights, cooling areas/fridge and utilities including toilets
   - Contaminated spaces/smells
   - Opening/closing times. First stall to set up (what time do they arrive).
   - Stall conditions, location, segregation of produce, open air/undercover, sex/age/ability/ presentation of stall keeper
   - What are the major activities carried out in each zone/section of the market? By whom?
   - Location of the most expensive fish and cheapest fish sold? Are they always in the same location, or do they move around the market?
   - Are women and men, and people from different socio-economic groups, able to equally access each zone?
     - *Probe: Where do different population sub-groups congregate? Are they segregated or mixed? Any stereotypes in the market?*

2. Ask key informants to show you around the marketplace and agree to start at one end and finish at another
3. Walk through the market with key informants (meander around the market – no need for a straight line) and ask them to describe why and how the market is set up. As the walk progresses, stop at key features and take photographs or draw sketches. It is not necessary to stick to a planned route - deviate when useful or interesting, or even at random, to observe the surrounding area, signage, roads, intersections and to gather relevant and useful information.
4. Walk slowly and gain an understanding of the physical features in the market from different perspectives. Question the size of certain stalls compared to the others and the cost of hiring each stall.
5. Question differences (query empty stalls, rubbish collection areas, water points, ask how the market is set up – e.g., why one type of fish is sold here and another over there). Ask if it is better to be at the edge of the market or in the middle and why. Question border areas between market segments.
6. Women and men met along the way (stall owner, shoppers, service delivery people) can be informally interviewed. Stop and talk to people, ask about smells and observations and inquire as too why things are done certain ways.

C. Adaptations

Should there be extra time, below are some additional questions to ask the transect walk participants.

- How regular are the market tenants?
- How long have you had a stall at this market, is there any other markets where you sell your fish?

- Why do you choose to work at this market?
- Age of market? What interventions for improvement have been made in the past 6 months? What is planned for the next 6 months?
- What major changes have there been over the past 5 years?
- What services and infrastructure are available here that makes this market different from the others?
- Any seasonal differences in terms of peak/off peak seasons, in terms of the types of fish bought and sold?
- Are the people who supply this market the collectors or is there someone in between?
- Where are some of the locations that the fish sold at this market comes from?
- Do suppliers get a good price for their fish at this market?
- How would you describe the attributes of the suppliers of the market's fish? (prompt: wealth, sex, age, rural, Wholesaler/retail/own consumption; single/married).
- What are the principal problems in the market (is it infrastructure, stall owners, service provision, council rates increasing)?
    - *Probe: What constraints or problems affect the different zones/areas of the market?*
- How would you describe the attributes of the sellers of the market's fish? (prompt: wealth, sex, age, rural, Wholesaler/retail/own consumption; single/married).
- Do sellers get a good price for their fish at this market? Do consumers get a good price for their fish at this market?
- How would you describe the attributes of the buyers/consumers of the market's fish? E.g., Who comes to buy fish from this market?
    - *Probe*: wealth, sex, age, rural, wholesaler/retail/own consumption; single/married).

D. Tips and Tricks for Using the Tool

Tip: Make sure to stop and ask store holders why they chose to set up at that stall and which stall is their favourite/least favourite and why.

Tip: Using symbols as codes on the map can make the map visually appealing as well as stimulate discussion and questions from informants. For example, the market manager may assume that stallholders selling more expensive fish are richer and thus, charge them more for the stalls. See Figure 1 below to see how a $, $$, $$$ symbol represents table costs, and a corresponding animal symbol represents the product costs (e.g.,  , , for fish).

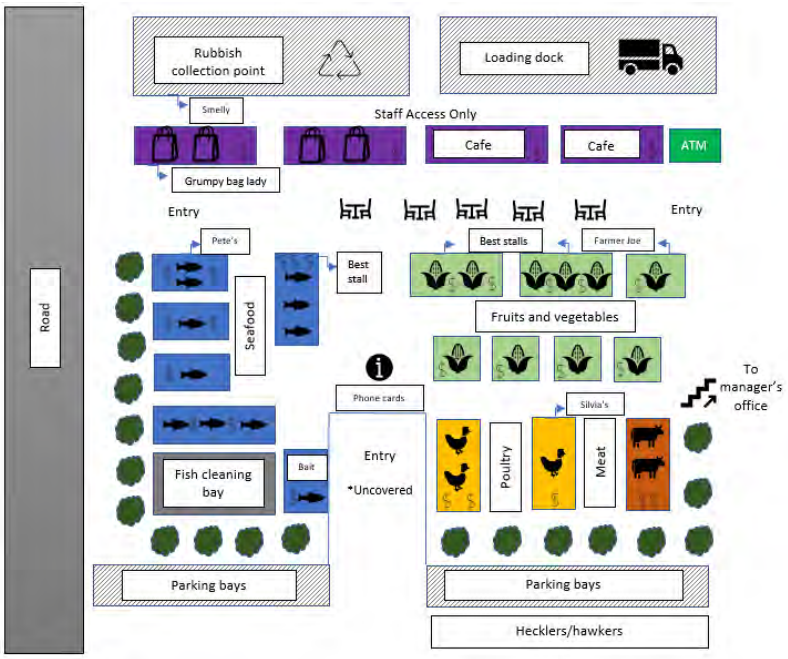


Figure 4 An example of a market map showing the costs of goods through symbols

E. Analysing the data

- After the transect walk has finished, record the information and data collected in a suitable place. These may include, map and name stalls, toilets, washing areas, rubbish collection areas, common areas, café, managers office "table."
- Create transect diagrams according to informant (e.g., if the market manager says, "this is where the fish ladies sell" then it should be noted on the map or if the market manager states his/her "favourite part of the market", it must be marked on the map accordingly.
- Down the side of the map, list headings of the areas of interest (plants, land use, problems, drainage system, and so on) and then fill in the details of what was observed in each zone.
- Once more than one transect walk has been completed, results can be combined and compared. Analyse differences in the diagrams in terms of labels, problems, vision.
- Highlight any power differences or resources distribution differences and sites of tension/conflict/discrepancy.

F. Interpreting the data

- Go back through the diagram with those who helped you to create it. Ask about problems, visions for the future and things they would like changed. Have them confirm or challenge/comment on labels, problems, vision, and discrepancies.
- If possible, come up with a master map, if not keep multiple maps from different perspectives.

G. Informed consent statement

ORAL INFORMED CONSENT
Market Transect Walk

Exploring Women's Empowerment in Small-Scale Fisheries (EWEF)

Client: WorldFish
Research firm: Includovate
Lead researcher: Dr. Kristie Drucza kristie@includovate.com

Thank you for the opportunity to speak with you. My name is …… I am from a research incubator called Includovate which is a social enterprise that innovates for inclusion. WorldFish has contracted Includovate to conduct a collaborative study on women's empowerment in small-scale fisheries (SSF). We would like to interview you about your experiences within the industry.

In order to maintain safety during COVID-19, we kindly ask that you maintain social distancing measures of staying apart at least 1.5m and wearing a face mask. However, your views and opinions are still very important for us, hence we are still conducting this walk. We hope that things will go back to normal very soon and appreciate you agreeing to social distancing and a face covering.

We received your contact details through WorldFish who commissioned this methodology because momentum around sustainable aquatic development pathways is growing and because WorldFish does not want to exclude women participants. They may have received your details from their own contacts and networks. You have been chosen to be interviewed because you are the owner of a stall within the market or a leader of the market (e.g., manager, deputy manager). We will ask you questions related to the fish market and explore the relationships between the different market actors in this location today.

We ask for your support by answering questions as honestly and fully as possible – there are no right or wrong answers. We just want to know your actual experiences, opinions, and the challenges you face in order to understand how to improve the program. Your answers will be completely confidential. During the interview, we will be taking notes, and with your permission, we would like to audio record the discussion. These materials will be kept completely confidential and any personal identifying information will not be used in any reports, publications, or presentations resultant from this research.

Although you may not directly benefit from taking part in this study, the information you provide may lead to improved understanding of the SSF industry and any gendered issues, norms and challenges faced specifically by women participants. The interview will take approximately 1 hour, and you will not be compensated for your time. There is no anticipated discomfort for those contributing to this study. If you agree to participate, you can choose to stop at any time or to skip any topics you do not want to answer. Your participation is entirely voluntary.

Do you have any questions about the study or what I have said?
If, in the future, you have any questions or concerns regarding the study and the interview, or if you wish to add additional details, we welcome you to contact Dr Sujata Ganguly who Chair of Includovate's internal ethical review board is sujata@includovate.com. We will leave one copy of this form with you, so that you will have a record of this contact information and about the study.

Do you agree to participate in this study?
[If YES, indicate below that the oral informed consent has been obtained. Then proceed with the question below regarding audio recording. If they refuse, thank them for their time and cancel the interview.]

□ Oral informed consent received

Do you agree for your responses to be recorded?
[If YES, indicate below. If participant responds "NO", proceed with the interview without recording.]

□ Consent to manual record of interview responses received

Signature of interviewer: _____ Date: _____/_____/_____

Location of respondent:_____
Mode of interview: (e.g., face to face, telephone, zoom) _____

Background information:

WorldFish's mission is to reduce poverty and hunger by improving fisheries and aquaculture. Gender equality is integral to World Fish achieving its goals and advancing #Agenda2030. World Fish has a responsibility to its partners to capture and communicate the impact of its work on men and women, girls and boys and communities at large. Moreover, gender equality contributes to inclusive growth and sustainable development (Madgavkar 2020). The study of, and advocacy for, women's empowerment is necessary because the causes and consequences of low levels of empowerment can be found to limit women's opportunities (Malhotra and Schuler, 2005) and many policies and programs aim to increase empowerment (Alsop and Heinsohn, 2005) but evidence of their success is lacking (Springer and Drucza 2019). From a research for development perspective, this research facilitates greater awareness of what women's empowerment is and is not in a given context, and importantly sets a new standard regarding the quality through which researchers can 'claim women's empowerment.' WorldFish is dedicated to ensuring the alleviating of women as an excluded group in the SSF industry to be improved and made equal.

Scoping Phase Tool 4: Node-Network-Power-Intersectionality Analysis (NNPIA)

This focus group discussion (FGDs) has 2 activities:
Activity I: Empowerment FGD
Activity 2: Value chain FGD
Collectively, these FGDs capture people's experiences of empowerment and disempowerment and reflections and predictions of constraining and enabling factors within the value chain. The second one builds upon the rapport established and knowledge collected during the first activity. A break will be held between each activity for refreshment purposes and this should be provided by the facilitator. The data from these two FGDs should be used to triangulate the data gathered by the SSIIs.

Activity 1: Empowerment	
Purpose	To help identify and frame the concept of 'empowerment' in the local context and within the broader context of the SSF system and to identify drivers (possible factors) of empowerment. Research question(s) addressed: RQ1, RQ2
Respondents	The target population are women and men working in the fish sector as catchers, collectors, retailers, and processors (different nodes and by rural/urban and other relevant intersectional categories).[4]
Sampling	1 male and 1 female (separate sex) FGD per value chain node, 6-15 participants per FGD[5] The concept of "Information Power" is used to determine sample size (Malterud et al. 2016). Information Power "indicates that the more information the sample holds, relevant for the actual study, the lower number of participants is needed" (p.7). Thus, while an initial estimate is needed for planning the study, whether the final sample is sufficient must be evaluated continuously throughout the research process (Carlsen & Glenton, 2011). Six will be sufficient for this purpose but this can be increased depending on budget and the information needed and the diversity of views shared. Additional groups can be added if saturation/information power has not been obtained (McDougall and Curnow, 2020).
Type of Data and Info	Qualitative perceptions of what empowerment means to different women/men based on the study's core definition of 'empowerment' - For women and men, to understand to what extent women and men see themselves as empowered based on their understanding (endogenous framings).
Strengths of The Tool	Provides insights into sources of complex behaviours and motivations. Interactions within groups among participants offers data consensus and diversity of views that capture points of agreement and disagreement.

4 If time and budget permits, it would be useful to also do this with an organisation working in the SSF, including WorldFish staff, and compare the results to the workers as a means of triangulating and understanding any differing opinions associated with position.
5 Justification for focus group discussion size is a relatively under-researched area compared to the organization and analysis of focus group data, with most guides suggesting a minimum of 4 and a maximum of 12 participants (Carlsen and Glenton, 2011). However, Chambers (1994), the godfather of participatory methods, including rural appraisals suggests 10-15 individuals per group - this larger than the average sampling parameters of a focus group, but not too large to ensure that each member is able to be have their ideas seen and heard within the confines of the workshop.

Weaknesses of The Tool	Underlying power dynamics within groups can lead to nominal participation from less powerful discussants. The moderator, in shaping the discussion, can disrupt the flow and interactions of the group. Specific questions that require abstraction like attributing characteristics to an abstract ideal of an individual/group may be difficult for participants to follow due to cultural differences.

Table 13 Summary of the Empowerment FGD

A. Circumstances

This method calls for one interviewer and one notetaker. Materials such as a flipchart, markers, pens, sticky notes are needed for the exercise and the materials needed for data collection include an audio recorder, notebook/pen, or device for manual notes. If there is a community leader in the group, invite them to have a semi-structured interview instead (so they do not hijack the group discussion).

B. Facilitating and Conducting the Empowerment FGD

Introduce the purpose of the study at the beginning of the FGD and obtain informed consent (to be interviewed and consent to be audio-recorded) and anonymity should be guaranteed. An example of an informed consent document can be found at section H. After obtaining informed consent the following table should be filled out by the notetaker:

Venue:	
Group:	
Date and Session:	
Note Taker:	
Facilitator:	

FGD Members	Number of Participants
Men	
Women	
Youth	
Elderly	
Disabled	

Table 14 Example of table for record of information

Activity 1A: Role models for women and men

Think of a female member of the community who is able to make important decisions in her life and put those decisions into action? What is this woman like? What is her life like?

Ask participants to think of a female member of the community that is admired (has a high status/reputation). Then ask them to call out the qualities of that person and write them on a flip chart. Write every quality down without judgement. Then go back to each quality and ask if it is a good or bad quality and why (put crosses for bad and ticks for good and make a note of the discussion). Then ask the group to vote for their top 3 qualities that they most agree with (this will help you to understand the most consistent attributes).

Tip: If people cannot think of a woman who is able to make important decisions or who is admired, then ask them to describe a "strong" woman. This can help stimulate the imagination in communities where women are not usually admired.

1. Specifically probe for power within attributes: Psychological resources; Internal beliefs; Positive self-talk; Confidence; Resilience.
2. Are there many women like this (with these attributes) in your community? Why/why not?
3. How are these women regarded by other women?
    - *Other men?*
4. What would a husband think if his wife was like this?
5. I usually describe women with these attributes as 'empowered' because they have more freedom to move around, make decisions and take action. However, this depends on the context. In this community, would you describe women with these attributes as empowered? Why/why not?
6. Are the qualities of empowered women something to emulate?
7. Who or what empowers these women?
    - *Probe: in what ways have they been empowered (e.g., divorced a bad husband, won the lottery, migrated and returned with capital, inherited land, worked hard)?*
8. Who is the most important person to these 'empowered' women (reference group6)?
9. In this community, is there an abundance or shortage of empowered women compared to other communities? Why?
10. Do you think the number of empowered women has changed over time? Why or why not?

Repeat the exercise for men

C. Adaptations

This tool can be adapted to the local context as necessary. For example, if the women are illiterate then consider using pictures to expand on what they say for later voting.

D. Tips and Tricks for Using the Tool

Tip*:* Before closing an FGD ask the participants if there is anything else they would like to ask or share? It is important to give the participants a chance to shape what is recorded and what they learn/discuss.

Tip: Qualitative research pays attention to outliers and anomalies and looks to explore this in more detail in subsequent phases and during validation.

E. Analysing the data

The following questions should guide the analysis:

a) What are women's and men's perceptions on what empowerment means based on our core empowerment framework?
b) Who can empower them and in what ways?
c) Is there a frequently heard reference group?
d) How are men's empowerment pathways different to men?

F. Interpreting the data

In interpreting and presenting the results of the FGDs, the researcher should prioritize representing the trends and variations found. The flip chart responses and categorisation process should be presented in a table. In addition, to the researcher's own analysis, the expectation is to also draw upon direct quotations were possible to express the emergent findings and to give greater voice to research

6 A reference group involves one or more people who shape / influence the norms that this person subscribes to. Understanding is any patterns emerge for men or women here can be useful for changing norms.

participants themselves in representing the issues. This is done by the use of participant quotes. You should discuss how common such a sentiment was heard, e.g., across all FGDs, only by a few older women… this helps the reader of your report contextualise your data.

The results of the focus groups should give an explanation of a women's empowerment characteristics/pathways compared to men. Any differences between the FGDs should be noted (e.g., younger people are more likely to note the following empowerment characteristics…., whereas older people are more likely to note….) the reference group should be explained by category (e.g., for married women it was the husband but for younger women it was their father), and any commonalities or differences observed between and among groups.

This activity can be repeated (and tweaked/improved) during the deepening phase if the initial FGDs yield informative data that requires further clarification.

Tip: If it is decided to do exercise 2 immediately after exercise 1 it is advisable to have a refreshment break. Provide drinks and snacks for participants and let them make some calls and use the bathroom before continuing.

ACTIVITY 2: Value chain map	
Purpose	To map out the different power dynamics (visible, hidden and invisible) at different scales (individual, intra-household, community, market) within different value chain nodes of the SSF system and to capture people's experiences of (dis)empowerment and reflections and predications of enabling/constraining factors within the value chain. The goal of this activity is to produce a map that can be validated in the next phase and to examine power relations and personalities, demographics for different value chain nodes. Research question(s) addressed: RQ1, RQ2
Respondents	1 male and 1 female FGD per value chain node
Sampling	Workers from intersectional categories per value chain node
Type of Data and Info	Qualitative data describing the different value chain nodes, actors, and gender power dynamics; visual maps and diagramming of complex gendered relationships and roles at different nodes of the SSF system. A 'follow the fish' approach entails identifying the different nodes of the fish value chain that the fish travels through – from catchment point to sales/processing to consumption – and exploring how different gendered actors within the value chain are connected. Participants can be selected from either a single node or multiple nodes of the value chain but should reflect the diversity of intersectional social positions within the study site (e.g., gender + age/wealth status/ethnicity/etc.).
Strengths of The Tool	An engaging visual activity that facilitates group dialogue around the differentiated roles and relationships between and among women and men in the SSF system in a less formal way than an FGD.
Weaknesses of The Tool	Literacy and confidence in presenting ideas visually may limit the ability for the group to fully engage in the mapping exercise. Group power dynamics and cultural norms influence who speaks first, who can contest/question/add new ideas to the conversation.

Table 15 Summary of the FGD Activity 2

A. Circumstances

Same as activity 1. If some participants have to leave, make a note of this on the table used at the start of activity 1. If you complete activity 2 at a different time to 1 you will need to complete a new record table.

B. Facilitating and Conducting the tool

Using a flipchart and markers, beginning with the raw product and ask the participants to help sketch out the different nodes in the fish value chain (e.g., retailer, customer/consumer, catcher, processor). Ask which fish/seafood or product each node sells. Next, examine the flow, 'a follow the fish approach.' Who catches what (do they have a different name if they catch different species?) how do they catch (hands, boat, net), who do they sell it to and do that do any value addition/processing themselves? See figure X for an example of an early brain storming value chain map with landless people. They were unable to complete more of the value chain because they were unaware of what happens next.

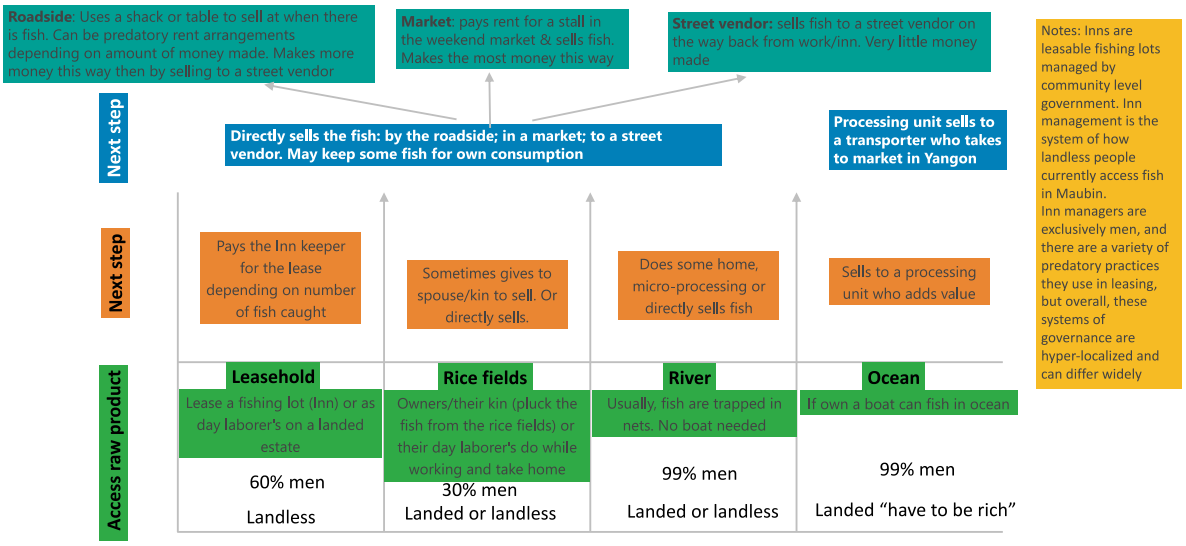


Figure 5 value chain map example

After your main map is completed, examine each node differentiated by gender and intersectionality (G & I) by asking the following questions:

- Are these mainly men or mainly women (%)?
- Average age?
- Socio-economic status?
- Name of the most successful male and female at this node/level.
- Name of the most empowered male/female at this level according to empowerment FGD definitions.
- Average income per node?
- Average price of fish bought and sold?
- What are the characteristics/demographics of those with power at this node?
- How are decision made in this node (any collective buying/selling, or is it individual) are there key stakeholders and decision-makers?
- What roles do different stakeholders play?
- Where are the spaces where decisions are made? (e.g., Visible, hidden, invisible?)
- How/Where are stakeholders/nodes connected (time/spaces/places)?

Tip: If there is dispute between categories of respondents (e.g., a young woman and an old women disagree, or a landless and a landed person disagree) then point out the way intersectionality could shape these differing opinions. Ask the group if some of the differences might be associated with the category of woman answering? For example,

"It seems to me that I am hearing that there is a difference between young/old, landed/landless? Am I understanding correctly?" Probe: Why or why not?
Make sure to write down any comments heard as it will help you with the intersectionality analysis.

- Once the map is finished (and this could be a messy and iterative process, where perfection and neatness follows afterwards), ask:
- How might the links between these nodes change as rice production intensifies?

C. Adaptations

This is a flexible tool to open discussion and build trust while doing the mapping. You should note down the local terms and expressions used to describe nodes/people. You can add or subtract prompting questions as needed. For example, asking about background and/or historical information on relationships, policies and interventions and how these have impacted the current value chain set up is useful. Additionally, probing for emergent trends, risks and opportunities (especially for women) that may have come from the literature review or previous tools is recommended.

D. Tips and Tricks for Using the Tool

Sampling bias is a common pitfall in qualitative research, especially when using group data collection methods such as PRAs and FGDs.
The use of convenience and/or snowball sampling risks bias towards dominant groups and can create an 'echo-chamber' effect by not representing the perspectives and experiences of the community as whole.
To prevent sampling bias, try using context-appropriate strategies, like working through local partners and women's groups, or gathering information via women and men key informants who can reliably represent other marginalized actors (McDougall and Curnow, 2020).

E. Analysing the data

The following questions should guide the analysis:
In analysing each node differentiated by gender, address:

- Who are the key stakeholders and decision-makers? What do they do? What are the ways in which they are connected? Where are they connected (time/space/ places)?
- Where are the spaces where decisions are made? How might the links between these nodes change as fish production intensifies?

F. Interpreting the data

In interpreting and presenting the results of this FGD, the researcher should prioritize representing the trends and variations found. In addition to the researcher's own analysis, the expectation is to also draw upon direct quotations were possible to express the emergent findings and to give greater voice to research participants themselves in representing the issues.

The goal of this activity is to produce a map that can be validated in the next phase and to examine power relations and personalities, demographics for different value chain nodes.

Tip: The two focus groups should be compared together to show a map of the different power dynamics (visible, hidden, and invisible) at different scales (individual, intra-household, community, market) within different value chain nodes of the SSF system. The map should include where empowered people reside in the VC and who will be winners and losers of any policy changes.

G. Informed consent statement

ORAL INFORMED CONSENT
Focus Group Discussion

Exploring Women's Empowerment in Small-Scale Fisheries (EWEF)

Client: WorldFish
Research firm: Includovate
Lead researcher: Dr. Kristie Drucza kristie@includovate.com

Thank you for the opportunity to speak with you. My name is …… I am from a research incubator called Includovate which is a social enterprise that innovates for inclusion. WorldFish has contracted Includovate to conduct a collaborative study on women's empowerment in small-scale fisheries (SSF). We would like to interview you about your experiences within the industry.
Ideally, we wanted to meet you and ask these questions face to face. But we cannot visit you because of COVID-19. However, your views and opinions are still very important for us, hence we are asking you these questions over the phone. We hope that things will go back to normal very soon, and that one day we will get to meet you in person.
We received your contact details through WorldFish who commissioned this methodology because momentum around sustainable aquatic development pathways is growing and because WorldFish does not want to exclude women participants. They may have received your details from their own contacts and networks. You have been chosen to be interviewed because you are a woman or man working in the fish sector as catchers, collectors, retailers, and processors.

We ask for your support by answering questions as honestly and fully as possible – there are no right or wrong answers. We just want to know your actual experiences, opinions, and the challenges you face in order to understand how to improve the program. Your answers will be completely confidential. During the interview, we will be taking notes, and with your permission, we would like to audio record the discussion. These materials will be kept completely confidential and any personal identifying information will not be used in any reports, publications, or presentations resultant from this research.

Other participants in this group discussion will hear your answers. Therefore, it is also your responsibility to maintain the confidentiality of fellow participants. Please do not share the discussion content with anyone beyond those who are present for the group discussion.

Although you may not directly benefit from taking part in this study, the information you provide may lead to improved disability programming. This group discussion will take approximately 1-2 hours and you will not be compensated for your time. There is no anticipated discomfort for those contributing to this study, so risk to participants is minimal. If you agree to participate, you can choose to stop at any time or to skip any topics you do not want to answer. Your participation is entirely voluntary.

Do you have any questions about the study or what I have said?
If, in the future, you have any questions or concerns regarding the study and the interview, or if you wish to add additional details, we welcome you to contact Dr Sujata Ganguly who acts as Chair of Includovate's internal ethical review board is sujata@includovate.com. We will leave one copy of this form with you, so that you will have a record of this contact information and about the study.

Do you agree to participate in this study?

[If YES, indicate below that the oral informed consent has been obtained. Then proceed with the question below regarding audio recording. If they refuse, thank them for their time and cancel the interview.]

□ Oral informed consent received

Do you agree to be audio recorded?

[If YES, indicate below. If participant responds "NO", proceed with the interview without recording.]

□ Consent to audio record interview received

Signature of interviewer: _____ Date: _____/_____/_____

Location of respondent:_____

Mode of interview: (e.g., face to face, telephone, zoom) _____

Background information:

WorldFish's mission is to reduce poverty and hunger by improving fisheries and aquaculture. Gender equality is integral to World Fish achieving its goals and advancing #Agenda2030. World Fish has a responsibility to its partners to capture and communicate the impact of its work on men and women, girls and boys and communities at large. Moreover, gender equality contributes to inclusive growth and sustainable development (Madgavkar 2020). The study of, and advocacy for, women's empowerment is necessary because the causes and consequences of low levels of empowerment can be found to limit women's opportunities (Malhotra and Schuler, 2005) and many policies and programs aim to increase empowerment (Alsop and Heinsohn, 2005) but evidence of their success is lacking (Springer and Drucza 2019). From a research for development perspective, this research facilitates greater awareness of what women's empowerment is and is not in a given context, and importantly sets a new standard regarding the quality through which researchers can 'claim women's empowerment.' WorldFish is dedicated to ensuring the alleviating of women as an excluded group in the SSF industry to be improved and made equal.

Scoping Phase Tool 5: Semi Structured interviews (SSI) with Fish Value Chain Actors

These interviews enable the researcher to deeply explore the topic. They are semi structured to allow for probing. This enables the researcher to ask follow up questions, depending on the answers given, and allows the researcher to follow the topics of interest to the participant.

SEMI STRUCTURED INDIVIDUAL INTERVIEWS	
Purpose	To elicit women's and men's perceptions and experiences as fish value chain actors. This information will provide the foundation for understanding empowerment pathways for women in different nodes of the Rice-Fish system. Research question(s) addressed: RQ1, RQ2
Respondents	The target population are women and men working in the fish sector as catchers, collectors, retailers, and processors (different nodes and by rural/urban and other relevant intersectional categories
Sampling	The sample size should be 4 women and 4 men (2 urban men and 2 urban women and 2 rural men and 2 rural women per value chain node).
Type of Data and Info	SSIs provide valuable qualitative data that capture different drivers and pathways to empowerment for retailers in SSF by probing the impact their daily activities, opportunities, constraints, relationships with suppliers and consumers, and examining the role resources, collective action, knowledge and information, and enabling institutions have on their sense of individual empowerment.
Strengths of The Tool	Allows in-depth probing of women's and men's pathways to empowerment and identifies possible factors towards empowerment.
Weaknesses of The Tool	Can be difficult to isolate individuals for interview, due to domestic, productive or community responsibilities that constrain time and availability for interview.

Table 16 Summary of the SSI

A. Circumstances of SSI

The SSI's should have one interviewer and one notetaker. Materials such as a notebook and a pen as well as an electronic device for manual notes must be provided for accurate data collection.

B. Facilitating and Conducting the SSI's:

Introduce the purpose of the study at the beginning of the SSI and obtain informed consent (both consents to being interviewed and consent to being audio-recorded). After obtaining informed consent the following table should be filled out by the notetaker:

SSI Code (Interview Type_location_gender_#)	
Date (dd/mm/yyyy)	
Name of location (market type / village)	
Rural/Urban	
Interview Type (SSI)	
Name of Interviewee	
Age/sex	
Marital Status	
Landowner Status	

Table 17 Example of table for record of information

Questionnaire Guide

Overall story

1. Can you tell me about how you become a fish retailer/catcher/collector/processor?

2. *Probe*: was it your individual choice? An expectation from family? Was anyone in your family in fish selling before you? An opportunity presented itself.
3. What are the types of resources you needed to work in fish?
    a. How did you acquire them?
4. How did/do you obtain knowledge for your work in fish?
    a. Did you ever attend a training program or certification related to fish handling or fish business?
5. Regarding the income you make in fish, what generally happens to the money you make? (what do you spend it on)?
    a. Who keeps it, decides about how to spend or save it?
    b. Have these dynamics changed over time? Why/why not?
6. Out of the fish you catch/sell, how much (%) do you keep for own/family consumption?
7. What are your expectations for the future of your business as a fish retailer/catcher/collector/ processor?
    a. What are some of the reasons you've stayed in the fish sector?
    b. Are you planning on leaving the trade or staying? If yes, what are some of the challenges you face as a fish retailer/catcher/collector/ processor that makes you want to leave?
    c. What are some of the ways you've dealt with these challenges?
    d. Are there challenges that you continue to deal with? If yes, why don't you solve these challenges/what do you need to overcome these challenges?
    e. What opportunities would you need to stay and upgrade your fish business?
    f. What would make you leave the fish industry completely?
8. Do you ever exchange fish informally as a gift? Why/why not?
9. How do you feel when you give or receive fish as a gift? (What does it mean to you as a woman/man)?

<u>Relationships with Fish Consumers</u>

10. Who typically buys from you (men or women, friends, extended family, certain caste/ethnicity)?
    a. Is it usually the same people every day or different people?
    b. What do they do with the fish? (Eat it? Process it? On-sell)?
11. Why do your customers buy from you?
    a. Is there anything different about the fish you sell (compared to other fish sold at this market/in this town)?

<u>Credit</u>

12. Do you ever allow customers to buy on credit? Why, how often, and how do you seek repayment?
13. Have you ever applied for a credit yourself?
    a. What was your experience of trying to get a loan?
    b. What were the repayment terms?
    c. Did you manage to repay or default? If you defaulted, what happened?

<u>Day-to-day activities</u>

14. Can you walk me through an average day for you?
    a. What time do you wake up and go to bed?
    b. How do you allocate your time between tasks?
15. Outside of your work as a fish retailer/catcher/collector/processor, what are some of your other responsibilities?
    a. How does this compare to other people in your household?
    b. How have your responsibilities changed over time?
16. Do you have enough time to do the things you enjoy as well as work? Why/why not?

   a. Which types of work/chores do you enjoy more than others? Why/why not?
17. What are some of the day to day decisions you need to make?
   a. Do you prefer to consult anyone when you make these decisions (who)?

Gendered social status of fish retailers

18. How is fish as a job regarded by other people in your community?
   a. How are you treated when and because you sell/work with fish? Why?
19. Are women working in other commodities treated differently to women in fish? Why/why not?
20. Are there certain types of jobs that are never done by men or women in the fish industry? (e.g., in some cultures, women do not catch the fish, but they can sell it)
   a. What about any differences between older and younger women or men?
   b. Any differences by caste, ethnicity, family status (e.g., Mother in-law /daughter in-law? First wife/second wife)

Policies, Laws and Regulations

21. Do you need to have a license to work in the fish industry?
   a. If so, how do you apply for the licence?
   b. Are certain people restricted from getting a licence? Why?
22. Are there any other rules/regulations for people who work in fish like you?
   a. Who usually breaks rules/laws, and what are the consequences for breaking rules/laws?
23. Do you have to interact with any authorities during your fish work?
   a. If yes, what is your relationship to these authorities like (resentful? Fearful? Collegial? No problems? …)
   b. Does everyone in the fish industry have a similar relationship to fish authorities as you? (e.g., do some people have better or worse relationships? Why?)

Ladder of Power & Freedom (for the individual)

If time, please complete this activity (you do not have to complete this for every interview, only those that have time/interest. This activity will be completed in a FGD in the deepening phase. This is an opportunity to get an individual's perspective on the ladder of power and freedom. This can later be compared with the FGD results.

Explain: *In this activity we want to understand to what degree you have the power (freedom) to make your own decisions about important affairs in your life, such as "if you will do paid work, which kind, how many children you will have, if you get to pursue an education, or whether you will start or end a marriage." We want you to think about power and freedom as if it is a 5-step ladder. Step 5, the top step, indicates great power and freedom, whereas step 1 signifies very little power and freedom to make important decisions.*

The facilitator should have a five-step ladder printed out (see Figure 1).

Figure 6 Example of a ladder of power and freedom[7]

1. Where do you think you are now on the ladder?
    - *Probe*: why do you think this? What kinds of decisions do you get to make at this level? (e.g., in terms of relationships; in terms of access and control over resources, assets and income and other).
2. Where is the average woman in this community on this ladder of power and freedom? Probe: why is the average women higher or lower or the same as you?
3. Do you know a woman in your community who is on the top rung, step 5?
    - *Probe*: tell me about why you think she is step 5? Describe her relationships, access and control over resources, assets and income. How did she come to be on that rung (what enabled that high level of empowerment)?
4. Let's return to you: Where were you on the ladder 10 years ago?
    - *Probe*: In what ways has your ability to make important life decisions and act on them changed (+, -)? Why?
5. If possible, would you want more power to make choices?
    - *Probe*: If yes, in what ways would you like more power? Probe to understand over what parts of their life (including which decisions, and over time, body, etc), enablers/ constraints.
6. If no, why not?

Wrap Up

24. Would you advise your daughter and son to enter the fish industry? Why/why not?
25. Is there anything else I should know about being a man/woman who sells fish?
26. Who is the most successful woman in the SSF value chain?
    - *Probe*: How can I contact her?

C. Adaptations

Adaptations include adding in the ladder of power and freedom. This tool returns in an FGD setting in the deepening phase, so it is a good idea to practice asking about it with at least some individuals during this phase.

D. Tips and Tricks for Using the Tool

[7] Sari, Irna & McDougall, Cynthia & Rajaratnam, Surendran. (2017). Women's empowerment in aquaculture: Two case studies from Indonesia.

Tip: Interviewing at a 'place of work' can be difficult in loud and busy marketplaces, or when a vendor is in the middle of a shift/currently working. Try introducing the purpose of the study and asking them if they would be interested in participating now or at another time/place that would be better suited to their schedule and location.

E. Analysing the data

The data collected through these interviews should provide a good picture of what it means to be a woman working in the SSF sector, and how they got into the industry and their desire to leave or expand and why. It can help triangulate information in other tools on the roles of different market players (retailers, wholesalers and collectors) and the gendered power relations and space/place-based issues (including safety and seasonality) that mediate player engagement with the SSF sector. Guiding questions for the analysis are:

- What are the emergent gender issues in the SSF system/value chain/node?
- What are the relevant gender norms and market relationships that mediate women's and men's work in the SSF? In what node?
- Level of power and contentment with the SSF sector (past versus now)?

F. Interpreting the data

In interpreting and presenting the results of the SSIs, the researcher should prioritize representing the trends and variations found in terms of empowerment, pathways, and factors, changes over time and location. In addition to the researcher's own analysis, the expectation is to also draw upon direct quotations were possible to express the emergent findings and to give greater voice to research participants themselves in representing the issues.

G. Informed consent statement

ORAL INFORMED CONSENT

Semi Structured Individual Interviews

Exploring Women's Empowerment in Small-Scale Fisheries (EWEF)

Client: WorldFish
Research firm: Includovate
Lead researcher: Dr. Kristie Drucza kristie@includovate.com

Thank you for the opportunity to speak with you. My name is ..... I am from a research incubator called Includovate which is a social enterprise that innovates for inclusion. WorldFish has contracted Includovate to conduct a collaborative study on women's empowerment in small-scale fisheries (SSF). We would like to interview you about your experiences within the industry.

Ideally, we wanted to meet you and ask these questions face to face. But we cannot visit you because of COVID-19. However, your views and opinions are still very important for us, hence we are asking you these questions over the phone. We hope that things will go back to normal very soon, and that one day we will get to meet you in person.

We received your contact details through WorldFish who commissioned this methodology because momentum around sustainable aquatic development pathways is growing and because WorldFish does not want to exclude women participants. They may have received your details from their own contacts and networks. You have been chosen to be interviewed because you are a woman or man working in the fish sector as catchers, collectors, retailers, and processors. We will ask you questions related to the fish value chain and explore your perception and experiences as a fish value chain actor in the SSF system.

We ask for your support by answering questions as honestly and fully as possible – there are no right or wrong answers. We just want to know your actual experiences, opinions, and the challenges you face in order to understand how to improve the program. Your answers will be completely confidential. During the interview, we will be taking notes, and with your permission, we would like to audio record the discussion. These materials will be kept completely confidential and any personal identifying information will not be used in any reports, publications, or presentations resultant from this research. Demographic questions and the responses to any gendered questions will only be used for disaggregation and cannot be tracked back to the respondent.

Although you may not directly benefit from taking part in this study, the information you provide may lead to improved understanding of the SSF industry and any gendered issues, norms and challenges faced specifically by women participants. The interview will take approximately 1 hour, and you will not be compensated for your time. There is no anticipated discomfort for those contributing to this study. If you agree to participate, you can choose to stop at any time or to skip any topics you do not want to answer. Your participation is entirely voluntary.

Do you have any questions about the study or what I have said?
If, in the future, you have any questions or concerns regarding the study and the interview, or if you wish to add additional details, we welcome you to contact Dr Sujata Ganguly who acts as Chair of Includovate's internal ethical review board is sujata@includovate.com. We will leave one copy of this form with you, so that you will have a record of this contact information and about the study.

Do you agree to participate in this study?
[If YES, indicate below that the oral informed consent has been obtained. Then proceed with the question below regarding audio recording. If they refuse, thank them for their time and cancel the interview.]

□ Oral informed consent received

Do you agree to be audio recorded?
[If YES, indicate below. If participant responds "NO", proceed with the interview without recording.]

□ Consent to audio record interview received

Signature of interviewer: _____ Date: _____/_____/_____

Location of respondent:_____

Mode of interview: (e.g., face to face, telephone, zoom) _____

Background information:

WorldFish's mission is to reduce poverty and hunger by improving fisheries and aquaculture. Gender equality is integral to World Fish achieving its goals and advancing #Agenda2030. World Fish has a

responsibility to its partners to capture and communicate the impact of its work on men and women, girls and boys and communities at large. Moreover, gender equality contributes to inclusive growth and sustainable development (Madgavkar 2020). The study of, and advocacy for, women's empowerment is necessary because the causes and consequences of low levels of empowerment can be found to limit women's opportunities (Malhotra and Schuler, 2005) and many policies and programs aim to increase empowerment (Alsop and Heinsohn, 2005) but evidence of their success is lacking (Springer and Drucza 2019). From a research for development perspective, this research facilitates greater awareness of what women's empowerment is and is not in a given context, and importantly sets a new standard regarding the quality through which researchers can 'claim women's empowerment.' WorldFish is dedicated to ensuring the alleviating of women as an excluded group in the SSF industry to be improved and made equal.

Scoping Phase Tool 6: Cognitive Interviewing

Cognitive interviewing is done to estimate maximum variance among the respondent group by interviewing a diverse range of individuals who will be useful in informing decisions about if and how to modify questions. The modifications that could be made include re-wording questions, providing more specific instructions and specifically offering culturally appropriate examples, and defining terms explicitly.

COGNITIVE INTERVIEWING	
Purpose	To determine whether the survey question's intent and the meanings inferred by participants align.
Respondents	Respondents should be randomly selected from local level lists (e.g., village, woreda, location where associated project is being implemented). This information can be obtained from project partners and/or local level administration.
Sampling	3 women and 3 men engaged in the SSF sector identified as potential survey respondents (make sure to include someone with only a primary school education)
Type of Data and Info	Qualitative data in the form of detailed notetaking to determine whether the question's intent and the meanings inferred by participants align.
Strengths of the Tool8	Adds internal validity on how meaningful survey questions are. Provides critical feedback on survey participant comprehension, retrieval, judgement, and response.
Weaknesses of the Tool	Takes the time of respondents.

Table 18 Summary of the cognitive interviews

A. Circumstances of Interview

The cognitive interviews should have one interviewer and one notetaker. Materials such as an audio recorder, notebook/pen and device are needed for data collection and flipchart, markers, pens, sticky notes must be provided for the exercise. The target population are the women and men involved in the SSF sector and the sample size should be 5-8 women and men respondents.

B. Facilitating and conducting the Cognitive Interviews:

Read through the finalized survey questionnaire individually with each participant. For each question, ask what the question means to the respondent, discuss whether the respondent fully comprehends the intent of each question, while also exploring potentially different meanings and areas of confusion. Make detailed notes of such cases. Ask the respondent how they would answer the question. This will help to more deeply cross check comprehension.

C. Adaptations

Future testing of the tool is needed to determine possible adaptations. Malapit et al. (2016) suggest that portions of the questionnaire that may be particularly challenging/relatively easier to misinterpret should be prioritized in the facilitation of cognitive interviews. Further testing of the tool is needed to determine adaptations regarding specific questions.

D. Tips and Tricks for Using the Tool

8 For full set of strengths and weaknesses of cognitive interviewing, see Malapit, H. J., Sproule, K., & Kovarik, C. (2016). *Using cognitive interviewing to improve the Women's Empowerment in Agriculture Index survey instruments: Evidence from Bangladesh and Uganda* (Vol. 1564). International Food Policy Research Institute (IFPRI).

Tip: To save time, the research team can opt to not transcribe the cognitive interviews and simply summarize the key findings and proceed with making the necessary edits to the survey before piloting.

Tip: if certain words, definitions or phrases are not understood by the respondent, the researcher may want to pilot some of the following:

1 – modifying the wording of questions until comprehension is reached.
2 – have culturally/ locally relevant examples prepared to experiment with probes/prompts.
3 – defining terms explicitly Defining terms explicitly in the survey and comparing these to how the respondent would explain the definition. and

E. Analysing the data

The following questions should guide the analysis:

- What specific questions and/or areas of the questionnaire did potential respondents struggle with/were confused by?
- Which questions were identified as requiring modification in terms of wording?
- Are more specific instructions needed for completion and/or culturally appropriate examples?
- Do any terms need to be defined more explicitly in the questionnaire?
- Data should be organized and coded according to area of the questionnaire (domain of empowerment) and further divided by specific questions and sub-questions.

F. Interpreting the data

If more than one person does the cognitive interviews, then the research team should meet and compare/compile notes from the cognitive interviews clustered around the questions for guiding the analysis. A full list of potential areas for revision should be assembled (based on domain of empowerment, specific question, and sub-questions) and be discussed in terms of possible revisions.

G. Informed consent statement

ORAL INFORMED CONSENT
Cognitive Interviews

Exploring Women's Empowerment in Small-Scale Fisheries (EWEF)

Client: WorldFish
Research firm: Includovate
Lead researcher: Dr. Kristie Drucza kristie@includovate.com

Thank you for the opportunity to speak with you. My name is …… I am from a research incubator called Includovate which is a social enterprise that innovates for inclusion. WorldFish has contracted Includovate to conduct a collaborative study on women's empowerment in small-scale fisheries (SSF). We would like to interview you about your experiences within the industry.

Ideally, we wanted to meet you and ask these questions face to face. But we cannot visit you because of COVID-19. However, your views and opinions are still very important for us, hence we are asking you

these questions over the phone. We hope that things will go back to normal very soon, and that one day we will get to meet you in person.

We received your contact details through WorldFish who commissioned this methodology because momentum around sustainable aquatic development pathways is growing and because WorldFish does not want to exclude women participants. They may have received your details from their own contacts and networks. You have been randomly chosen to be interviewed because you are a woman or man engaged in the SSF sector. We will ask you questions related to the fish value chain and explore your perception and experiences as a fish value chain actor in the SSF system.

We ask for your support by answering questions as honestly and fully as possible – there are no right or wrong answers. We just want to know your actual experiences, opinions, and the challenges you face in order to understand how to improve the program. Your answers will be completely confidential. During the interview, we will be taking notes, and with your permission, we would like to audio record the discussion. These materials will be kept completely confidential and any personal identifying information will not be used in any reports, publications, or presentations resultant from this research.

Although you may not directly benefit from taking part in this study, the information you provide may lead to improved understanding of the SSF industry and any gendered issues, norms and challenges faced specifically by women participants. The interview will take approximately 1 hour, and you will not be compensated for your time. There is no anticipated discomfort for those contributing to this study. If you agree to participate, you can choose to stop at any time or to skip any topics you do not want to answer. Your participation is entirely voluntary.

Do you have any questions about the study or what I have said?
If, in the future, you have any questions or concerns regarding the study and the interview, or if you wish to add additional details, we welcome you to contact Dr Sujata Ganguly who acts as Chair of Includovate's internal ethical review board is sujata@includovate.com. We will leave one copy of this form with you, so that you will have a record of this contact information and about the study.

Do you agree to participate in this study?
[If YES, indicate below that the oral informed consent has been obtained. Then proceed with the question below regarding audio recording. If they refuse, thank them for their time and cancel the interview.]

□ Oral informed consent received

Do you agree to be audio recorded?
[If YES, indicate below. If participant responds "NO", proceed with the interview without recording.]

□ Consent to audio record interview received

Signature of interviewer: _____ Date: _____/_____/_____

Location of respondent:_____

Mode of interview: (e.g., face to face, telephone, zoom) _____

Background information:

WorldFish's mission is to reduce poverty and hunger by improving fisheries and aquaculture. Gender equality is integral to World Fish achieving its goals and advancing #Agenda2030. World Fish has a

responsibility to its partners to capture and communicate the impact of its work on men and women, girls and boys and communities at large. Moreover, gender equality contributes to inclusive growth and sustainable development (Madgavkar 2020). The study of, and advocacy for, women's empowerment is necessary because the causes and consequences of low levels of empowerment can be found to limit women's opportunities (Malhotra and Schuler, 2005) and many policies and programs aim to increase empowerment (Alsop and Heinsohn, 2005) but evidence of their success is lacking (Springer and Drucza 2019). From a research for development perspective, this research facilitates greater awareness of what women's empowerment is and is not in a given context, and importantly sets a new standard regarding the quality through which researchers can 'claim women's empowerment.' WorldFish is dedicated to ensuring the alleviating of women as an excluded group in the SSF industry to be improved and made equal.

Scoping Phase Tool 7: Learning Journal Field Diary

This tool if a reflect journal that will help improve the research quality and overall methodology. The researcher's skills and familiarity with the tools will also improve from this process.

Learning Journal Field Diary	
Purpose	The purpose of the learning journal field diary is to reflect daily and collate feedback as a research team during the data collection process. The diary should include specific reflections and areas for improvement (e.g., How successful was the method(s)? Why? What worked well/less well and what improvements to the design or certain questions, or tools are necessary). Through these iterative reflections, this reflexive tool adds internal context validity. To reflect on the responses, and an endogenous understanding of empowerment that is emerging. To remain vigilant of when an exogenous understanding of empowerment is creeping in and/or to understand how an exogenous understanding is different to an endogenous one.
Respondents	Each researcher who collects data. If more than one researcher collects data (e.g., FGD note taker and facilitator) then both should complete the diary together.
Sampling	The diary should be completed daily but there are times when it might make sense to do it after a specific activity. For example, if an interview did not go to plan, then capturing the reasons while they are fresh in the researcher's mind is advised, so the information is not lost.
Type of Data and Info	Qualitative and self-reflexive data in the form of detailed notetaking to determine the relevance of the study design and to reflect upon the position and power of the researcher.
Strengths of The Tool	Gives the researcher additional time to reflect upon and analyse, become familiar with, the data and the different respondent types. Ensures the researcher learns and has the time to improve their research skills while reinforcing and reflecting upon their role as insider/outsider. As such it helps with intersectionality and power analysis.
Weaknesses of The Tool	Can take time and some tired researchers can be resentful of taking the extra time in the evening to do the activity.

Table 19 Summary of the Learning Journal Field Diary

A. Circumstances

This can be done individually or as a team at the end of each day. If the day is tiring (hot sun, busy, or lots of challenges faced), then the learning and reflection can be done as a team in the vehicle on the way home.

B. Facilitating and Conducting the tool

After each day of data collection, please take time to complete the following reflection journal

Date: Location: Your name: Research assistant's name(s):
Observations and broad takeaways from the tool
Overall, did you get good data from the respondent? Why/why not?
Did the respondent get emotional for any of the questions? Why/which question(s)

In terms of the research questions, what topics/questions worked well?
In terms of the research questions, which questions/topics were hard for the respondent to understand?
What did you have to do to help the respondent understand?
What were the challenges? (be specific, it may be about finding participants, or having them turn up on time, getting them to understand the questions)
Specific reflections
What new information did I get about women's empowerment from today's interviews?
Could I identify any empowerment pathways from the data collected? What?
Did I learn anything new about conducting this type of research?
Have any patterns emerged from the research so far?
How did I feel doing this interview (confident, shy, like an outside/insider, rushed?)
Areas for improvement
What hindered the process of data collection? (it may be a person, the weather, time of the interview, you had to ask a lot of prompting questions…)
Which questions did you not need to ask because they had already been answered?
What else would you like to know about but there isn't a question covering this?
If we could turn back the clock, what should we/you do differently next time?
What advice would you give to another researcher who was completing this study (especially in terms of building rapport with the respondent)?

C. Adaptations

These questions are a guide. More questions or reflections can be added as needed.

D. Tips and Tricks for Using the Tool

Completing the journal at the end of each day is advised. Even if you are tired, this information will be used during the validation process and shared with WorldFish to improve the methodology.

E. Analysing the data

Pay attention to repeated observations and strengthens and weaknesses. Count the frequency of observations.

F. Interpreting the data

Develop tables and other graphs so they can be easily presented during the validation workshop.

4.2 Deepening Phase Pack of tools

The deepening phase is designed to more deeply explore the research questions. There are a number of long focus group discussions, an in-depth interview and a survey in this phase

Tool	No. and type of respondents	Time it Takes
DP1: Validate the VC maps	• 2 women who work in the VC • 2 men who work in the VC • 1 government official • 1 other stakeholder	45 minutes
DP2: Ladder of power and freedom	Four focus group discussions per study location: • 2 all-women groups • 2 all-men groups	2 hours
DP3: Historical Timeline and SN change	2 FGDs groups, 1 all-women group and 1 all-men group.	1 hour per tool
DP4: Aspirations	6 FGDs, two all-women and two all men group and two mixed sex groups.	2 hours
DP6: IDI	It is recommended that 6 life histories are recorded with 3 younger women (25-35) and 3 older women (35-65) at different nodes of the value chain in a rural area, and another 6 should be completed in an urban area.	1.5 hours
DP7: Learning journal Field Diary	N/A	Will take between 5-30 minutes per evening
DP8: Survey	50% women/50% men, with 1/3 of the survey population representing de jure women-headed households. The total number of respondents will vary depending on the population size and the size of the SSF	1 hour

Table 20 Deepening Phase Methods Summary

Deepening Phase Tool 1: Validate VC maps

This is a validation activity to check the value chain maps. While there is a separate validation phase it is important to have a good understanding of the value chains at this point. Hence any errors in the map should be corrected.

Value Chain Map Validation	
Purpose	To cross check with different actors if the value chain and the gender and social relationships of power resonate with their experiences.
Respondents	The following respondents are recommended: • 2 women who work in the VC • 2 men who work in the VC • 1 government official • 1 other stakeholder Each VC node should be covered by at least one respondent who has worked in aquaculture.
Sampling	There are no strict sampling specificities for this tool, as the sampling strategy is based on convenience and purpose. However, the target population are women and men engaged in the SSF sector by different types of production, node and/or intersectional identity (as identified in the scoping phase), market stakeholders such as the market managers and sellers of fish. The main goal is to show the maps to people not involved in the first data collection process and have them confirm or contest the gender and power relations between nodes/actors. If major discrepancies emerge from this activity then you will need to repeat the NNPIA scoping phase activity.
Type of Data and Info	Validation data
Strengths of The Tool	Corrects any mis-interpretations or assumptions before the research continues, gives the researcher confidence in the findings and may provide participants with a new way of understanding markets and the flow of goods and services.
Weaknesses of The Tool	Sampling is based on convenience and VC node/purpose.

A. Circumstances

You could approach people at the marketplace, or elsewhere you know they will be from the scoping phase. Meeting with government people may require an appointment and more organisation. Print your maps out first and take them with you together with a voice recorder. You will need to use informed consent for participation and recording purposes. The location can be in a marketplace, in an office, or anywhere.

B. Facilitating and Conducting the tool

Background Information

Name of facilitator	
Date (dd/mm/yyyy)	

No. of participants	
Location	
Sex	
Age range	
Marital Status	
Position/role in the community	

Table 21 Example of table for record of information

Show the map and explain to the respondent how the map was developed and that you would like to get their opinion on the accuracy of the map. Explain the map and allow the respondent to ask clarifying questions or to critique anything. Make a note of what they ask and say.

1. What are your first impressions about this map? (probe: did you learn something new?)
2. Is there any actor or stakeholder missing from this map? (Who/where?)

Is there anything you would agree with, want to change, or comment on about the following:

3. The number of men or mainly women (%) in the node?
4. Average age of workers/producers/suppliers in the node?
5. Socio-economic status of workers/producers/suppliers in the node?
6. Name of the most successful male and female at this node/level.
7. Name of the most empowered male/female at this level according to empowerment FGD definitions.
8. Average income per node?
9. Average price of fish bought and sold?
10. What are the characteristics/demographics of those with power at this node?
    a. What roles do different stakeholders play?
11. How are decisions made in this node (any collective buying/selling, or is it individual. Do certain people control a lot of decisions? And if so, how are these done e.g., in public or private spaces)?
12. How/Where are stakeholders/nodes connected (time/spaces/places)?
13. Is there anything else you would change about this map after all your comments?
14. Anything else you want to add or share with me before I ask my final question?
15. How might the links between these nodes change as rice production intensifies?

C. Adaptations

Adaptations to the instrument are allowed and will depend on the original VC map and the responses of the person. Additional iterations and testing are needed to assess what questions can be skipped in future usage of the tool.

D. Tips and Tricks for Using the Tool

This is a very relaxed tool. There is no need to stress about using it wrong. We are putting in a little quality check at this stage of the data collection to reconnect with participants and maintain an endogenous understanding.

E. Analysing the data

Any new information should be noted and added to the map. If the map needs to be re-done because a lot of discrepancies emerged, then please repeat activity four from the scoping study.

F. Informed consent statement

ORAL INFORMED CONSENT
Value Chain Map Validation

Exploring Women's Empowerment in Small-Scale Fisheries

Client: WorldFish
Research firm: Includovate
Lead researcher: Dr. Kristie Drucza kristie@includovate.com

Thank you for the opportunity to speak with you. My name is ..... I am from a research incubator called Includovate which is a social enterprise that innovates for inclusion. WorldFish has contracted Includovate to conduct a collaborative study on women's empowerment in small-scale fisheries (SSF). We would like to interview you about your experiences within the industry.

In order to maintain safety during COVID-19, we kindly ask that you maintain social distancing measures of staying apart at least 1.5m and wearing a face mask. However, your views and opinions are still very important for us, hence we are still conducting this activity. We hope that things will go back to normal very soon and appreciate you agreeing to social distancing and a face covering.

We received your contact details through WorldFish who commissioned this methodology because momentum around sustainable aquatic development pathways is growing and because WorldFish does not want to exclude women participants. They may have received your details from their own contacts and networks. You have been chosen to be interviewed because you are considered a woman or a man in the fish value chain, a government official or a SSF stakeholder (e.g., fisheries staff, market managers, or market owner). You must not have been involved in the first data collection process. We will ask you questions related to a series of maps that we will provide regarding the fish value chain and explore the different actors in the diagram. We will require you to either confirm or contest the information we give you and provide justification.

We ask for your support by answering questions as honestly and fully as possible – there are no right or wrong answers. We just want to know your actual experiences, opinions, and the challenges you face in order to understand how to improve the program. Your answers will be completely confidential. During the interview, we will be taking notes, and with your permission, we would like to audio record the discussion. These materials will be kept completely confidential and any personal identifying information will not be used in any reports, publications, or presentations resultant from this research. Demographic questions and the responses to any gendered questions will only be used for disaggregation and cannot be tracked back to the respondent.

Although you may not directly benefit from taking part in this study, the information you provide may lead to improved understanding of the SSF industry and any gendered issues, norms and challenges faced specifically by women participants. The interview will take approximately 1 hour, and you will not be compensated for your time. There is no anticipated discomfort for those contributing to this study. If you agree to participate, you can choose to stop at any time or to skip any topics you do not want to answer. Your participation is entirely voluntary.

Do you have any questions about the study or what I have said?
If, in the future, you have any questions or concerns regarding the study and the interview, or if you wish to add additional details, we welcome you to contact Dr Sujata Ganguly who acts as Chair of Includovate's internal ethical review board is sujata@includovate.com. We will leave one copy of this form with you, so that you will have a record of this contact information and about the study.

Do you agree to participate in this study?
[If YES, indicate below that the oral informed consent has been obtained. Then proceed with the question below regarding audio recording. If they refuse, thank them for their time and cancel the interview.]

□ Oral informed consent received

Do you agree to be audio recorded?
[If YES, indicate below. If participant responds "NO", proceed with the interview without recording.]

□ Consent to audio record interview received

Signature of interviewer: _____ Date: _____/_____/_____

Location of respondent:_____

Mode of interview: (e.g., face to face, telephone, zoom) _____

Background information:

WorldFish's mission is to reduce poverty and hunger by improving fisheries and aquaculture. Gender equality is integral to World Fish achieving its goals and advancing #Agenda2030. World Fish has a responsibility to its partners to capture and communicate the impact of its work on men and women, girls and boys and communities at large. Moreover, gender equality contributes to inclusive growth and sustainable development (Madgavkar 2020). The study of, and advocacy for, women's empowerment is necessary because the causes and consequences of low levels of empowerment can be found to limit women's opportunities (Malhotra and Schuler, 2005) and many policies and programs aim to increase empowerment (Alsop and Heinsohn, 2005) but evidence of their success is lacking (Springer and Drucza 2019). From a research for development perspective, this research facilitates greater awareness of what women's empowerment is and is not in a given context, and importantly sets a new standard regarding the quality through which researchers can 'claim women's empowerment.' WorldFish is dedicated to ensuring the alleviating of women as an excluded group in the SSF industry to be improved and made equal.

Deepening Phase Tool 2: Ladder of Power and Freedom

The Ladder of Power and Freedom is a key tool in provide meaningful contextual and comparative evidence of people's own assessments and interpretations of their levels of agency in their lives, and the key factors and processes that they perceive to shape their capacities in making important decisions. The activity also enables the capturing of perceptions of relative empowerment between women and men.

THE LADDER OF POWER AND FREEDOM – FOCUS GROUP DISCUSSION (FGD)	
Purpose	To provide meaningful contextual and comparative evidence of people's own assessments and interpretations of their levels of agency in their lives, and the key factors and processes that they perceive to shape their capacities in making important decisions and to capture relative empowerment between women and men. Research question(s) addressed: RQ1; RQ2
Respondents	It is recommended that there will be four focus group discussions per study location: • 2 all-women groups • 2 all-men groups 6-12 participants per focus group
Sampling	Non-Probability Sampling or Purposive sampling by exclusion categories will be done in consultation with context-appropriate local partners/organisations/ experts to select respondents from the intersectional groups prioritized for the individual study. Sampling size will be largely determined by the saturation point required to collect the information needed for the study
Type of Data and Info	Qualitative data: Perceptions of relative empowerment between women and men (Ladder of Power and Freedom)
Strengths of The Tool	Identifies drivers of women's empowerment and relative levels of empowerment between women and men. Also helps identify who different types of people in the community (e.g., at different levels of empowerment) and interactions within group among participants offers data consensus. Diversity of views that capture points of agreement and disagreement.
Weaknesses of The Tool	Overt group power dynamics/biases mean that some participants self-identify at a certain ladder rung and tell others what rung they "should be" on, reflecting their biases of the understanding of the questions and activity. Group may think the activity is about social status/wealth ranking in the community as opposed to individual decision-making

A. Circumstances

The focus group discussion should have one facilitator and one notetaker. Materials such as flipchart, markers, pens, sticky notes should be used for this exercise together with an audio recorder, camera (to photograph the ladder), paper/pen or device for manual notes. The target population are the women and men engaged in the SSF sector by different types of production, node and/or intersectional identity (as identified in the scoping phase), market stakeholders such as the market manager and sellers of fish.

Name of facilitator	

Date (dd/mm/yyyy)	
No. of participants	
Location	
Sex	
Age range	
Marital Status	
Position/role in the community	

Table 22 Example of table for record of information

B. Facilitating and Conducting the tool[9]

The goal of the exercise is to understand the factors that shape women's or men's conceptions of power and freedom in their lives, and reasons for changes in these conceptions over time, rather than obtaining exact measurements or absolute values for agency.

Before starting the focus group, the facilitator should create a visual of a five-step ladder on a flipchart (Fig 1).

Figure 7 Example of a ladder of power and freedom[10]

The facilitator will explain to the focus group that step 5, the top step, indicates great power and freedom, whereas step 1 signifies very little power and freedom to make these consequential decisions. On the first step, is a women who nobody wants to be like, she has little power to make her own decisions about important affairs in her life. She has little to say about if or where she will work, or about starting or ending a relationship. On the highest step, the fifth, stand those who have great capacity to make important decisions for themselves, including about their working life and whether to start or end a relationship in their personal life.

1. Ask the group to describe women from this community who are on step one
   List the attributes of the person on step one on a flip chart according to what the respondents say. Cross out if people disagree and add to the list when there is agreement.

   Prompt: what is her self-worth and self-belief like (power within); what is her social network/capital like, her mutual support and respect (power with); can she take action to change her life if she

[9] Directions and information on this tool directly cited from Petesch, P. & Bullock, R. (2018). Ladder of Power and Freedom: Qualitative data collection tool to understand local perceptions of agency and decision-making. GENNOVATE resources for scientists and research teams. CDMX, Mexico: CIMMYT.

[10] Sari, Irna & McDougall, Cynthia & Rajaratnam, Surendran. (2017). Women's empowerment in aquaculture: Two case studies from Indonesia.

wants (power to); does she control any income, assets and resources (power over); does she have important networks that will support her advancement (power through)?
Ask: Does everyone agree that someone with these attributes would be on step 1? Discuss until there is agreement about what qualities constitutes step 1. Write then down so people remember the attributes for step 1.

2. Repeat for the person on step five: Ask the group to describe women from this community who are on step five if any (there may be none, do not pressure to add here)

List the attributes of the person on step five on a flip chart according to what the respondents say. Cross out if people disagree and add to the list when there is agreement.

Prompt: what is her self-worth and self-belief like (power within); what is her social network/capital like, her mutual support and respect (power with); can she take action to change her life if she wants (power too); does she control any income, assets and resources (power over); does she have important networks that will support her advancement (power through)?
Ask: Does everyone agree that someone with these attributes would be on step 5? Discuss until there is agreement about what qualities constitutes step 5. Write then down so people remember the attributes for step 5.

3. Repeat for the person on step two: Ask the group to describe which women are on step two, if any.

List the attributes of the person on step two on a flip chart according to what the respondents say. Cross out if people disagree and add to the list when there is agreement.

Prompt: what is her self-worth and self-belief like (power within); what is her social network/capital like, her mutual support and respect (power with); can she take action to change her life if she wants (power too); does she control any income, assets and resources (power over); does she have important networks that will support her advancement (power through)?
Ask: Does everyone agree that someone with these attributes would be on step 2? Discuss until there is agreement about what qualities constitutes step 2. Write then down so people remember the attributes for step 2.

4. Repeat for the person on step three: Ask the group to describe which women are on step three, if any.

List the attributes of the person on step three on a flip chart according to what the respondents say. Cross out if people disagree and add to the list when there is agreement.

Prompt: what is her self-worth and self-belief like (power within); what is her social network/capital like, her mutual support and respect (power with); can she take action to change her life if she wants (power too); does she control any income, assets and resources (power over); does she have important networks that will support her advancement (power through)?
Ask: Does everyone agree that someone with these attributes would be on step 3? Discuss until there is agreement about what qualities constitutes step 3. Write then down so people remember the attributes for step 3.

5. Repeat for the person on step four: Ask the group to describe which women on step four, if any.

List the attributes of the person on step four on a flip chart according to what the respondents say. Cross out if people disagree and add to the list when there is agreement.

Prompt: what is her self-worth and self-belief like (power within); what is her social network/capital like, her mutual support and respect (power with); can she take action to change her life if she wants (power too); does she control any income, assets and resources (power over); does she have important networks that will support her advancement (power through)?
Ask: Does everyone agree that someone with these attributes would be on step four? Discuss until there is agreement about what qualities constitutes step four.

6. Ask each focus group participant to privately vote on a small sticky note for the step where they think they land on the ladder. Symbols may be used if illiterate.

Ask: Would they like to be higher or lower on the ladder? Inform respondents to write an arrow pointing up or down on the same sticky note
Ask: What do they do to earn income/livelihood? Inform respondents to write this on the same sticky note

Ask: Where would you place yourself on the ladder 10 years ago? Inform respondents to write this on the same sticky note but on the other side.

Go around the room one by one and ask the person if they were higher or lower 10 years ago and why this is the case. Probe for people, experiences, networks, policies, programs, crises, own capacities or confidence/agency, relations + resources + formal and informal institutions (norms, rules, policies) + programs, control over own time and mobility, control over/access to technology/information).

Ask: Were you engaged in a different livelihood 10 years ago or the same? Inform respondents to write this on the same sticky note

Collect the paper/sticky note and document later.

Tip: In facilitating the discussion and to elicit a multidimensional and inclusive discussion of the reasons for the rankings identified the facilitator should probe deeply into the focus group members' explanations of their ladder rankings. The rankings and discussion are then repeated to capture perceptions of power and freedom 10 years ago. These discussions should also be probed deeply to elicit detailed explanations for the trends in agency identified.

7. What are some of the things that would cause a woman to move down the ladder?

Write down the list on a flip chart paper. After the brain storming is finished and people have run out of ideas, read each item out again and allocate a symbol next to it for people who may be illiterate. Give each person 3 tokens (rocks, pens, bits of paper) and explain that they can chose the top three biggest problems/barriers/pitfalls that would cause someone to move down the ladder. Place the flipcharts on the floor and explain that they must place their 3 tokens on what they consider to be the biggest problems/barriers/pitfalls.

8. What are some of the things that would help a woman move up the ladder?

This can be relationships, good luck, assets, resources, education, inheritance, etc). Write down the answers on a flip chart paper. After the brain storming is finished and people have run out of ideas, read each item out again and allocate a symbol next to it for people who may be illiterate. Give each person 3 tokens (rocks, pens, bits of paper) and explain that they can chose the top three biggest opportunities that would help someone move up the ladder. Place the flipcharts on the floor and explain that they have to place their 3 tokens on what they consider to be the biggest opportunities to move up the ladder.

9. In which of these spaces do women face the greatest challenge: the market, home, community, school, health centre, work or other space?

Ask people to write their answer down and then facilitate a discussion on why the think this space is the most challenging.

10. If you think about the women in your life.
    a) what is the biggest barrier they face?

Probe ideas/attitudes (and norms) about what women or men can and can't and why? Access to or control over certain resources (which ones), including financing or information or technologies; control over own time and mobility (including gender distribution of labour & ability to share domestic roles/unpaid labour); access to programs (e.g., opportunities), including extension; policies (any level); own capacities or confidence; relationships (HH, community or group, association, VC networks, private sector, other?)

    b) …and what are the most important things that could happen to remove those barriers? Probe re things women could do (individual or together), men could do, programs could do, policies et cetera.

C. Adaptations

Adaptations to the instrument and adjustments will be informed and identified respectively in future iterations of the tool. Additional iterations and testing are needed to assess what questions can be skipped in future usage of the tool.

D. Tips and Tricks for Using the Tool

Tip: The success of this activity in capturing detailed explanations for the trends in agency identified is contingent on the quantity and quality of the probing of rankings. In addition to the mechanics of the main ranking activity, the researchers should intimately familiarise themselves with the probing questions to facilitate an inclusive and deep discussion.

The Ladder of Power and Freedom tool also allows for more direct probing around research question #3 regarding the hypothetical changes that could occur in the SSF system given policy changes or interventions (e.g., If SSF production intensifies so there is greater fish production, how will this affect women? Which women (e.g., poorer, landless, minority groups)? How would the burdens, risks and potential opportunities manifest? Further probing for ideas regarding programming and policy to mitigate risks and create an enabling environment conducive to empowerment are also encouraged in this activity. The questions in the IDI tool focus on understanding the different pathways women take towards empowerment and who and what helps them along their journey. The tool also helps understand changes in empowerment over time.

E. Analysing the data

Provide meaningful contextual and comparative qualitative evidence regarding what empowerment is seen locally to embody, current and past levels (degrees/kinds) of empowerment of different women and men, and insights into enablers/constraints and pathways to empowerment for different women and men. Specifically, elucidate how women and men:

- Understand empowerment to be in that context terms of what kinds of 'powers and freedoms' are important

- See 'full' versus 'little' empowerment in that context (e.g., what the top versus bottom rungs represent)
- See different people of their own gender – and the opposite gender – in terms of how empowered they are/are not and WHY (e.g., drivers, barriers/enablers and people's perceptions of relative empowerment between women and men)
- Perceive how empowerment has changed (or not) for different women and men over the past decade and why (e.g., trends, barriers/enablers and pathways)

Tip: Remember, the goal of the exercise is to understand the factors that shape women's or men's conceptions of power and freedom in their lives, and reasons for changes in these conceptions over time, rather than obtaining exact measurements or absolute values for agency.

Please also use the coding tree to help make sense of the data.

F. Interpreting the data

In interpreting and presenting the results of the Ladder of Power and Freedom, the researcher(s) should prioritize representing the trends and variations found amongst the participants. In addition to the researcher's own analysis, the expectation is to also draw upon direct quotations where possible to express the emergent findings and to give greater voice to research participants themselves in representing the issues.

G. Informed consent statement

ORAL INFORMED CONSENT
Ladder of Power and Freedom Focus Group Discussion (FGD)

Exploring Women's Empowerment in Small-Scale Fisheries

Client: WorldFish
Research firm: Includovate
Lead researcher: Dr. Kristie Drucza kristie@includovate.com

Thank you for the opportunity to speak with you. My name is ..... I am from a research incubator called Includovate which is a social enterprise that innovates for inclusion. WorldFish has contracted Includovate to conduct a collaborative study on women's empowerment in small-scale fisheries (SSF). We would like to interview you about your experiences within the industry.

Ideally, we wanted to meet you and ask these questions face to face. But we cannot visit you because of COVID-19. However, your views and opinions are still very important for us, hence we are asking you these questions over the phone. We hope that things will go back to normal very soon, and that one day we will get to meet you in person.

We received your contact details through WorldFish who commissioned this methodology because momentum around sustainable aquatic development pathways is growing and because WorldFish does not want to exclude women participants. They may have received your details from their own contacts and networks. You have been chosen to be interviewed because you are part of our target population. We will ask you questions related to your personal empowerment, gender equality and relationships.

We ask for your support by answering questions as honestly and fully as possible – there are no right or wrong answers. We just want to know your actual experiences, opinions, and the challenges you face in order to understand how to improve the program. Your answers will be completely confidential.

During the interview, we will be taking notes, and with your permission, we would like to audio record the discussion. These materials will be kept completely confidential and any personal identifying information will not be used in any reports, publications, or presentations resultant from this research. Demographic questions and the responses to any gendered questions will only be used for disaggregation and cannot be tracked back to the respondent.

Other participants in this group discussion will hear your answers. Therefore, it is also your responsibility to maintain the confidentiality of fellow participants. Please do not share the discussion content with anyone beyond those who are present for the group discussion.

Although you may not directly benefit from taking part in this study, the information you provide may lead to improved understanding of the SSF industry and any gendered issues, norms and challenges faced specifically by women participants. The interview will take approximately 1 hour, and you will not be compensated for your time. There is no anticipated discomfort for those contributing to this study. If you agree to participate, you can choose to stop at any time or to skip any topics you do not want to answer. Your participation is entirely voluntary.

Do you have any questions about the study or what I have said?
If, in the future, you have any questions or concerns regarding the study and the interview, or if you wish to add additional details, we welcome you to contact Chair of Includovate's internal ethical review board: sujata@includovate.com. We will leave one copy of this form with you, so that you will have a record of this contact information and about the study.

Do you agree to participate in this study?
[If YES, indicate below that the oral informed consent has been obtained. Then proceed with the question below regarding audio recording. If they refuse, thank them for their time and cancel the interview.]

□ Oral informed consent received

Do you agree for your responses to be recorded?
[If YES, indicate below. If participant responds "NO", proceed with the interview without recording.]

□ Consent to manual record of interview responses received

Signature of interviewer: _____ Date: _____/_____/_____

Location of respondent:_____

Mode of interview: (e.g., face to face, telephone, zoom) _____

Background information:
WorldFish's mission is to reduce poverty and hunger by improving fisheries and aquaculture. Gender equality is integral to World Fish achieving its goals and advancing #Agenda2030. World Fish has a responsibility to its partners to capture and communicate the impact of its work on men and women, girls and boys and communities at large. Moreover, gender equality contributes to inclusive growth and sustainable development (Madgavkar 2020). The study of, and advocacy for, women's empowerment is necessary because the causes and consequences of low levels of empowerment can be found to limit women's opportunities (Malhotra and Schuler, 2005) and many policies and programs aim to increase empowerment (Alsop and Heinsohn, 2005) but evidence of their success is lacking (Springer and Drucza 2019). From a research for development perspective, this research facilitates greater awareness of

what women's empowerment is and is not in a given context, and importantly sets a new standard regarding the quality through which researchers can 'claim women's empowerment.' WorldFish is dedicated to ensuring the alleviating of women as an excluded group in the SSF industry to be improved and made equal.

Deepening Phase Tool 3: Historical Timeline and Social Norms Change

Activity 1: Historical Timeline

Activity 2: Mapping of Changes in Gender Norms

This tool has two activities. The historical timeline and mapping of changes in gender norms should provide valuable contextual information on the major events the community has collectively experienced, and how these events are implicated in the current SSF practices of men and women in the community. The findings from this tool can inform questions in IDIs that can probe around specific events/changes that have occurred that are of particular relevance to the current system and anticipated changes in the future.

HISTORICAL TIMELINE AND MAPPING OF CHANGES IN GENDER NORMS	
Purpose	To document changes in gender norms in a given time frame based on past, present, and anticipated future changes, and document people's experiences and pathways of change within the value chain. Research question(s) addressed: RQ1, RQ2
Respondents	The target population are women and men working in the fish sector as catchers, collectors, retailers, and processors.
Sampling	Rural: 2 FGDs groups, 1 all-women group and 1 all-men group. Recommended sample size: Approximately 10-15 individuals per group.[11]
Type of Data and Info	Qualitative data: visual map of community-produced timeline that illustrates key events and gender changes across time that have influenced/are influencing people's notions, experiences, and pathways of gender norm change.
Strengths of The Tool	Provides a community-driven baseline of their conceptualization of key events and gender changes over time to further contextualize the emergence of different notions of empowerment
Weaknesses of The Tool	Literacy and confidence in presenting ideas visually may limit the ability for the group to fully engage in the mapping the timeline.

Table 23 Summary of the FGD Activity 2

A. Circumstances

This workshop should have one interviewer and one notetaker. Materials such as a flipchart, markers, pens, sticky notes are needed for the activities and the materials needed for data collection include an audio recorder, notebook/pen, or device for manual notes. If there is a community leader in the group, invite them to have a semi-structured interview instead (so they do not hijack the group discussion).

[11] Sampling for FGDs should be based on approximate stratification of the community by geographic location, relative wealth and positioning within the community and cross-checking with local experts (Cavestro 2003). For example, consulting with local experts to identify salient wealth categories at community level (e.g., using roofing materials as proxies for wealth categories, such as iron, wooden, and bamboo/grass to indicate rich, average, and poor households) can also produce meaningful representation. As opposed to seeking maximum representation, the FGD approach tends to emphasize the importance of "identifying poor, marginalized and vulnerable people and giving them a voice" (Leurs 1996: 66). A sample size of approximately 10-15 individuals per group is the original suggested size (Chambers, 1994), but this should be viewed as flexible depending on the budget and time constraints of the study. A sample size of 10-15 participants is larger than the average sampling parameters of a focus group, but not too large to ensure that each member is able to have their ideas seen and heard within the confines of the workshop. The recommended 2 FGDs groups of women and men for each activity should be viewed as the minimum number - additional FGD groups should be considered if saturation/information power has not been obtained.

B. Facilitating and Conducting

Introduce the purpose of the study at the beginning of the FGD and obtain informed consent (both consents to being interviewed and consent to being audio-recorded). After obtaining informed consent the following table should be filled out by the notetaker:

Venue:	
Group:	
Date and Session:	
Note Taker:	
Facilitator:	

FGD Members	Number of Participants
Men	
Women	
Youth	
Elderly	
Disabled	

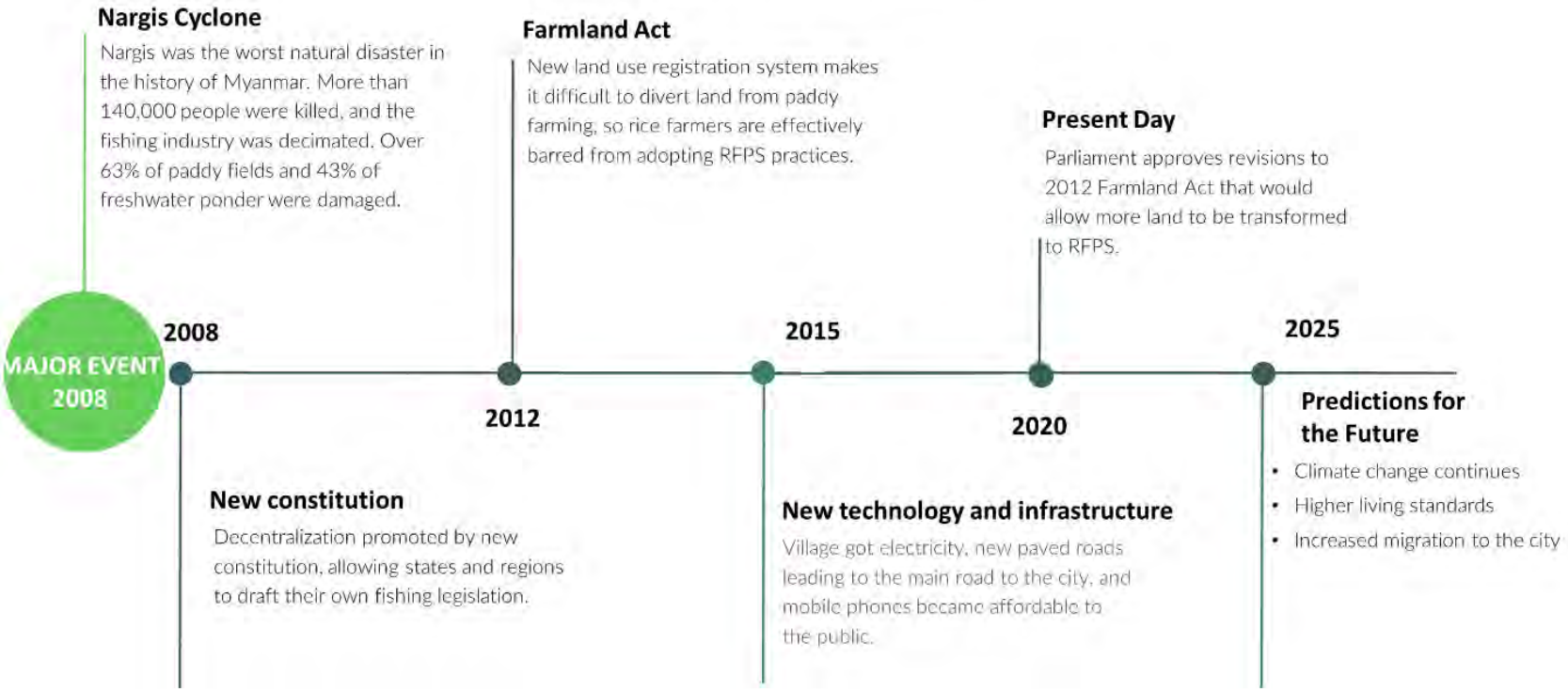
Activity 1 Historical Timeline

Step 1: Identify a member of the FGD as the first 'artist' and ask them to draw a timeline that begins at the present moment and extends into the past and future. While ideally, a group will have multiple artists to add to the timeline, depending on the comfortability of the group with sharing their thoughts visually, the facilitator may need to take on this role.

Step 2: Ask the group what the key events have been since the beginning of the timeline. Individual responses will vary per group but try to include all key events mentioned. If there is a singular event in time that can be identified as a "major event" label it on the timeline and start mapping other events from that point in time. An example of a completed historical timeline from a rural fishing community in Myanmar is listed below, with the major event of the Nargis Cyclone as the starting point.

Historical Timeline

Example from Myanmar Pilot



Step 3: As the group is populating the timeline, ask questions around these key events and moments in time, being sure to capture information on how men and women were involved and effected at the time. These questions include:

1. Specifically probe for how 'power over' attributes were implicated in each of the key events. These include control over assets; control over land/fisheries; and control over other's lives (e.g., power relations between the government and fishers, power relations between fishers and inland fisheries managers/owners).
2. What have been the positive impacts of these events? Have the impacts been different for women and for men? If so, how? If not, why not?
3. What have been the negative impacts of these events? Have the impacts been different for women and for men? If so, how? If not, why not?
4. Who in the community has been the most negatively impacted by this event? Why?
5. Who in the community has most benefitted from these events? Why?
6. Given everything that has happened up until now, what are your predictions for the future of this community?

Tip 1: Before closing Activity 1, ask the participants if there are any other events they would like to add to the timeline or any additional information they would like to provide on an event that is already on the timeline.

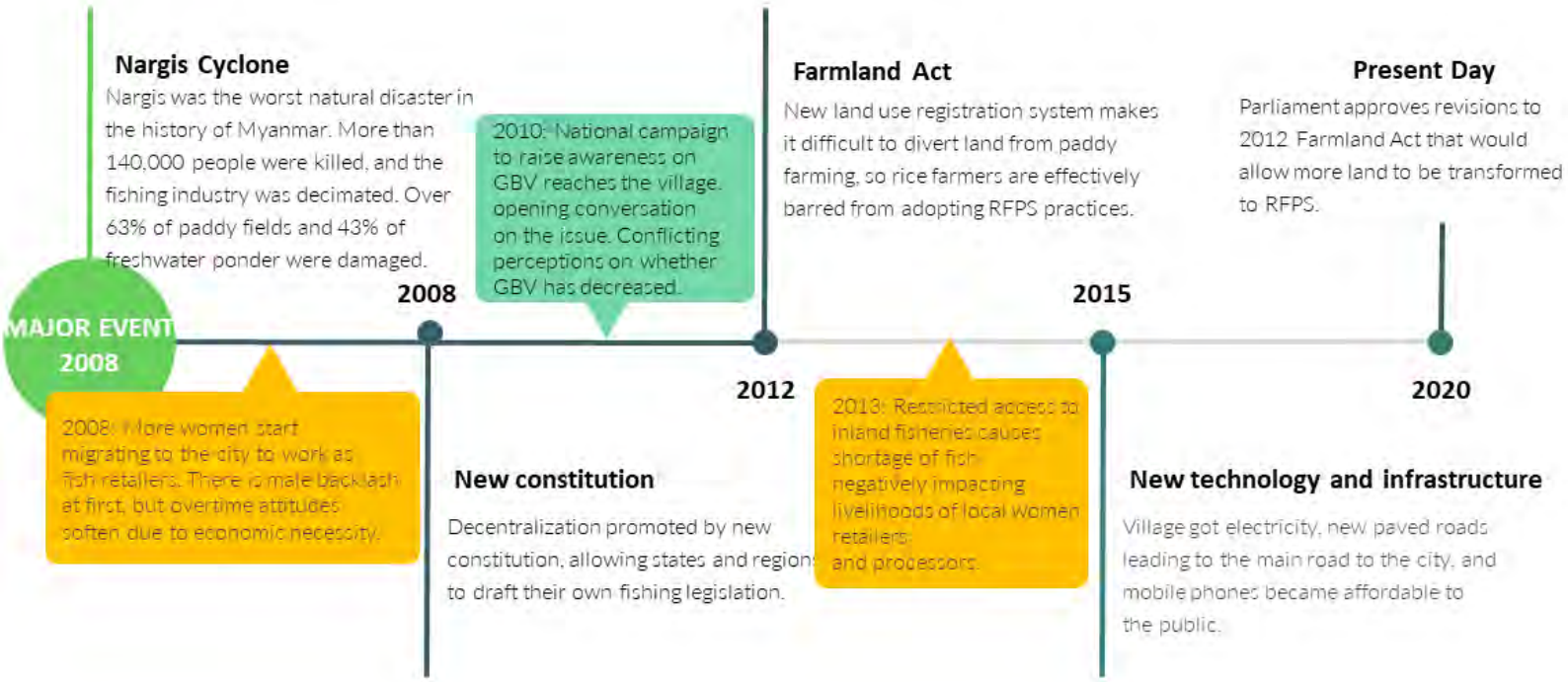
Tip 2: If doing Activity 2 immediately after Activity 1, it is advisable to have a refreshment break. Provide drinks and snacks to participants and let them make some calls and use the bathroom before continuing. Be sure to set a time limit to ensure participants stay focused and committed to returning to the activity.

Activity 2 Changes in Gender Norms

Step 1: When the group has re-convened after the refreshment break, introduce the purpose of the second activity: Now that the group has mapped out the key historical events and their impacts on women and men, the facilitator can probe deeper into how gender norms have changed over the historical timelines, and to discuss issues directly related to people's experiences and pathways of change within the SSF system over that time, plus get their perspectives on anticipated future changes. This activity will require sticky notes and pens/markers to write down the specific changes in gender norms and apply them to the historical timeline. An example of a completed historical timeline with changes in gender norms mapped onto it is listed below.

Mapping changes in gender norms

Example from Myanmar Pilot



Step 2: Begin by asking how women's and men's roles in the community have changed since the "Major Event" identified in Activity 1. Use the following questions to guide the activity:

1. Have women entered new professions/started engaging in new livelihood activities since the major event? What about in the time before the major event? Have men experienced the same changes or different changes? Please, describe these changes.
2. Have the day-to-day activities of women and men changed since the major event? In what ways? Have these changes had a positive or negative impact on the community? Why?
3. Are the expectations of what women and men are 'supposed to do' the same now as they were at the time of the major event? What about in comparison to the time before?
4. Can you tell me about women leaders in your community (probe: could be from the past or present)? What were the types of changes they helped start? What changed? What enabled the change to happen? What have been the implications of the change(s)?
5. What have been some of the challenges that women and men have faced in relation to their roles in the SSF system over the timeline? Do you think these challenges will be the same in the future?
6. Have issues like gender-based violence and women's mobility changed since the "Major Event"?

Tip 1: If additional probing is needed to kickstart the conversation on identifying key changes in gender norms, ask, what have been the changes and trends in the environment, economy, and/or technologies and ask how different types of women and men have been affected by these changes?

Tip 2: In addition to capturing the gender norm changes on the timeline, make sure the notetaker is taking detailed notes of the discussion. If consent for audio recording was obtained at the beginning of the workshop, ensure the facilitator and notetaker listen to the recording in transcribing and/or summarizing the data.

C. Adaptations

This tool can be adapted to the local context as necessary. For example, if group participants do not feel comfortable adding to the timeline themselves, the facilitator can take over this role. It is recommended that the facilitator familiarize themselves as best as possible with the history of the community through existing literature, so they can probe for additional key events in case they are not brought up (for example, potentially controversial issues related to government regime changes).

Further adaptations can be made to the sampling frame, which can be adapted to urban populations if the case study is specifically focusing on nodes of the VC that are non-rural. The recommendation is to hold 2 FGDs groups, 1 all-women and 1 all-men. This may require additional coordination through local partners to organize participants, so be sure to plan far enough in advance to ensure this is possible (e.g., 2-3 weeks in advance).

G. Tips and Tricks for Using the Tool

Existing power dynamics within communities can be reinforced in these activities if there is no direct intervention from the facilitator. Power dynamics within the FGD may mean some participants do not feel comfortable speaking out and/or voicing perspectives that are different from the more outspoken/dominant/relatively more powerful members of the group. The facilitator should be cognizant of these dynamics throughout the activity, and try to elicit participation from as many people as possible. As opposed to calling on specific individuals within the group, try asking questions aimed at the different intersectional groups, e.g., "*What do the younger members of the group think? Have you*

had experiences with these changes or not? Have you experienced different changes? If so, can you please share with us?"

D. Analysing the Data

The following questions should guide the analysis:

- How were women and men involved in the key events and gender changes that have taken place?
- What were the gendered implications of these changes?
- Open-ended organizational and substantive coding is recommended.[12] This is a deductive coding structure, where the researcher identifies recurring themes and concepts that become categories through the coding process (known as organization coding). Subthemes are then created to identify the relevant key concepts and issues identified by the participants (known as substantive coding). All codes should be revisited to identify significant data that addresses the case study's research questions.

E. Interpreting the data

In interpreting and presenting the results of the activity, the researcher should prioritize representing the trends and variations found. In addition to the researcher's own analysis, the expectation is to also draw upon direct quotations were possible to express the emergent findings and to give greater voice to research participants themselves in representing the issues.

The goal of these activities is to produce a community timeline of historical key events and the accompanying gender changes that have occurred, and how these changes are implicated in the current SSF system and how they could be implicated in transitions to other types of systems (e.g., from open-access fishing to aquaculture).

F. Informed consent statement

ORAL INFORMED CONSENT

Historical Timeline Workshop

Exploring Women's Empowerment in Small-Scale Fisheries

Client: WorldFish
Research firm: Includovate
Lead researcher: Dr. Kristie Drucza kristie@includovate.com

Thank you for the opportunity to speak with you. My name is …… I am from a research incubator called Includovate which is a social enterprise that innovates for inclusion. WorldFish has contracted Includovate to conduct a collaborative study on women's empowerment in small-scale fisheries (SSF). We would like to interview you about your experiences within the industry.

In order to maintain safety during COVID-19, we kindly ask that you maintain social distancing measures of staying apart at least 1.5m and wearing a face mask. However, your views and opinions are still very

[12] See Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications for additional guidance on coding options.

important for us, hence we are still conducting this walk. We hope that things will go back to normal very soon and appreciate you agreeing to social distancing and a face covering.

We received your contact details through WorldFish who commissioned this methodology because momentum around sustainable aquatic development pathways is growing and because WorldFish does not want to exclude women participants. They may have received your details from their own contacts and networks. You have been chosen to be interviewed because you are a woman or man working in the fish sector as catchers, collectors, retailers, and processors. You will be asked questions about changes in gender norms in a given time frame which will allow us to document this data and better analyse our research topics.

We ask for your support by answering questions as honestly and fully as possible – there are no right or wrong answers. We just want to know your actual experiences, opinions, and the challenges you face in order to understand how to improve the program. Your answers will be completely confidential. During the interview, we will be taking notes, and with your permission, we would like to audio record the discussion. These materials will be kept completely confidential and any personal identifying information will not be used in any reports, publications, or presentations resultant from this research.

Other participants in this group discussion will hear your answers. Therefore, it is also your responsibility to maintain the confidentiality of fellow participants. Please do not share the discussion content with anyone beyond those who are present for the group discussion.

Although you may not directly benefit from taking part in this study, the information you provide may lead to improved disability programming. This group discussion will take approximately 1-2 hours and you will not be compensated for your time. There is no anticipated discomfort for those contributing to this study, so risk to participants is minimal. If you agree to participate, you can choose to stop at any time or to skip any topics you do not want to answer. Your participation is entirely voluntary.

Do you have any questions about the study or what I have said?
If, in the future, you have any questions or concerns regarding the study and the interview, or if you wish to add additional details, we welcome you to contact Dr Sujata Ganguly who acts as Chair of Includovate's internal ethical review board is sujata@includovate.com. We will leave one copy of this form with you, so that you will have a record of this contact information and about the study.

Do you agree to participate in this study?
[If YES, indicate below that the oral informed consent has been obtained. Then proceed with the question below regarding audio recording. If they refuse, thank them for their time and cancel the interview.]

□ Oral informed consent received

Do you agree to be audio recorded?
[If YES, indicate below. If participant responds "NO", proceed with the interview without recording.]

□ Consent to audio record interview received

Signature of interviewer: _____ Date: _____/_____/_____

Location of respondent:_____

Mode of interview: (e.g., face to face, telephone, zoom) _____

Background information:

WorldFish's mission is to reduce poverty and hunger by improving fisheries and aquaculture. Gender equality is integral to World Fish achieving its goals and advancing #Agenda2030. World Fish has a responsibility to its partners to capture and communicate the impact of its work on men and women, girls and boys and communities at large. Moreover, gender equality contributes to inclusive growth and sustainable development (Madgavkar 2020). The study of, and advocacy for, women's empowerment is necessary because the causes and consequences of low levels of empowerment can be found to limit women's opportunities (Malhotra and Schuler, 2005) and many policies and programs aim to increase empowerment (Alsop and Heinsohn, 2005) but evidence of their success is lacking (Springer and Drucza 2019). From a research for development perspective, this research facilitates greater awareness of what women's empowerment is and is not in a given context, and importantly sets a new standard regarding the quality through which researchers can 'claim women's empowerment.' WorldFish is dedicated to ensuring the alleviating of women as an excluded group in the SSF industry to be improved and made equal.

Deepening Phase Tool 4: Aspirations

This focus group discussion is all about understanding the aspirations and dreams of respondents. Knowing this will help ask respondents what they might need to do to achieve their dreams, and if anyone stands in their way. As such it documents women's strategic freedoms and potential pathways towards these.

ACTIVITY 3: ASPIRATIONS EXERCISE	
Purpose	To document the trajectories and pathways of women's empowerment in the community by eliciting their personal visions for the future and how they conceptualise their strategic freedoms. It also addresses the multi-level and multi-relational aspects of aspirations by discussing how people's visions are situated within societal structures, interpersonal relationships, and norms. Research question(s) addressed: RQ1, RQ2
Respondents	Women and men working in the fish sector as catchers, collectors, retailers, and processors.
Sampling	6 FGDs, two all-women and two all men group and two mixed sex groups. Recommended sample size: Approximately 10-15 individuals per group.
Type of Data and Info	Qualitative data: explores how men and women see themselves in their current life/social positionings and identifies possible trajectories and pathways to empowerment.
Strengths of The Tool	Provides multi-level and multi-relational information on how women and men envision empowerment as both an 'end goal' and pathway.
Weaknesses of The Tool	Eliciting pathways to empowerment specifically within the SSF can be complicated if participants' aspirations, dreams and goals for themselves and the future are to leave the SSF sector.

Table 24 Summary of the Aspirations Activity

A. Circumstances

This should have one interviewer and one notetaker. Materials such as a flipchart, markers, pens, sticky notes are needed for the exercise and the materials needed for data collection include an audio recorder, notebook/pen, or device for manual notes.

B. Facilitating and Conducting the tool

Introduce the purpose of the study at the beginning of the FGD and obtain informed consent (both consent to being interviewed and consent to being audio-recorded). After obtaining informed consent the following table should be filled out by the notetaker:

Venue:	
Group:	
Date and Session:	
Note Taker:	
Facilitator:	

FGD Members	Number of Participants
Men	
Women	

Youth	
Elderly	
Disabled	

Today we will discuss qualities that help you overcome challenges and that you admire, your dreams for the future, and for that of your children.

1. Tell me a story about a time when you faced adversity in your life and overcame it?
    a. What happened, who was involved and who/what helped you to overcome the challenging time/situation?

Tip: Sometimes people are initially reluctant to speak and express their opinions. You may want to call upon someone to start. You may want to share a story from your own life as a way to encourage people to share.

2. With this next activity I would like to go around the room and hear from everyone and then write their answers on a flip chart. Can you tell me what you hope your son will be like (achieve) in adulthood?
    a. Ask if anyone else has the same ambition for their son, and hopefully a discussion and some laughter between respondents around hopes for their son will ensue.
3. Then ask the same questions for their daughters - Can you tell me what you hope your daughter will be like (achieve) in adulthood?
    a. Ask if anyone else has the same ambition for their daughter, and hopefully a discussion and some laughter between respondents around hopes for their daughters will ensue.
4. Comment on whether participants are more excited to think about their son's future or their daughter's future – and ask if your observation is correct and why that is the case (probe: do men have more opportunities than women, does a daughter or son (or in law) look after you more)?
5. If no one mentions their current profession in fish, then ask if they would like their son or daughter to follow in their footsteps in the fish industry.
    a. If a different activity, why? What would their child achieve by pursuing such an activity?
    b. What would they need to achieve this profession in the future? How would they be able to accomplish this?
    c. If the same fish activity, why? And what would you advise them about working in fish?
6. I would like to go around the room and make a list of everyone's visions for the future? (prompt: where would you like to be financially, socially, in your career, in your family in 10 years' time) *Write the responses on a flip chart and discuss each one and make sure what everyone means is clear.*
7. Then ask who wrote this one (if you don't remember)? (read it out for anyone who is illiterate) And ask them what change would need to happen for this to be achieved/ would contribute most to making that change happen?
8. Then ask about who are the change agents that can help make it happen (see table below).

Tip: If there is time, then add a column to the below table and ask what might prevent this vision/dream/change from occurring.

10 year future state/vision	What change needs to happen	Change agent

	to realise this vision	
I want to earn more money and feel financially safe. I would like to have a job in an office and not sell fish anymore.	Get a college degree	Self – has to study hard
My children will go to university.	Save money for tuition	Husband, self and children
I will get a market stall in a big market and sell twice as many fish and make twice as much money.	Save money. Find the price of stall, take loan	Self & micro finance company

9. Imagine your daughter/son is all grown up. Is there a woman/man in your community that you hope your daughter becomes like?
    a. Who is it (Is it yourself?)
    b. What qualities does this woman/man have that you would like to see in your daughter/son?
10. Imagine a rich philanthropist (you can also use the name of a famous person that most people know like a singer, film star or sportsperson) visited your village/town and said they would give $100 to the household that was the most gender equal when then returned in 4 weeks. What would your household do to win that money?
11. Imagine a rich philanthropist visited your village/town and said they would give $1000 to the household that was the most gender equal when then returned in 4 weeks. What would your household do to win that money?
12. Do you want your household to be more gender equal even if there wasn't a rich philanthropist offering you money? Why/why not?

C. Adaptations

A number of tips are present throughout the tool which can be considered adaptations. The facilitator will need to read the room to see how fatigued people are, and the rapport and energy of the participants. Ideally all questions will be covered. But these additions can be skipped if time and energy will not permit them. We do not want our participants to feel tired or drained after such a workshop.

Tip: It can be emotional for some people to talk about their future or their children, or when/how they overcame diversity. If people cry during the FGD or show strong emotions that represent dis-ease, please pause the focus group and focus on the participant's feelings. Let them know they do not have to continue the FGD, or that story if it is upsetting.

D. Tips and Tricks for Using the Tool

During the pilot study a clear external locus of control was found. There were strong cultural beliefs raised about success/personality:

- Wealth is associated with past lives/religion
- Empowered women are "just born that way" (in-born drive)
- Past lives/fate are associated with their future and aspirations.
- Their children's personality and success were already determined.

In terms of gender norms, it was heard that you cannot have two people in a relationship be 'powerful' (e.g., 'power couples' do not exist). Thus, one must always be above. These observations were more challenging to interpret during the scoping phase. However, during the deepening phase these nuances became more obvious.

However, reconciling how aspirations change over time when everything is pre-determined and why education for their children could actually change fate, along with social relations was challenging to explore/comprehend and required non-judgemental facilitation.

E. Analysing the data

The following questions should guide the analysis:

- What do women's and men's aspirations for themselves and their children indicate about pathways to empowerment over time?
- What qualities related to empowerment do role models in the community possess?
- How are men's and women's aspirations connected to fish as a livelihood?

F. Interpreting the data

In interpreting and presenting the results of the FGD, the researcher should prioritize representing the trends and variations found. In addition to the researcher's own analysis, the expectation is to also draw upon direct quotations were possible to express the emergent findings and to give greater voice to research participants themselves in representing the issues.

G. Informed consent statement

ORAL INFORMED CONSENT
Aspirations Exercise

Exploring Women's Empowerment in Small-Scale Fisheries

Client: WorldFish
Research firm: Includovate
Lead researcher: Dr. Kristie Drucza kristie@includovate.com

Thank you for the opportunity to speak with you. My name is …… I am from a research incubator called Includovate which is a social enterprise that innovates for inclusion. WorldFish has contracted Includovate to conduct a collaborative study on women's empowerment in small-scale fisheries (SSF).

Ideally, we wanted to meet you and ask these questions face to face. But we cannot visit you because of COVID-19. However, your views and opinions are still very important for us, hence we are asking you these questions over the phone. We hope that things will go back to normal very soon, and that one day we will get to meet you in person.

We received your contact details through WorldFish who commissioned this methodology because momentum around sustainable aquatic development pathways is growing and because WorldFish does not want to exclude women participants. They may have received your details from their own contacts and

networks. You have been chosen to be interviewed because you are a woman or man working in the fish sector as catchers, collectors, retailers, and processors. We will ask you questions related to your aspirations, dreams and personal vision of your future.

We ask for your support by answering questions as honestly and fully as possible – there are no right or wrong answers. We just want to know your actual experiences, opinions, and the challenges you face in order to understand how to improve the program. Your answers will be completely confidential. During the interview, we will be taking notes, and with your permission, we would like to audio record the discussion. These materials will be kept completely confidential and any personal identifying information will not be used in any reports, publications, or presentations resultant from this research. Demographic questions and the responses to any gendered questions will only be used for disaggregation and cannot be tracked back to the respondent.

Although you may not directly benefit from taking part in this study, the information you provide may lead to improved understanding of the SSF industry and any gendered issues, norms and challenges faced specifically by women participants. The interview will take approximately 1 hour, and you will not be compensated for your time. There is no anticipated discomfort for those contributing to this study. If you agree to participate, you can choose to stop at any time or to skip any topics you do not want to answer. Your participation is entirely voluntary.

Do you have any questions about the study or what I have said?
If, in the future, you have any questions or concerns regarding the study and the interview, or if you wish to add additional details, we welcome you to contact Dr Sujata Ganguly who acts as Chair of Includovate's internal ethical review board is sujata@includovate.com. We will leave one copy of this form with you, so that you will have a record of this contact information and about the study.

Do you agree to participate in this study?
[If YES, indicate below that the oral informed consent has been obtained. Then proceed with the question below regarding audio recording. If they refuse, thank them for their time and cancel the interview.]

□ Oral informed consent received

Do you agree to be audio recorded?
[If YES, indicate below. If participant responds "NO", proceed with the interview without recording.]

□ Consent to audio record interview received

Signature of interviewer: _____ Date: _____/_____/_____

Location of respondent:_____

Mode of interview: (e.g., face to face, telephone, zoom) _____
Background information:

WorldFish's mission is to reduce poverty and hunger by improving fisheries and aquaculture. Gender equality is integral to World Fish achieving its goals and advancing #Agenda2030. World Fish has a responsibility to its partners to capture and communicate the impact of its work on men and women, girls and boys and communities at large. Moreover, gender equality contributes to inclusive growth and

sustainable development (Madgavkar 2020). The study of, and advocacy for, women's empowerment is necessary because the causes and consequences of low levels of empowerment can be found to limit women's opportunities (Malhotra and Schuler, 2005) and many policies and programs aim to increase empowerment (Alsop and Heinsohn, 2005) but evidence of their success is lacking (Springer and Drucza 2019). From a research for development perspective, this research facilitates greater awareness of what women's empowerment is and is not in a given context, and importantly sets a new standard regarding the quality through which researchers can 'claim women's empowerment.' WorldFish is dedicated to ensuring the alleviating of women as an excluded group in the SSF industry to be improved and made equal.

Deepening Phase Tool 5: In Depth Interviews (IDI)

This in-depth interview is part life history and needs to be understood as probing 'pathways', which means being more explicit about what contributed to empowerment or disempowerment. In each of the questions, the researcher(s) should probe for who and what enabled or constrained women's (and men's) power and freedoms to make important life decisions. This might include people/relations, experiences, networks, policies, programs, crises, and self-belief/agency.

IN-DEPTH INTERVIEWS (IDIs)	
Purpose	The questions in the IDI tool focus on understanding the different pathways women take towards empowerment and who and what helps them along their journey. This tool will inform endogenous understandings of women's empowerment and changes over time. Research question(s) addressed: RQ1; RQ2
Respondents	It is recommended that 6 life histories are recorded with 3 younger women (25-35) and 3 older women (35-65) at different nodes of the value chain in a rural area, and another 6 should be completed in an urban area.
Sampling	Non-Probability Sampling – Purposive Sampling done in consultation with context-appropriate local partners/organisations/experts to select respondents from the intersectional groups prioritized for the individual study. To fully capture the spectrum of life histories, it is important to capture IDIs from relatively younger and relatively older generations of women. Sampling size will be largely determined by the saturation point required to collect the information needed for the study.
Type of Data and Info	Qualitative data: Rich narratives on women of different generations' pathways/journeys to empowerment.
Strengths of The Tool	Allows in-depth probing of women's and men's pathways to empowerment and identifies possible factors towards empowerment.
Weaknesses of The Tool	Can be difficult to isolate individuals for interview, due to domestic, productive or community responsibilities that constrain time and availability for interview.

A. Circumstances of Interview

The IDIs should have one interviewer and one notetaker. Materials such as an audio recorder, notebook, and a pen as well must be provided for the exercise.

The questions focus on understanding the different pathways women take towards empowerment and who and what helps them along their journey. We also want to understand changes in empowerment over time. This tool needs to be understood mainly as probing 'pathways', which means being more explicit about what contributed to empowerment or disempowerment? In each of these, probe for who and what enabled or constrained women's (and men's) power and freedoms to make important life decisions. This might include people/relations, experiences, networks, policies, programs, crises, self-belief/agency., etc. As such, you will need to probe to see if it was:

- Due to internal (to the respondent) drivers (agency), versus/combined with external (to the respondent) drivers, including (existing or changes in) relations or structures (attitudes, norms; policies).
- Probe to see what the mechanisms were that caused the changes above (including if it was a program, an experience such as becoming a 'head of household' due to migration, evolution of community norms, or other)
- And try to identify in the above specifics of how this interacted with access to and control over resources, including information, technologies, finance, with care and time burdens, or other factors

B. Facilitating and Conducting the tool

Start with introductions, purpose, and permissions (as per ethics protocols) including that all will be made anonymous. Clarify that the questions you will ask are about the respondent (not their family), that there are no 'right or wrong' answers etc.

C. Facilitating and conducting the IDIs:

	Building block/theme	Question/Tool
1	**Overall story**: Who is the respondent and how did they come to be in the place, work, and situation? What is their self-perception/ identity? Do they have an internal/external locus of control?	1. Please tell me the story of your life (…'who are you', what is your family background, and how did you come to be living here and working in this sector/ livelihood?) (Prompt if she does not cover her age, number of children and marital status) *Probe*: How would you describe your wealth status? How would you describe your health and nutrition status? And family situation/marital status (so we can interpret all below) 2. I am going to ask you two questions and I would like to know which one you most agree with and why: a. "Each person is primarily responsible for his/her success or failure in life." b. "One's success or failure in life is a matter of his/her destiny/luck." 3. Who do you admire or look up to because you consider them a role model? *Probe*: Are there exemplary people who inspire your daily conduct? e.g., religious and community leaders, relatives, in-laws, neighbours, model farmers, etc. What attributes does this person have that you would like to emulate? Why would you like these attributes? 4. Does anyone admire you or consider you a role model? *Probe*: Who/why?
2	**What are your important life changes /desires and who has power over them?** Power to	5. What has been the most significant change in your life? Probe to understand enablers/ constraints, who was involved? How did you cope during this period of change? (Who or what supported you?) 6. What important things in your *life* would you like to see change? (e.g., quality of relationships, control over resources, workload, or labour situation, solve personal problems, get more education and/or training, make home improvements, etc.) *Probe*: Who would have the power to make that change happen? Who would prevent that from happening? 7. What are the main difficulties that you feel might prevent these changes from occurring? (it could be a lack of funds, social support, feeling too old or to have low status, etc.) *Probe*: How much of making that change is within your control? (You? Others? Why/not?)

3	**Concerns and ability to address them** Power to, power within	8. What do you worry most about? (what keeps you awake at night/are the main stresses in your life) 9. How much can you do to address these worries/stresses versus how much are they out of your control? *Probe*: Under whose control? How much can others influence what you do? *Probe*: If they have control to change things ask, why don't they take steps to change this?
4	**Life aspirations** and what needed to get there?	10. What outcomes would you like to see for yourself in 5 years? a) Is this achievable? b) Why/why not? *Probe* to understand enablers/constraints 11. What future would you like your children to have? [Life and work] a) Is this achievable? b) Why/why not? 12. What advice would you give to your children so they can have a better life than you? 13. What advice would you give your younger self to make your life better at your age? *Probe*: Is this advice realistic/achievable?
5	**Abilities in things that matter** Power within self	14. In your work, what are things that you are good at? What enabled you to become good at these things? *Probe*: how did you acquire these skills? Through someone, extension, formal education, watching/mimicking others? 15. In your work, what things (that matter to you) that you are not good at but wish you were? What has stopped you from becoming good at them? *Probe*: relations, ideas, self-belief 16. In your work, what don't you know how to do but wish you did because then you would feel more content/competent or become more successful? *Probe:* What would be needed in order for this to happen – within your control? That is controlled by others (people, programs, policies, other)?
6	**Solving problems** related to livelihoods (power to)	17. What are the main challenges you have faced in your work as a [e.g., fish retailer]? E.g., transport, etc 18. To what extent have you been able to solve these challenges? How? (Which yes, which no –why?) 19. How confident are you in yourself that you will be able to solve challenges that will arise in the future in your work? Why/why not? Tell me about a time in your life when you did not have enough time in the day to fulfil your daily duties? (Prompts: what was going on in your life at the time? How long did this period of time last? What brought an end to this business? Did you ask for help? From whom?)
7.	**Relationships** Power with (relations)	20. Which relationships have been most important in contributing to your ability to live the life you want/make the choices you want? *Probe*: it could be your spouse, parents, friends, children, women's group/association, etc 21. Do you feel able to live up to their expectations? Why/why not *[Note shift here to work from life]* 22. Which relationships enable you to be successful in your work? Why? Which are most constraining?

		23. What do other family members think about your fish work? (e.g. spouse (if married), children and/or other powerful family members) *Probe*: How do you know this (how does it play out?) How do those perceptions affect you and your ability to make choices about your work [or succeed in your work?] 24. To what extent are you connected with customers, buyers, sellers, or decision makers that shape how successful you are/aren't in your work? 25. To what extent are you connected to/socialize with other women or men in similar work as you (e.g., through formal or informal groups?) In what ways do you help each other versus compete? 26. Is it harder for women to make decisions and act on them at different points in their lives (e.g., before they are married, as elders in the community, when married)?
8	**Ability and desire to succeed in livelihood(s)**	27. On a scale of 1- 5 how good are you at market negotiation. Prompt: bargaining and getting a good price for your produce? *Probe*: What are some of the negotiation strategies you use? Where did you learn these? 28. What motivated you to be in your current work(s) ("how did you end up in this job"?) *Probe*: To what extent did you have other options? Why/why not? 29. To what extent, if any, have you been able to improve your success in/benefits from this work (e.g., new products, increasing sales, income) *Probe*: If so how and why? If not, why not? What is within their power versus outside factors 30. How do you see yourself progressing in your current job? 'Moving up' by expanding your current activities or moving to a different job in the fish sector, or 'moving out' of the fish sector? *Probe*: Why? What is needed to make this happen? Is this in your control? Who/what controls that? 31. What advice would you give your children if they enter the same livelihood as you?
9	Wrap up, final questions	*If by the end of the interview, none of these topics have been discussed (domestic work; stress; extension/training/agriculture knowledge; access/control over finances, owning/controlling assets and resources) please ask the respondent: we haven't heard anything from you on _____ can you tell me a little bit about how this helps or hinders your progress.* 32. *Is there anything else you would like to say or ask?*

D. Adaptations

Adaptations to the instrument and adjustments will be informed and identified respectively in future iterations of the tool. Additional iterations and testing are needed to assess what questions can be skipped in future usage of the tool.

E. Tips and Tricks for Using the Tool

Note from the pilot: Capturing both rural and urban perspectives in this regard was done to take a 'systems approach' to the analysis, and the SSF value chain has clear and important linkages between the rural site (Maubin) and the urban site (Yangon). Thus, the sample strategy for the pilot chose a total of 6 women from the rural site and 6 women from the urban site.

- In Maubin (2 x fish vendors, 2 x fish paste producer, 2 x woman engaging in SSF business) AND
- In Yangon (2 x woman working as a fish 'scaler'/processor, 2 x individual fish vendor, 2 x woman manager of fish business)

Tip: While asking questions, please record the persons emotions when they answer or think about their answer. If the person requires clarification on the questions, but there is not a prompt/probe, tell them you will come back to the questions at the end. If they still do not understand the question, do not prompt, just skip the question and record that this happened.

F. Analysing the data

The following questions should guide the analysis:

- What are the different pathways people take towards empowerment and what helps them along their journey?
- Who and what enabled or constrained women and men's power and freedoms to make important life decisions?

The coding structure can be deductive based on the building block/themes described in the tool, with further inductive codes identified based on recurring themes in the emergent data.

G. Interpreting the data

In interpreting and presenting the results of the IDIs, the researcher(s) should prioritize representing the trends and variations found amongst the participants. In addition to the researcher's own analysis, the expectation is to also draw upon direct quotations were possible to express the emergent findings and to give greater voice to research participants themselves in representing the issues.

H. Informed consent statement

ORAL INFORMED CONSENT
In-Depth Interviews

Exploring Women's Empowerment in Small-Scale Fisheries

Client: WorldFish
Research firm: Includovate
Lead researcher: Dr. Kristie Drucza kristie@includovate.com

Thank you for the opportunity to speak with you. My name is …… I am from a research incubator called Includovate which is a social enterprise that innovates for inclusion. WorldFish has contracted Includovate to conduct a collaborative study on women's empowerment in small-scale fisheries (SSF). We would like to interview you about your experiences within the industry.

Ideally, we wanted to meet you and ask these questions face to face. But we cannot visit you because of COVID-19. However, your views and opinions are still very important for us, hence we are asking you these questions over the phone. We hope that things will go back to normal very soon, and that one day we will get to meet you in person.

We received your contact details through WorldFish who commissioned this methodology because momentum around sustainable aquatic development pathways is growing and because WorldFish does not want to exclude women participants. They may have received your details from their own contacts and networks. You have been randomly chosen to be interviewed because you are a woman between the age of 25-35 or a woman between the age of 35-65. We will ask you questions related to your life histories and what personal decisions you have made that have significantly changed your life direction or otherwise.

We ask for your support by answering questions as honestly and fully as possible – there are no right or wrong answers. We just want to know your actual experiences, opinions, and the challenges you face in order to understand how to improve the program. Your answers will be completely confidential. During the interview, we will be taking notes, and with your permission, we would like to audio record the discussion. These materials will be kept completely confidential and any personal identifying information will not be used in any reports, publications, or presentations resultant from this research.

Although you may not directly benefit from taking part in this study, the information you provide may lead to improved understanding of the SSF industry and any gendered issues, norms and challenges faced specifically by women participants. The interview will take approximately 1 hour, and you will not be compensated for your time. There is no anticipated discomfort for those contributing to this study. If you agree to participate, you can choose to stop at any time or to skip any topics you do not want to answer. Your participation is entirely voluntary.

Do you have any questions about the study or what I have said?
If, in the future, you have any questions or concerns regarding the study and the interview, or if you wish to add additional details, we welcome you to contact Dr Sujata Ganguly who acts as Chair of Includovate's internal ethical review board is sujata@includovate.com. We will leave one copy of this form with you, so that you will have a record of this contact information and about the study.

Do you agree to participate in this study?
[If YES, indicate below that the oral informed consent has been obtained. Then proceed with the question below regarding audio recording. If they refuse, thank them for their time and cancel the interview.]

□ Oral informed consent received

Do you agree to be audio recorded?
[If YES, indicate below. If participant responds "NO", proceed with the interview without recording.]

□ Consent to audio record interview received

Signature of interviewer: _____ Date: _____/_____/_____

Location of respondent:_____

Mode of interview: (e.g., face to face, telephone, zoom) _____

Background information:

WorldFish's mission is to reduce poverty and hunger by improving fisheries and aquaculture. Gender equality is integral to World Fish achieving its goals and advancing #Agenda2030. World Fish has a responsibility to its partners to capture and communicate the impact of its work on men and women, girls and boys and communities at large. Moreover, gender equality contributes to inclusive growth and sustainable development (Madgavkar 2020). The study of, and advocacy for, women's empowerment is necessary because the causes and consequences of low levels of empowerment can be found to limit women's opportunities (Malhotra and Schuler, 2005) and many policies and programs aim to increase empowerment (Alsop and Heinsohn, 2005) but evidence of their success is lacking (Springer and Drucza 2019). From a research for development perspective, this research facilitates greater awareness of what women's empowerment is and is not in a given context, and importantly sets a new standard regarding the quality through which researchers can 'claim women's empowerment.' WorldFish is dedicated to ensuring the alleviating of women as an excluded group in the SSF industry to be improved and made equal.

Deepening Phase Tool 6: Learning Journal Field Diary

See scoping phase tool 7

Deepening phase tool 7: Formal Survey

While the tool is partially inspired by the Women's Empowerment in Fisheries Index (WEFI), this survey is not meant to be a composite index. Although this survey covers different domains of empowerment (similar to the Women's Empowerment in Agriculture Index (WEAI), the questions are more related to strategic freedoms, are perceptions-based, and are tailored to the fish value chain (or in the case of the pilot study, the integrated Rice-Fish system). Compared to other indices for assessing women's empowerment in agriculture (WEAI) or fisheries (WEFI), the questionnaire for the formal survey provides significantly more detailed demographic information, including data related to migration, gendered composition of households, and specific social positioning in the small scale fisheries system that enables a truly innovative, intersectional gendered analysis of survey data.

FORMAL SURVEY	
Purpose	The purpose of the formal survey is to measure to what extent men and women from different intersectional groups in the small-scale fisheries system are currently empowered (e.g., "how much" empowerment for women and men based on the different domains of empowerment). Overall, the survey tool is meant to generate robust gender analysis that goes beyond women's economic empowerment to identify potential patterns and relationships between predictive variables for empowerment in SSF; to obtain numerical measures for attitudes towards gender, cultural and market norms; numerical measures of the perceived impacts of hypothetical changes to the SSF system. Research question(s) addressed: RQ1; RQ2; RQ3
Respondents	Women and men engaged in the SSF sector
Sampling	50% women/50% men, with 1/3 of the survey population representing de jure women-headed households. The total number of respondents will vary depending on the population size and the size of the SSF. *See tool for sample size specifications
Type of Data and Info	Quantitative data: Provides detailed numerical data across 5 domains of women's empowerment (power within, power with, power to, power through, and power over)
Strengths of The Tool	Allows in-depth analysis of women's and men's pathways to empowerment. Surveys provide detailed demographic information, including data related to migration, gendered composition of households and specific social positioning in SSF system that facilitates intersectional gendered analysis of survey data.
Weaknesses of The Tool	Intersectional analysis weakens statistical significance. Pilot data is needed to assess survey's potential weaknesses.

For a full list of comparisons between the WEFI and this formal survey questionnaire, see Table 1 below.

WEFI Survey Sections	WEFI Key Variables	This Survey Tool
Identification and Demographics	Key Variables: sex, age, education, total # of people in household (not gendered)	Provides significantly more detailed demographic information, including: • Migration variables (#years/months in current location; presence of spouse)

		• Gender of adult members of household • Land/landlessness • Rice production
Role in household decision-making around fish-related and other activities	Key variables: Participation (yes/no binary); input in decision-making (ordinal); input on decision-making related to income (ordinal)	Provides additional variables related to group participation, networks and equitable household decision-making and spousal relations (*Power With*) Provides additional variables related to skills and knowledge needed to succeed and for 'moving up'/expanding participation in fish sector, safety, conscientization (*Power To)*
Access to productive assets	Key variables: Decision-making and control over assets disaggregated by categorical intrahousehold selection [e.g., self; spouse; jointly; other HH member] Asset questions: Do you have asset; how acquired; how many your household has; who can decide to sell, give away or purchase	Provides variables related to access to and control over key assets (income, credit) and services (digital); (*Power Over*)
Access to fisheries extension services	Key variables: Met with agent in past year; # times met; gender of agent; training received (y/n); who provided	Do you have access to fisheries extension services? (*Power Over*)
Individual leadership and influence in the fishing camp	Key variables: Do you feel comfortable speaking in public to help decide on projects and issues affecting this [name of fishing camp] (e.g., canal clearing, fishing ban)? And to protest the use of *sefa-sefa* and other illegal fishing activities? (Likert scale)	No variables related to fishing camp leadership, but does provide questions related to more general norms around leadership (e.g., I believe that if I publicly criticized our community leaders then my spouse would be upset with me; I feel able to be a leader in my community; Women can be leaders as well as men. (Likert scale)
Gender attitudes	Key variables: 8 questions related to existing gender attitudes relevant within the fish value chain	Provides variables that capture locus of control and structural influences, including norms and rights (*Power Through*)
Time allocation	Key variables: 20 different activities tracked for time allocation; do you have enough time for leisure; who makes the decision on how your leisure time is spent	Does not collect data related to time allocation, but asks questions related to the 'meaning of time' (e.g., I feel like I have enough time to take care of myself; I feel like I get enough sleep) (*Power To*)

Table 25 Summary table of key differences between WEFI and this survey tool

A. Circumstances

Survey Target Population, Location, and Sampling Protocol
The methods package protocols regarding the appropriate selection of the target population, location and sample size are listed below.

Target population
The target population for this tool should be identical to the target population for the qualitative component of the methodology.

Location
Location selection will be contingent upon the gendered axes of intersectional disaggregation the project wants to focus on. These gendered axes of intersectional disaggregation shall be identified in Phase I and Phase II of the Methodology Package and substantiated during the cognitive interviewing tool to take place before the implementation of this survey tool. Selecting the specific geographical location for the survey will be contingent upon the specific goals of the study, whether the study is interested in one or more nodes of the supply/value chain and whether the desired gendered axes of intersectional disaggregation are available amongst the given population.

Sampling
Choosing the appropriate sampling for the survey should be decided upon 2 key factors:

(1) **Gender balance** – Respondent selection should be 50% women/50% men, with 1/3 of the survey population representing de jure women-headed households (you will need to distinguish between de-facto and de jure headed households) to allow for inter-household three-way comparisons between women and men in dual-headed households and women in women-headed households.
(2) **Balanced sample based on identified/desired intersectional categories:** Selecting an equal number of respondents based on the identified and prioritized intersectional category(ies) desired for the analyses. Recognizing that achieving statistical significance will be more difficult the more disaggregated/ "sliced" the dataset becomes, we recommend calculating sample size based on the number of desired intersectional categories for analysis. If a statistically significant sample is not possible from the given population, we recommend running descriptive statistical analyses or basic inferential statistics as opposed to multi-variate regressions to demonstrate patterns as opposed to significant relationships among variables.

B. Facilitating and Conducting the tool

Section 1: Identification

1. Household identification number (e.g., H001 numeric)
2. Name of respondent {fill in the blank}
3. Name of district/village {fill in the blank}
4. Contact details/ WhatsApp number/phone number? {fill in the blank}
5. Birthplace {fill in the blank}
6. No of years/month living in current location/village? {fill in the blank}

Section 2: Demographics for applied intersectional analysis

1. Age of the respondent (the year they were born in) {numeric-fill in the blank}
2. Which gender do you identify as? 1=male; 2=female; 99=Or please specify your gender {fill in the blank}
3. Mother tongue[13] of the respondent {fill in the blank}
4. What is the specific part of the small-scale fisheries sector you are working in? {1=Vendor; 2=Wholesaler; 3= Processor; 4=Fisher; 99=other {specify}
5. What activities are your involved in? {multiple choice: 1=fishing; 2=processing fish (drying/smoking); 3=fish marketing (selling/trading fish); 99=other {specify}
6. What is your highest level of education? {1=none; 2=basic; 3=secondary; 4=vocational; 99=other {specify} or Number of years of schooling {numeric-fill in the blank}
7. What is your marital status? {single choice: 1=single, 2=married, 3=de-facto/living with partner, 4=separated from spouse, 5=divorced, 6=widowed}
8. Presence of spouse in household (migration): *If answer 2 or 3* (to Q7): are both spouses living in the HH (vs one working away? 1= both in HH for most of the year; 2= husband away for >50% of the year; 3= wife away for > than 50% of the year; 99=other arrangement {specify}
9. Marriage type: *if answer 2*: 1= marriage of two people (e.g., wife and husband); 2= polygamous; 3= polyandrous; 99=-other arrangement {specify}
10. Size of household (# of adults and kids) {numeric-fill in the blank}
11. Gender of adult members of household (gender composition of household) {single choice: 1=male and female adults; 2=female adult(s) only; 3=male adult(s) only}
12. What is the construction material of your home's roof?[14] 1=Nipa Palm; 2=Zinc; 99=other specify_____}

Demographics related to rice-fish system:

Land/Landlessness[15]

13. Does someone in your household currently own land? {single choice: 1=yes, 2=no} If yes, what type of land? {fill in the blank}
14. Do you personally currently own land? {single choice: 1=yes, 2=no}
15. Do you personally aspire to own land if you do not have your own land? {single choice: 1=yes, 2=no}

Fish and Rice

16. How do you currently access fish? {multiple choice: 1=purchase; 2=process; 3=re-sell; 4=harvest from own land; 5=harvest from open land; 6=exchange with other goods; 7=receive as payment; 99= other {specify}
17. Is your household currently engaged in rice production? {multiple choice: 1=yes, for home consumption only; 2=yes, with some consumed at home and some sold; 3=yes, with all rice sold; 4=no}

[13] Asking about ethnicity can be too sensitive and political. Reframing by asking, what is your "mother tongue" and/or "religion" can usually give the same result without making respondents uncomfortable.

[14] Question 12 is meant to indicate the socio-economic status of the household. Home roof construction material was chosen for this specific case as this was identified in the qualitative pilot component of the study as a meaningful local proxy for wealth. For other research contexts, we suggest drawing upon qualitative data to select socio-economic status indicators that resonate in the local context – if no qualitative data is available, we suggest adding a question in a pre-survey cognitive test.

[15] Following on the general demographic data generated in questions 1-12, we suggest different research contexts have 1-3 questions to identify the respondent in relation to the priority intersectional characteristic. In this Myanmar case study example, land-landless is the primary dimension of power difference, hence these questions.

Section 3: Power and Freedom, Intrinsic Agency (Power Within)[16]

Power and Freedom (overall, over time)

1. On a scale of 0-5, with 0 being the lowest score (a person that cannot change their life) and 5 being the highest score (a person that has total freedom to change their life), where would you rank your ability to make important decisions about your life right now? {single choice scale 0-5}
2. On a scale of 0-5, with 0 being the lowest score (a person that cannot change their life) and 5 being the highest score (a person that has total freedom to change their life), where would you rank your ability to make important decisions about your life 10 years ago? {single choice scale 0-5}

Self-Efficacy, Aspirations and Perceived Control Over One's Life

3. For each of the following statements select one: {single choice: 1=NA/DK; 2=Strongly disagree/3=Disagree/4=Neither agree nor disagree; 6=Agree;7=Strongly agree}

   3a. Other members of my community, other than my household consult me for advice.
   3b. I know that if I try hard enough, I can do what I need to improve my family's life.
   3c. There are things I would like to change about my life, but I do not feel that I can.

4. If you had more ability to choose and more power in determining/changing your life, what would you do? {Fill in the blank}

Fish Specific: Aspirations in Relation to Fish as Livelihood

5. For each of the following statements select one: {single choice: 1=NA/DK; 2=Strongly disagree/3=Disagree/4=Neither agree nor disagree; 6=Agree;7=Strongly agree}

   5a. I worry that working in the fish sector could damage my reputation or bring me shame.
   5b. I feel safe travelling in the fish market by myself.
   5c. I aspire to one day not work in the fish sector.

6. How does engagement in fisheries relate to the expansion of life choices, successes, and aspirations? [to round out identification of factors]

   6a. To what extent has working in fisheries been a way FOR YOU to expand your life choices, successes/meeting your aspirations? Why/why not? {fill in the blank}
   6b. To what extent has working in fisheries been a way FOR OTHERS to expand their life choices, successes/aspirations? {fill in the blank and probe why same or different from you?}
   6c. What would need to change in the sector for work in fisheries to be a way for you to expand your life choices, successes/meet your aspirations? {fill in the blank}

Section 4: Group Participation, Networks, and Equitable HH Decision Making (Power With)[17]

Collective Action and Group Strength

1. Are you currently a member of a group or association? {single choice:1=yes, 2=no}

[16] *Power within* refers to women's and men's consciousness – internal and psychological resources [self-efficacy, self-esteem and self-confidence], aspirations and internal beliefs.

[17] *Power with* refers to collective action and group strength, social capital, networks, and solidarity, and equitable household decision-making and spousal support.

2. If you are a member of a group of association, what are the benefits of being a member? {multiple choice is possible: 1=access to loans; 2=information related to fish business; 3=gaining confidence to share my opinions; 99=other specify_____}

Social Capital, Networks and Solidarity

3. Are you currently engaged in social or business networks (e.g., buyer networks) that help you succeed? {single choice: 1=yes, 2=no}
4. In the groups that you belong to, do you feel that you have decision-making power or the ability to influence decisions? {single choice: 1=yes, 2=no}
5. Are you linked to private sector organisations that delivers seeds or other inputs for fish production? {single choice: 1=yes, 2=no}
6. Are you linked to private sector organisations that delivers seeds or other inputs for rice production? {single choice: 1=yes, 2=no}

Equitable household decision-making and spousal relations

7. If you had the choice, would you like to have more involvement than you currently do in any of the following*: 1=household budget/expenditure; 2=children's education; 3=selling household assets; 4=how you earn money
   *for each, rank with 1=more involved; 2=same; 3=less involved; 4=don't know; 5=NA
8. How supportive is your partner in you working outside the home to earn an income? {single choice: 1=not supportive, 2=a little supportive, 3=very supportive, 4=does not have a partner}
9. If your partner is not supportive or just a little supportive, how do they show that they do not support you? {[multiple response is possible]: 1=by telling you it is not important/not worth it, 2=by telling you the family is more important, 3=by telling you that it's not a good idea/silly, 4=with violence, 99=other specify_____}
10. If your partner supports you, how do they show that support? {[multiple response is possible]: 1=by encouraging you in difficult situations, 2=by taking more responsibility at home, 3=by financially assisting your business, 4=by giving you ideas, 99=other specify _____}
11. For each of the following questions select one: {single choice: 1=NA/DK; 2=Strongly disagree/3=Disagree/ 4=Neither agree nor disagree; 6=Agree;7=Strongly agree}

    11a. I discuss what I want for my future with my spouse
    11b.My spouse trusts I can manage our household finances well11c. I feel able to resolve disagreements with my spouse.
    11d. It is a woman's role to tolerate violence in her household to keep her family together.
    11e. My spouse restricts me from speaking with my parents, brothers and/or sisters.

Section 5: Skills and knowledge needed to succeed and for 'moving up'/expanding participation in fish sector, safety, conscientization (Power To)[18]

Knowledge and skills

1. What are the top skills you need to succeed in your profession? {fill in the blank}
2. To what extent do you have the information you need to succeed in your profession? {fill in the blank}

[18] *Power to* refers to women's and men's power to act and to realize one's aspirations. The *Power to* dimension includes transformative capabilities and abilities, including knowledge and skills, awareness and conscientization, nutrition, health and bodily integrity (Hillenbrand et al, 2015: 35).

Awareness and conscientization

3. Women's awareness of their rights: Do you know of any laws that supports women's rights? {single choice: 1=yes; 2=no} If yes, specify {fill in the blank}
4. Do you feel entitled to exercise these rights? {single choice: 1=yes, 2=no}

Nutrition and Income- implications to 'power to' from changes in fish-rice systems

5.What would happen to your family's food security if you could no longer catch any fish from rice fields? {fill in the blank}
6. What would happen to your own income if you could no longer catch any fish from rice fields? {fill in the blank}

Safety

7. Can you rate your perception of safety (for yourself) in relation to the place you operate in the fish sector? (e.g., marketplace; processing place) {1=safe; 2=somewhat safe; 3=somewhat unsafe; 4=unsafe; 5=NA/DK}
8. Theft is something I worry about when moving around my community {single choice: 1=NA/DK; 2=Strongly disagree/3=Disagree/ 4=Neither agree nor disagree; 6=Agree;7=Strongly agree}

Bodily Integrity - Looking After Ones' Health and Well Being

9. Who usually makes decisions about health care for yourself? {single choice:1=respondent; 2=spouse; 3=jointly; 99=other{specify}
10. For each of the following questions select one: {single choice: 1=NA/DK; 2=Strongly disagree/3=Disagree/ 4=Neither agree nor disagree; 6=Agree;7=Strongly agree}

    10a. I would prefer to be more involved in making decision about my health care.
    10b. Looking after my health is important.
    10c. I have time to take care of myself.
    10d. I feel like I get enough sleep.
    10e. My spouse's health is more important than mine.
    10f. I believe it is a woman's role to always meet her spouse's sexual needs.

Section 6: Access to and control over key assets (income, credit) and services (digital) (Power Over)[19]

Power Over: Control Over Income, Assets, and Resources

Control over income

1. From the income you derive from fish, do you make the final decision to put it towards becoming a processor or to buy more fish? (invest in your business) {single choice: 1=yes, 2=no, 3=not married/does not apply}
2. If you would like to grow your business, how supportive do you think your spouse would be? {single choice: 1=not supportive, 2=a little supportive, 3=very supportive, 4=does not have a partner}
3. When you envision growing your business in the future, do you think your spouse, or another member of your household would try to take over the income generated? {single choice: 1=yes, 2=no, 3=not married/does not apply}

[19] *Power Over* refers to control over resources, services, and others' lives – these include control over income, assets and resources; control over labour; land; and control over others – mobility/gender-based violence.

Control over credit

4. Do you think you have sufficient access to credit? {single choice: 1=yes; 2=no}

b) When you wish to acquire credit, do you need to consult your spouse? {single choice: 1=yes; 2=no; 3=not applicable}

5. Do I need to consult my spouse with how I use that credit? {single choice: 1=yes; 2=no; 3=not applicable}

6. Do you feel that credit has enabled you to increase your wellbeing? {single choice: 1=yes; 2=no; 3=not applicable}

Access to Digital Services

7. Do you own a mobile phone? {single choice: 1=yes; 2=no}
8. Do you use a phone to access extension services? {single choice: 1=yes; 2=no}
9. Do you use a phone to access financial services? {single choice: 1=yes; 2=no}

Power over: Control Over Others

Mobility

10. For each of the following questions select one: {single choice: 1=NA/DK; 2=Strongly disagree/3=Disagree/ 4=Neither agree nor disagree; 6=Agree;7=Strongly agree}

    10a. My spouse tries to stop me from meeting with my friends.
    10b. If I want to go to the market, I can do that.

Gender-based violence

11. For each of the following questions select one: {single choice: 1=NA/DK; 2=yes; 3=no; 4= prefer not to answer. In your opinion, is a husband justified in hitting or beating his wife:

    11a. If she goes out without telling him?
    11b. If she neglects the children?
    11c. If she argues with him?
    11d. If she refuses to have sex with him?
    11e. If she burns the food?

Section 7: Locus of Control and structural influences, including norms and rights (Power Through)[20]

Locus of control

1. Which of the following do you most agree with?
   A "Each person is primarily responsible for his/her success or failure in life."
   B "One's success or failure in life is a matter of his/her destiny/LUCK."

Formal Structures - Policy and rights

2. Do you have legal status in your country? {single choice: 1=yes; 2=no; 3=NA/DK}
3. Do you have access to social protection? {single choice: 1=yes; 2=no; 3=NA/DK}
4. Are your rights recognized in the marketplace? {single choice: 1=yes; 2=no; 3=NA/DK}

Informal Structures - Norms

[20] *Power through* refers to power mediated by forces beyond personal agency and relationships, including fatalism (locus of control) and informal (norms and stereotypes) and formal structural factors (policy).

5. For each of the following questions select one: {single choice: 1=NA/DK; 2=Strongly disagree/3=Disagree/ 4=Neither agree nor disagree; 6=Agree;7=Strongly agree}

5a. I believe that if I publicly criticized our community leaders then my spouse would be upset with me.
5b. Even if my spouse would be upset with me, I would express my opinions.
5c. I feel able to be a leader in my community.
5d. Women can be leaders as well as men.
5e. I believe the husband deserves the best meal.
5f. When there is a job opportunity, men deserve the job more than women.
5g. When a mother works for income outside the house, the children suffer.

6. If you must choose only one (boy or girl) to send to the school, which would you choose? {single choice: 1=boy; 2=girl; 3=don't know; 4=prefer not to answer}

C. Adaptations

Further piloting and testing of the tool are needed to address potential adaptations and adjustments, however, as this questionnaire was originally created based on a rice-fish system, it is anticipated that Section 2 sub-sections "Demographics related to Rice-Fish" (land/landlessness) and (fish and rice) can be removed/adopted to specific case study SSF system. Further piloting and testing of the tool are needed to address what questions can be skipped under which situation.

D. Tips and Tricks for Using the Tool

Tip: From the Pilot Case in Myanmar: Landed/landlessness was identified as the biggest contributing factor to whether men and women can benefit from the transition to integrated rice-fish in Myanmar. While the survey during the pilot phase was not implemented due to COVID-19, the hypothetical sample would have been 50/50 women and men, divided into equal "High risk" = landless and "lower risk" = landed categories.[1]

E. Analysing the data

In the Methods Package, quantitative data is collected in the Scoping Phase (in the form of contextual data using national level statistics on GBV/other proxies)[21] and in the Phase III survey tool. The survey is meant to mainly address research questions 1 and 2, but also touches on elements related to research question 3. Ultimately, the survey tool can be used to produce analyses along two areas of inquiry: (1) To explore relationships among variables; and (2) To explore differences among groups. The guidelines for how to run these analyses in relation to the method package's research questions are listed below.

Guidelines for Addressing RQ1: The Extent of Empowerment Between/Among groups:

The first research question deals with the extent to which women and men are empowerment or disempowered in each SSF system, and how women's empowerment compares to men's empowerment in this context. This requires measuring 'how much' empowerment between women and men and exploring differences between groups of different women and men. Because the survey captures various intersectional categories (see Table 2), these can be run as independent variables in both descriptive and

[21] Regarding the quantitative data from the Scoping Phase, this secondary data can be presented in the form of descriptive statistics (e.g., % of women and men engaged in the retail sector of the fish value chain, # of hours per day women spend on fish-related activities).

inferential statistical analyses. In this way, the researcher can explore the various gendered axes of intersectional disaggregation, also known as Gender Based Analysis Plus (GBA+) (Status of Women Canada, 2020). Using GBA+, the following can be explored in the survey dataset using descriptive and inferential statistics:

- Measures of the exogenous and endogenous empowerment factors identified across domains
- Relative empowerment in the different domains between women and men

Descriptive statistics: Display descriptive statistics and use GBA+[22] categories for intersectional disaggregation. For Categorical Variables, use Frequencies. For Continuous Variables, use mean, standard deviation, minimum, maximum, skewness, and kurtosis.

Inferential statistics: T-tests, One-way analysis of variance (ANOVA), Two-way analysis of variance, multivariate analysis of variance (MANOVA), Analysis of covariance

As discussed in the sample size selection section, running these inferential statistical tests across multiple intersectional groups in a single test (e.g., comparative interactions between gender, ethnicity, and wealth status), is unlikely to yield sufficient statistical power for post hoc multiple comparisons without a very large sample size (see Brooks and Johanson, 2011 for ANOVA sample size determinations). For example, to achieve a standardized mean difference effect size of 0.80 for the Tukey HSD Multiple Comparison Procedure using a 3-way ANOVA (comparison of means across 3 groups to see whether there are statistically significant differences between groups), there would be a minimum of 33 participants per group sample size, for a total sample size of 99 (Brooks and Johanson, 2011). Thus, we encourage running these tests to compare means between groups to draw out patterns and trends in the data, but not to expect/rely on significance in the interpretation of results.

Independent variables	Variable Type
Location (e.g., Village/District)	Categorical
# of years/months living in the village	Continuous (can be collapsed into categorical variable using cut-offs)
Age	Continuous (can be collapsed into categorical variable using age cut-offs, e.g., 18-35, 36-55, …)
Gender identity	Categorical
Ethnic group	Categorical
Education level	Ordinal
Marital status	Categorical
Prescence of spouse in household (migration proxy)	Categorical
Marriage type	Categorical

[22] Gender-based Analysis Plus (GBA+) is an analytical process used to assess how diverse groups of women, men and non-binary people may experience policies, programs, and initiatives. The "plus" in GBA+ acknowledges that GBA+ goes beyond biological (sex) and socio-cultural (gender) differences to consider other identity factors, such as race, ethnicity, religion, and age (Status of Women Canada, 2020).

Size of household	Continuous (can be collapsed into categorical variable using cut-offs)
Gender of adult members of household	Categorical
Wealth proxy (e.g., roof construction type)	Categorical
Land/Landlessness	Categorical
Fish Access	Categorical
Specific node/activities in value chain	Categorical
Rice production	Categorical

Table 26 Independent variables list that can be used as gendered axes of intersectional disaggregation (Gender Based Analysis Plus / GBA+)

Guidelines for Addressing RQ 2: Factors for Empowerment

The second research question deals with identifying the enabling and constraining factors for empowerment in a SSF case study context. This requires exploring relationships between different variables within the five domains of empowerment. There are a variety of inferential statistics that can be used to explore these relationships, including correlations and partial correlations, multiple regressions, and factor analysis.

- Numeric measures of attitudes towards gender, cultural and market norms
- Numeric measures of the relationships between predictive variables for empowerment and disempowerment
- Numeric measures of self-efficacy, aspirations and perceived control over one's life, and Power & freedom over time
- Explore relationships between variables and patterns among groups to explore how the intersecting dimensions of vulnerabilities/inequalities are related

F. Informed Consent statement

INFORMED CONSENT

Online Survey

Exploring Women's Empowerment in Small-Scale Fisheries

Client: WorldFish
Research firm: Includovate
Lead researcher: Dr. Kristie Drucza kristie@includovate.com

We are inviting you to participate in an online survey to do with a collaborative study on women's empowerment in small-scale fisheries (SSF). If you agree to participate, you can choose to stop at any time or to skip any topics you do not want to answer. Your participation is entirely voluntary.

Although you may not directly benefit from taking part in this study, the information you provide may lead to improved understanding of the SSF industry and any gendered issues, norms and challenges faced

specifically by women participants. The interview will take approximately 30 minutes, and you will not be compensated for your time. There is no anticipated discomfort for those contributing to this study.

We received your contact details through WorldFish who commissioned this methodology because momentum around sustainable aquatic development pathways is growing and because WorldFish does not want to exclude women participants. They may have received your details from their own contacts and networks. You have been randomly chosen to be interviewed because you are a woman, or a man engaged in the SSF sector. We will ask you questions related to you, your role in SSF, your position as a stakeholder and relationships with other actors within the industry.

We ask for your support by answering questions as honestly and fully as possible – there are no right or wrong answers. We just want to know your actual experiences, opinions, and the challenges you face in order to understand how to improve the program. Your answers will be completely confidential.

Confidentiality and Data Security

We will collect the following identifying information for the research: your name and email address. This information is necessary to contact you for the study. A common risk you experience any time you provide information online is that the online data is hacked or intercepted. So, there is a chance your data could be seen by someone who should not have access to it. We are using a secure system to collect this data, but we are unable to completely eliminate this risk. However, we are minimizing this risk in the following ways:

- All identifying information is removed and replaced with a study ID in the publication of results.
- Includovate will store all electronic data on a password-protected, encrypted computer.
- Includovate will keep your identifying information separate from your research data, but the researchers will be able to link it to you.
- For more information on Includovate's privacy policy, see here.

Demographic questions and the responses to any gendered questions will only be used for disaggregation and cannot be tracked back to the respondent.

Where will data be stored?

The data will be stored on the Includovate server for the online survey software. It will be downloaded without your email and other identifying information and stored on Includovate's secure server.

How long will it be kept?

The data will be kept for at least 5 years in case Includovate researchers need to contact the study's participants in the future.

Who can see my data?

The evaluation team will have access to your name and email address so we can identify you for the study. The evaluation findings will be presented in a final report and during presentations. No identifying information will be provided during interviews and pseudonyms (fictitious names) will be used if location is required.

Contact information:

For questions about the research, or to make a complaint: Contact Dr. Kristie Drucza lead researcher, kristie@includovate.com, or Dr. Sujata Ganguly Includovate's Ethical Review Board Chair

sujata@includovate.com. Should you wish to make an anonymous complaint, please refer to Includovate's online anonymous complaints process here.

Agreement to Participate

If you meet the eligibility criteria below and would like to participate in this study, click the button below to begin the survey. Remember, your participation is completely voluntary, and you are free to withdraw at any time.

- o I am at least 18 years old

Completion and submission of the survey is considered your implied consent to participate in this study. Please print this form for your records.

Background information:

WorldFish's mission is to reduce poverty and hunger by improving fisheries and aquaculture. Gender equality is integral to World Fish achieving its goals and advancing #Agenda2030. World Fish has a responsibility to its partners to capture and communicate the impact of its work on men and women, girls and boys and communities at large. Moreover, gender equality contributes to inclusive growth and sustainable development (Madgavkar 2020). The study of, and advocacy for, women's empowerment is necessary because the causes and consequences of low levels of empowerment can be found to limit women's opportunities (Malhotra and Schuler, 2005) and many policies and programs aim to increase empowerment (Alsop and Heinsohn, 2005) but evidence of their success is lacking (Springer and Drucza 2019). From a research for development perspective, this research facilitates greater awareness of what women's empowerment is and is not in a given context, and importantly sets a new standard regarding the quality through which researchers can 'claim women's empowerment.' WorldFish is dedicated to ensuring the alleviating of women as an excluded group in the SSF industry to be improved and made equal.

4.3 Validating Phase Pack of tools

The content of this validation phase will need to be developed from the analysis and the data you collect. The tools have been developed as guiding documents. In line with the literature on social norms it is suggested that you use vignettes to get beyond normative answers.[23] Consequently, you will turn some of the findings into vignettes. You will ask participants to indicate their level of confirmation with the vignetter on a Likert scale.

In line with the validation literature that argues a researcher should not pursue evidence to agree with their findings, but that validation should be considered a form of due diligence to uncover additional information that supports or contradicts the data.[24] Consequently, Likert scales are used to help understand if outliers are a data collection anomaly or sit within an acceptable range of possibility, without pressuring respondents with a binary choice.

There is no doubt, that a different definitions of empowerment will emerge from each case study and possibly from different value chain nodes, sexes and other intersectional categories. The validation process will help to avoid any exogenous lenses overlaying women's own understanding of their strategic freedoms and empowerment.

Table 27 Validation Methods Summary

Tool	No. and type of respondents	Time it takes
VP1: Validation workshop local	Per study site, 20-30 men and women who work in the SSF and participated in the research	2 hours
VP2: Validation workshop policy level	30 SSF stakeholders in urban area (e.g., fisheries staff, extension officers, licence providers, market managers, other fish stakeholders)	2 hours
VP3: Outcome mapping and action planning	Either the same as the policy making workshop or 10-15 interested participants from key stakeholders.	1.5 hours
VP4 Reflection workshop	As many of the research team as possible	1.5 hours

[23] Bicchieri, C. (2016). Diagnosing norms. In Norms in the wild (1st ed.,). Oxford, United Kingdom: Oxford University Press.

[24] Roller and Lavrakas 2015. Applied Qualitative Research Design: A total quality framework approach. Guilford Press: New York and London.

Validation Phase Tool 1: Validation workshop local

VALIDATION WORKSHOP – LOCAL LEVEL	
Purpose	To cross check the results with participants and engage them in a discussion
Respondents	20-30 men and women who work in the SSF and participated in the research. One validation workshop should be sufficient.
Sampling	This will be based on diversity. Each intersectional category that contributed to the research should be at the validation workshop.
Type of Data and Info	Validation data
Strengths of The Tool	Helps to check that your analysis is valid, and reliable. It also provides the opportunity to ensure the study has been sufficient and to hear if any more current evidence available. Can allow for a more accurate reflection of one's reality/situation and can stimulate further thought/discussion. It is ethically responsible to validate your study findings with those who participated in the study.
Weaknesses of The Tool	If a biased sample attends the validation process, then this can lead to biased results. Without the opportunity for marginalised or excluded groups to reflect on the findings their critical awareness and the possibilities for change will be less likely to manifest.

A. Circumstances

This tool assumes that the validations will occur at the local level and with less literate groups, or where there may be language barriers. For each question, participants will vote on a Likert scale that has symbols or numbers with a rock or some other physical object (this will help to ensure active participation for all participants):

Can you please confirm if this situation is familiar in your community/country by placing your rock on a number?

i. If you can strongly confirm that this situation is familiar to your community place your rock on number 5/symbol (point to the number 5)

ii. If you confirm but not strongly then place your rock on number/symbol 4 (point to number 4)

iii. If you can neither confirm nor deny, please place your rock on this symbol/number 3.

iv. If you cannot confirm that this situation is familiar to your community, please place your rock on number/symbol 2 (point to it)

v. If you strongly deny please place your rock here on number 1.

vi. If you don't know place your rock here.

[Make note of how many rocks are on each Likert number].

One note taker and one facilitator should be at this validation workshop. It would be useful if the note taker can watch the participants for shows of emotion and record these. For example, question 2 made people uncomfortable as they began shifting in their seats and shaking their heads.

G. Facilitating and Conducting the tool

Each research question (aside from 3[25]) should be covered during this workshop. The following evidence that answers the research questions should be presented here in qualitative, quantitative and diagrammatic form. Ask participants to rank on a Likert scale their agreement with the findings.

1. Women's own empowerment-related aims and aspirations in local context

This workshop should be seen as an opportunity to discuss the endogenous notion of empowerment arising from the research, as well as reach consensus on the understanding proposed.

- 1.a. To what extent are different categories of women currently empowered or disempowered in relation to which types of power in which node of the given SSF system?
- 1.b. How does women's empowerment compare to men's empowerment in this context and system?

2. Empowerment pathways

The conceptual framework should be presented here before the results to the following research questions:

- 2.a. What are the enabling and constraining factors that amplify or stifle empowerment as a process in the given SSF context?
- 2.b. What pathways have led to increased empowerment in the past and what might work in the future?

H. Adaptations

These will depend on the data you have collected. It is important to pay attention to anomalies and outliers as well as present data representing the endogenous framing and some of the research questions. If there is too much information to validate at each level, then consider splitting the validation workshop into two with different participants validating different questions to reduce the time burden on respondents.

An additional adaption is around the discussion of the Likert scale rankings. *If there is time and the participants are interested, pick up each rock one-by-one (make sure you vary the order with which you do this – e.g., sometimes start at 3, sometimes at don't know (D/K), sometimes at 1, etc.) and ask]*

1.1 "Who's rock is this?" "Please explain why you [confirm/disagree/D/K...] that this situation is familiar in your community? [*Ask a promoting/clarifying question depending on the response that digs a little deeper into the answer*].

I. Tips and Tricks for Using the Tool

[25] Question 3 could evoke negative responses from citizens or inflame conflict – depending on the results. The ethics clearance process should help to determine if questions 3 should be covered in this workshop.

Facilitation skills are key to getting people to participate and share their opinion. It is essential that you spend time building rapport even before the workshop begins. Create a friendly and open environment so everyone feels like contributing.

J. Analysing the data

This validation workshop is structured so every participant can vote on the findings. This will make it easy to present graphs as an annex to the final research report. Notes of discrepancies, or discussions, debates should be recorded and analysed for what they might mean.

K. Interpreting the data

The results from the validation workshop at the local level should be compared and contrasted to the other validation exercises, particularly those at the policymaking level, for each level represents a different purview.

L. Informed consent statement

The purpose of this discussion is to validate some of the findings from the original data collection process and share some of the research results with members of the community that participated in the original research. This will take approximately two hours. We will leave our office's email address and phone number with you in case you wish to make a complaint about the research, share additional information and insight, or to ask us some additional questions.

This discussion will be conducted anonymously. We will not record your name against your responses and no compensation will be provided for your time. We wish to record this discussion to ensure we accurately reflect all comments. It is hard to take down notes as fast as someone speaks. As already explained, we will not record your name or show the recording to anyone not affiliated by legal contract to our organization. The overall research results will be published and shared with the general public and decision makers.

We are going to ask you to confirm and clarify some statements for us

You are going to be given a rock with a symbol on it. You will then place the rock on one of the numbers between 1 – 5 when we ask you a question and then sit down again. We want you to think about your responses. 5 is strongly confirm 4 is confirm, 3 neither confirm nor deny, 2 can't confirm and 1 is strongly deny. We have written them on a piece of paper with symbols next to them to represent what each number stands for. We will then ask you to explain why you chose that number. There is no wrong answer. You are all allowed and encouraged to think the way you think whether the same or different to your peers.

We are interested in everybody's thoughts, experiences, beliefs and feelings. We want to hear from each and every one of you. We believe your uniqueness will add value to this research. My colleague here will observe and try to write down all your comments. She can refer back to the recording if she misses anything. We hope to have an interesting and insightful discussion with you.

Participation in this discussion is voluntary. You have the opportunity to withdraw at any time or refuse any component(s) of the research without repercussion or penalty. Please let me know if you consent to being a part of this research by remaining seated. If anyone does not feel comfortable or does not want to

participate, I request that you depart now. You may leave at any time during our discussion as well. If you choose to participate in the research then we expect you to share your opinion and speak up. We also expect everyone to respect each other's opinions and differences. It is ok if you express your disagreement with other speakers – but please do so respectfully. Does anyone have any questions before we begin? We do encourage you to ask questions at any point.

Validating Phase Tool 2: Validation workshop policy level

VALIDATION WORKSHOP – POLICY LEVEL	
Purpose	To cross check the results with participants and engage them in a discussion
Respondents	30 people for fisheries related policies, plus the Ministry of Women, any small business association for women or enterprise ministry and other relevant social affairs ministries. One validation workshop should be sufficient.
Sampling	This will be based on the stakeholder map produced. The aim is to achieve maximum representation across stakeholders.
Type of Data and Info	Validation data
Strengths of The Tool	Helps to check that your analysis is valid, and reliable. It also provides the opportunity to ensure the study has been sufficient and to hear if any more current evidence available. Can allow for a more accurate reflection of one's reality/situation and can stimulate further thought/discussion. It is ethically responsible to validate your study findings with those who participated in the study.
Weaknesses of The Tool	If a biased sample attends the validation process, then this can lead to biased results. Without the opportunity for marginalised or excluded groups to reflect on the findings their critical awareness and the possibilities for change will be less likely to manifest.

A. Circumstances

One note taker and one facilitator should be at this validation workshop. It would be useful if the note taker can watch the participants for shows of emotion and record these. For example, question 2 made people uncomfortable as they began shifting in their seats and shaking their heads.

B. Facilitating and Conducting the tool

Background Information

Name of facilitator	
Date (dd/mm/yyyy)	
No. of participants	
Location	
Sex	
Age range	
Marital Status	
Position/role in the community	

Table 1 Example of table for record of information

Present the results as graphs, vignettes, qualitative, quantitative and diagrammatic form under the following headings:

3. Women's own empowerment-related aims and aspirations in local context

- 1.a. To what extent are different categories of women currently empowered or disempowered in relation to which types of power in which node of the given SSF system?
- 1.b. How does women's empowerment compare to men's empowerment in this context and system?

These could be presented in a number of ways and should be seen as an opportunity to discuss the endogenous notion of empowerment arising from the research, as well as reach consensus on the understanding emerging from the data.

4. Empowerment pathways

The conceptual framework should be presented here, and participants should be asked to rank on a Likert scale their agreement with the findings. Present evidence from the study for the following research questions:

- 2.a. What are the enabling and constraining factors that amplify or stifle empowerment as a process in the given SSF context?
- 2.b. What pathways have led to increased empowerment in the past and what might work in the future?

Explain that resilience can be considered a pathway towards empowerment because people have an opportunity to experiment with their own strength, overcome adversity and gain the confidence to try again.

5. Policies and programs that enable and constrain women's empowerment

The purpose of this discussion is to understand if there are any additional ways that policies and development investments might assist with enhancing women's self-defined strategic freedoms that were not captured by the research. And if any new solutions emerge. Policy and decision makers have a unique purview and the opportunity to validate with them should not be wasted. This question will not be asked at the local level.

- 3.a. To what extent do current fisheries development policies, strategies, and programs contribute to or constrain empowerment for different categories of women?
- 3.b. How can the enabling factors be amplified, and the constraining factors and risks to empowerment pathways for diverse women be mitigated?'

6. Recommendations

These can either come from the study's findings, or from crowd sourcing the participants of the validation workshop. Either way, the recommendations should be voted on by the audience in terms of a Likert scale of agreement.

C. Adaptations

Adaptations to the instrument are allowed and will depend on the original data collected and how it is analysed.

D. Tips and Tricks for Using the Tool

For each major data piece presented we want a Likert scale rank from the audience.
For remote validations this can be done with menti-meter or zoom polling

Policy makers expect a higher level of professionalism during validation workshops. Dress as if you worked on wall street. Give the graphs as handouts for the policy makers to keep. It would be best for information dissemination and uptake to give out a policy brief at the validation workshop.

E. Analysing the data

This validation workshop is structured so every participant can vote on the findings. This is not essential but will make it easy to present graphs as an annex to the final research report. Notes of discrepancies, or discussions, debates should be recorded and analysed for what they might mean. For example, the topic of gender equality often raises strong emotions (for and against). It is political and often misunderstood as a western imposed idea. These ideas should be allowed to surface and if challenged, this should come from the audience. Your role is to facilitate a respectful space for healthy discussion, where opinions can be shared without fear.

F. Interpreting the data

A small summary paragraph under each graph outlining the nature of the consensus or contest and any particular issues that arose should be included. Anything inconclusive should be commented on. The results of validation with policy makers should be compared to the results of the validation with local value chain actors.

G. Informed consent statement

The purpose of this discussion is to validate some of the findings from the original data collection process and share some of the research results with members of the community that participated in the original research. This will take approximately two hours. We will leave our office's email address and phone number with you in case you wish to make a complaint about the research, share additional information and insight, or to ask us some additional questions.

This discussion will be conducted anonymously. We will not record your name against your responses and no compensation will be provided for your time. We wish to record this discussion to ensure we accurately reflect all comments. It is hard to take down notes as fast as someone speaks. As already explained, we will not record your name or show the recording to anyone not affiliated by legal contract to our organization. The overall research results will be published and shared with the general public and decision makers.

We are going to ask you to confirm and clarify some statements for us according to a Likert scale. We will then ask you to explain your response. There is no wrong answer. You are all allowed and encouraged to think the way you think whether the same or different to your peers.

We are interested in everybody's thoughts, experiences, beliefs and feelings. We want to hear from each and every one of you. We believe your uniqueness will add value to this research. My colleague here will observe and try to write down all your comments. She can refer back to the recording if she misses anything. We hope to have an interesting and insightful discussion with you.

Participation in this discussion is voluntary. You have the opportunity to withdraw at any time or refuse any component(s) of the research without repercussion or penalty. Please let me know if you consent to being a part of this research by remaining seated. If anyone does not feel comfortable or does not want to participate, I request that you depart now. You may leave at any time during our discussion as well. If you choose to participate in the research then we expect you to share your opinion and speak up. We also expect everyone to respect each other's opinions and differences. It is ok if you express your disagreement with other speakers – but please do so respectfully. Does anyone have any questions before we begin? We do encourage you to ask questions at any point.

Validating Phase Tool 3: Outcome Mapping and Action Planning

Outcome mapping (OM) was created to help researchers and practitioners working towards behaviour change (such as women's empowerment) to have some sort of shared direction by visualising what success would look like. OM was originally established as a monitoring and evaluation tool. However, it is often used to promote social learning. Ultimately, OM is a participatory workshop that helps to align expectations and roles, promote reflection and interactive participation with key stakeholders (Ortiz, 2005). In this tool, outcomes are understood as changes in behaviour.

Outcome mapping and action planning	
Purpose	To turn research results into actions that policy makers can adopt/apply. Less of a map and more of an agreement of the behaviour change needed (and key boundary partners) to achieve the desired results as articulated by female respondents engaged in the SSF. To turn research results into actions that policy makers can adopt/apply.
Respondents	Engaged participants from the policymaking validation workshop plus some key stakeholders
Sampling	10-20 participants is sufficient
Type of Data and Info	Outlines the way key decision makers/stakeholder understand the situation and their appetite for change. Set a clear plan for how to achieve deep transformational change for women in the SSF.
Strengths of The Tool	Observations, reflections, and recommendations on what change is possible and can be facilitated by trusted friends (male alleys). Can generate action as well as discussion and consensus. Agreement and ownership for reforms is discussed and agreed to. Helps to identify that there is a limit to any opportunity. Focuses on social and organisational learning. Agreement and ownership for reforms is discussed and agreed upon.
Weaknesses of The Tool	Requires expert probing to understand hidden dynamics such as power. It can be subjective. It may be time consuming and resource intensive.

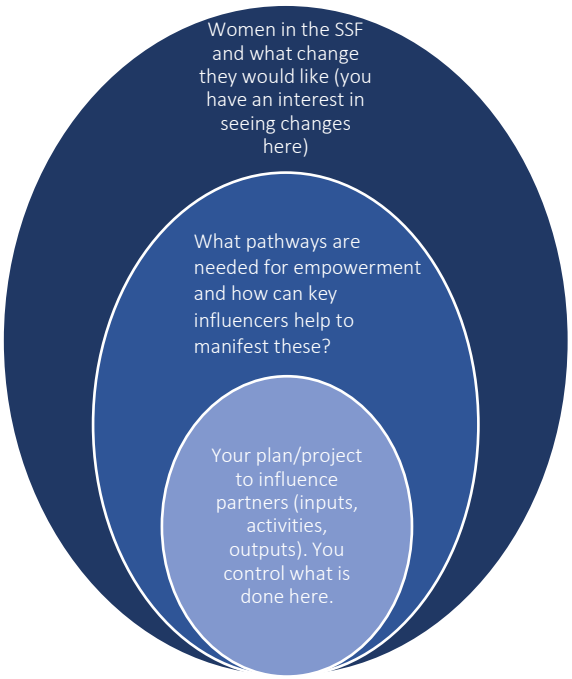
A. Circumstances

One facilitator and one note taker are required.

B. Facilitating and Conducting the tool

The facilitators role is to ensure collective participatory learning and reflection occurs. OM helps identify the key outcomes the research team, community members and other stakeholders would like/love/hope to see at the end of the study/project. This establishes consensus on the needed changes, roles and responsibilities and helps plan the strategies to be used (Earl et al., 2001).[26]

[26] Earl, S., Carden, F., & Smutylo, T. (2001). *Outcome mapping: Building learning and reflection into development programs*. IDRC, Ottawa, ON, CA.



Beneficiaries: sphere of interest. Start here and jot down what deep transformation should happen based upon the research results. What changes would you love to see here that will have a deep impact.

Partners/stakeholders that you can influence (what behaviour change is needed for these partners to operate differently). Write down a list of people/organisations that interact with women in the SSF, or could help contribute to their desired outcomes. What changes would you like to see here that would have these partners actively contribute to the deep transformation? Describe the behaviours that are needed.

Sphere of control: project/plan. What can be done to influence the partners? Write a list on a flip chart.

Have participants vote for the solution they think will be most impactful. Then form groups according to responses and have the groups work to complete the following table based on the recommendation they are most passionate about. You will have each group complete the following action plan table.

Action plan table

Name of the activity	Name(s) of the persons/ organisation responsible	Time Schedule		Resources required (money, material, people)	Acceptance of the activity and willingness/availability to dedicate resources
		When to start	When to complete		

When all groups have finished then have everyone huddle around one groups work and have that group explain it to everyone and facilitate a question and answer session until the action plan has been agreed. Move to the next group and repeat the activity.

At the end of this workshop there should be at least four solid action plans for change.

C. Adaptations

These are permitted and very much depend on the data collected and presented. A couple of suggested questions that could be ask if time and interest include:

- How controversial is this data in terms of its alignment or challenge of popular social/gender/cultural norms?
- Who should be in the room for such a discussion but is not there?
- How can they be mobilised to become interested?

D. Tips and Tricks for Using the Tool

This tool can be held immediately after the validation workshop. This can help with motivation and memory recall, rather than having a separate workshop on another day.

It is highly likely that other people will need to be brought into any change agreed upon. The facilitator should think of ways to do this and ensure enough budget is allocated for this purpose.

E. Analysing the data

This is a matter of assessing consensus and contestation. Ideally, influential people will own and take responsibility for implementing/driving certain outcomes/results. The analysis should centre around opportunity and appetite/ownership.

F. Interpreting the data

This is an is, or is not, situation. If influencers decide it is an idea worthy of addressing then the study should present as much. However, if an issue that is highly relevant to local women is not considered important to policy makers/influencers, then WorldFish and the research team have a responsibility to communicate this need and to help generate funding and support for this initiative.

One suggestion is to publish the results of this activity in the form of a brief. This helps with accountability and helps communicate the desired state to a wider audience.

Validation Phase Tool 4: Reflection workshop

This tool is an internal tool to be used by the researchers and enumerators to strengthen the learning around the methodology. The information for this tool will come from the reflection journal notes.

VP5: REFLECTION WORKSHOP	
PURPOSE	To use inputs from the team's learning journal field diaries to discuss their observations, reflections, and areas for improvement for the next use/iteration of the methods package, ensuring the methodology is continually refined.
RESPONDENTS	Principal investigator and research team; potentially community members and other relevant stakeholders
SAMPLING	Required: Principal investigator, enumerators, research assistants and research team (size contingent on study)
TYPE OF DATA AND INFO	Team observations, reflections, and recommendations on their experience with using specific study tools.
STRENGTHS OF THE TOOL	A method through which recommendations for future iterations of the methodology are identified, discussed, agreed and documented.
WEAKNESSES OF THE TOOL	Richness of discussion will depend on the depth of the research team's learning journal field diaries and their comprehension of the methodology. It may be time consuming and resource intensive.

A. Circumstances

Prior to the workshop, each researcher/team member is expected to prepare a summary document outlining the key sections of their learning journals over the data collection for the study (Observations and broad takeaways from each tool; Specific reflections; and Areas for improvement) so they will be prepared to participate.

Location: Online or in-person workshop
Materials needed for the exercise [if done in-person]: Flipchart, markers, pens, team learning journal field diaries

B. Facilitating and Conducting

Step 1: The facilitator will explain the purpose of the workshop to the team, obtain informed consent and outline the key activities. An assessment of the similarities and differences from the diaries will be pulled together and presented.

Then a tool called 1-2-4-all, will be used. Invite participants to spend 1 minute alone reflecting on the diary findings and recommendations. They should write down which recommendations they agree with, the ones they disagree with and the ones they are not sure about.

Then have participants pair up and share their notes for 2 minutes. What do they have in common? Are there any differences?

Then have two groups of two join to make a group of four and repeat the activity for 4 minutes.
Then hold a plenary discussion whereby similarities and differences are discussed and written onto a flipchart for later recording.

Step 2: In this step, please ask participants to form groups of four again and identify the key findings/new information related to women's empowerment emergent from the study. Get the group to discuss:

- Which of the main six research questions did we not get answers to, and why do they think this occurred? 12 minutes (2 minutes per research question)
    - Plenary discussion to see if consensus is reached.
- In the same groups of four, ask what do we now know for sure about an endogenous notion of women's empowerment in this context (that we did not know before the study commenced)? 5 minute discussion
- Plenary discussion where each group presents their learnings

Step 3: The third activity is to discuss the merit of the tools used in the study. Making a list of each of the tools used, for each research question:

Draw a table similar to the one below for each research question:

	What did we need to know?	What specific type of data was needed?	Which tools generated the information we needed? (strengths/weaknesses)	Recommendations for future use of the tool (how to address gaps)
Tools used				

Have the groups complete the table (if you have three groups, then each get group to do two different research questions). Allocate 15 minutes for each research question.

Plenary discussion - have each group present their table per research question. Each research question has 5 minutes for presentation and 5 minutes for questions/clarifications/disagreements from the audience. Take notes on a flipchart/electronic whiteboard.

Step 4: After filling out the table(s), have each group discuss the following questions:

A. What were the biggest challenges with carrying out the study?
B. If we could turn back the clock, what should the study have done differently?
C. What advice would you give to another researcher who was completing this study?
D. What are the follow-up questions and greatest points of interest for the next iteration of the methodology?

If there is time then have each group present their answers to these question in a plenary discussion.

C. Adaptations

Optional[27]: Draw a table like the one below for specific questions within tools used to address the larger research questions

	Which Questions and probes worked best?	Which questions didn't work?	Recommendations for future use of the tool
Tools used			

D. Tips and Tricks for Using the Tool

You want to hear as much as possible from the research team. It is rare to have such an opportunity to reflect on a data collection process and to hear the perspectives of enumerators. Encourage discussion and debate as much as possible.

E. Analysing the data

The data analysis occurs during the workshop. Very little additional analysis will be needed. There may be a need to refer back to research questions to substantiate the discussion.

F. Interpreting the data

A final report of this workshop and the methodology should occur and be sent to WorldFish.

[27] This activity would be useful if only a limited number of the total possible tools were used for the individual study. Otherwise, it could be too time-intensive to be conducted within the confines of a workshop.

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MYFish II and FRDN Steering Committee Meeting

Date – 10th July 2020 (Friday)

Time – 9:30 AM to 10:30AM

Meeting hosted by virtually

The Meeting Attendance List is as below:

No.	Name	Designation	Department
1	U Wai Linn Maung	Director General	DoF
2	U Myint Zinn Htoo	Deputy Director General	DoF
3	Dr.Aung Naing Oo	Director (Aquaculture Sector)	DoF
4	U Nyunt Win	Director (Kayar State)	DoF
5	Dr.Nilar Shein	Deputy Director (Aquaculture Sector)	DoF
6	Daw Kyu Kyu Thin	Fishery Officer (Finance Department)	DoF
7	U Myo Thura	National Project Officer (ACIAR)	??
8	Dr. Thant Zin	Professor of Head, Zoology Department FRDN Steering Committee Representative	Mandalay University
9	Dr.Thiadalay Thwae	Professor of Head, Zoology Department *FRDN Steering Committee Representative*	Yangon University of Distance Education
10	Dr.Khin Wah Wah	*Professor, Zoology Department* *FRDN Steering Committee Representative*	Yangon University
11	U Win Kyaing	General Secretary (Myanmar Fisheries Federation)	MFF
12	Mr. Michael Akester	Country Director *FRDN Steering Committee Representative*	WorldFish
13	Mr. Mark Dubios	Post.Doc. Aquaculture and SSF	WorldFish
14	Dr.Khin Maung Soe	National Consultant	WorldFish
15	Mr. Kimio Leemans	Research Assistant	WorldFish
16	Daw Hsu Mon Aung	Research & Administrative Officer	WorldFish

	Meeting Minutes	
1	Opening Remarks U Wai Lin Maung	The virtual meeting was started on 9:30 am. The Director General opened the 4th MYFish II and FRDN reference committee meeting.
2	Mr. Michael Akester	He presented MYFish II project's objectives and explained about the completed projects, publications, ongoing and upcoming activities under ACIAR funded. He shared the information thatt ACIAR allowed 3 months no cost extension to till 2021 March.
3	U Myo Thura	ACIAR representative raised the questions that due to Covid-19 what kind of support need to complete the project on time? Michael Akester answered that WF already requested ACIAR to provided no cost short extension to till 2021 March. The reason of extension is the research teams need to collect the data from 12 sites and analyze the data under FRDN project. We have a plan to hold the final result sharing workshop and closing seminar on 2021 March. The second question was raised based on the ongoing projects that where the fisheries management sites are situated Delta or CDZ? Michael Akester answered that all fisheries sites situate in Delta Ayeyarwady and explained sites selection and site situation.
4	U Nyunt Win	The MYFish Project leader (DoF) raised the question instead of DG that how department of fisheries research team (AWG team) is going with FRDN research? Michael Akester answered that department of fisheries is working closely with WF and other partners within the framework of FRDN network. During Covid- 19 research teams are not possible to go the field trip to reduce the potential risk. But all of the research team are closely collaborating with local DoF and local surveyors to get the data and all are going well.
5	Mr. Mark Dubios	He suggested the potential plan that to work through on compiling the data, analyze data set, interpret the result and paper writing by collaborating with all research team and WF during extension 3 months and it would be good for capacity development perspective and future work.
6.	Dr.Nilar Shein	She passed the message of DG comments on 3months extension that DoF already received the letter of extension and have to submit the report to the ministry of planning, cabinet and minister. So DoF need to get one more additional document which is rational and another one is the workplan of extension three months.

	Michael Akester	The workplan has already put in the attached and rational document will send after the meeting.
7.	Daw Hsu Mon Aung U Nyunt Win	She presented the FRDN project progress update including research sites, project timeline, research results on both socio-eco survey and bio-monitoring survey and financial status. He insisted additional explanation to Director General that FRDN is the first collaborative platform with Department of Fisheries, universities and private organization (MFF) for fisheries research in Myanmar and intentioned to institutionalize the network. There has already developed policy manual and currently this manual was referenced for Norway project. Myanmar Fisheries Partnership also was led by WorldFish and taking secretary role.
8	U Myo Thura	A question was raised about on research results, that comparing production by 2019 and 2020, why 2020 production was increased? Daw Hsu Mon Aung answered that, in both sites are working by community fisheries group and Hlaing Tar Mazeli sites has 4 no-fishing zones which WF was provided no fishing area signboard and provided conservation awareness workshop on 2019. This outcome showed the production was increased in 2020. In YinSae site, fish habitat is better than Hlaing Tar Mazeli and CFG management experiences is less than Hlaing Tar but the fisher are obeying the rule of CFG leader.
7	U Win Kyaing	He suggested FRDN research entitled that it should be prioritized in apply sector rather than academic research and would like to know what research titles currently FRDN is doing. There are many challenges in AYA fisheries management and suggested next FRDN research should be approach on fisheries legislation and it would be good to report to policy makers.
8	U Myint Zin Htoo	The deputy director general commented on MYFish II activities that he encouraged on conservation activities in AYA delta but according to the procedure, no one can decide no fishing zone in leasable area without approval of Department of Fisheries. Thus, next time WF need to consult with local DoF and getting assist for the project. Also, he explained about why department of fisheries research team is undertaking research in 3 sites under FRDN project. He also gave suggestion to host Myanmar Fisheries Partnership online meeting lead by WorldFish.
9	Mr. Michael Akester	He concluded by sharing information that WorldFish have a plan to do the mini symposium on end of the year to share the FRDN research result and final MYFish II symposium will be on March 2021.
10	U Wai Linn Maung	Director General gave final remark that Department of fisheries will help and support on WF future research activities and currently minister of MOALI is interesting the research programs.

		Also, DG shared the information that DoF have a plan to do research symposium within the department and during the time WorldFish will be invited to join the symposium. Regard with 3months extension, DG will submit the report to high level after received the document from WF.
The Meeting was concluded by 10:30 AM		

Action Points

No.	Action	Responsible stakeholder
1.	To send rational document to DoF	Michael Akester (Finished)
2.	To discuss with MFP member for 7th MFP virtual meeting	WorldFish

An Experience of Food Photo Data Collection among rural individuals in Pyapon, Myanmar

Introduction

Multiple studies demonstrated the use of photography as an effective tool to capture experiences of individuals. Stories of discrimination, inequality, social acceptance are shown through photos especially for people who are unable to use words to communicate traumatic and difficult experiences. On the other hand, photos are also used to document change in people for instance, from poor eating habits to adopting healthy eating behavior, travels, before and after project interventions, and with the advent of social media, photos become the modern way of communicating to people.

In this study, we utilized photos to document the diets of 9 individuals for more than two months in a pre-monsoon to mid-monsoon season in a rural village in Myanmar. Guided by participatory action research approach, the respondents were the village researchers[1] themselves, whereby they captured and sent photos of their own daily meals including snacks to the study team. After each month of data collection, the study team conducted a consultation meeting with the researchers to gather feedback and to seek ways of revising the methods used.

The study area Kyonkadun village in Pyapon Township, Ayeyarwady Delta, is one of the villages that WorldFish Myanmar is working through MYFish2 project funded by the Agricultural Center for International Agricultural Research (ACIAR), in collaboration with International Water Management Institute (IWMI) through Water Land Ecosystems- Flood Based Farming Systems (WLE-FBFS). For many rural farming communities, the ability to access food for consumption is influenced by many factors---landholding, market, behaviors, tradition, information, among others. In this study, we described a few of these factors through the accounts of the researchers.

The main purpose of the study is to present the methods used in collecting data of different foods consumed by rural individuals, subsequently, linking it to the diversity of their diets using the Minimum Dietary Diversity for women (MDDW) measurement guide; a proxy indicator in assessing the diet quality of women. The guide indicates ten food groups reflecting micronutrient adequacy in women's diet as many women suffer from micronutrient deficiencies such as anemia that has negative implications during pregnancy and lactation. The foods are groups as; grains, pulses (beans, peas, lentils), nuts and seeds, dairy, meat, poultry and fish, eggs, dark green leafy vegetables, other vitamin A rich fruits and vegetables, other vegetables and fruits.[2]

Although majority of researchers were male the study team decided to use the MDDW tool, since there is no similar measurement for men. It is noted that MDDW is used for population based assessment and not for assessing individual diets, but because there is no alternative tool at present that is easy and simple to use in a setting with limited time and resources, it was then decided by the team to utilize the tool only for the purpose of reflecting the diversity of the diets of the researchers.

The report is structured by describing first the methods of data collection---highlighting the software applications used, followed by the results of the study and discussion that intersects with the accounts from

[1] For clarity, the respondents are referred as researchers throughout the document

[2] FAO & FHI 360 (2016), *Minimum Dietary Diversity for Women: A Guide for Measurement*. Rome: FAO

the researchers during the last community meeting. The last section of the report covers the implications of the study and conclusion.

Methods

1st cycle- 2nd week of May to 4th week of June 2019

After explaining the objectives and the methods of the study, the researchers started collecting data by taking photos of the meals they ate daily and writing on a record sheet the sources of the food items; purchased from the village market, purchased outside from the village, home production-inside the irrigation area, and home production-outside the irrigation area. Photos of the food and record sheet were sent daily through viber phone application to the study team for the period of more than a month.

2nd cycle- 3rd week of July to 3rd week of August 2019

After the first month of data collection and a consultation meeting from the village researchers, it was decided by the team to develop an online questionnaire through Kobo application software (https://kf.kobotoolbox.org/accounts/login/?next=/#/) to enable faster data recording and analysis. Once developed, the team trained the researchers who volunteered to continue for another month on how to fill in and upload the form. A similar process was observed by the respondents as in the first cycle but instead of sending through viber application, the respondent filled in the online questionnaire on their phone, took photo of the meals when prompted. The questionnaire with attached pictures was uploaded daily to an online server by the researchers for the period of one month.

Minimum Dietary Diversity for Women score to reflect diet diversity

Using the photos of every meal that were sent by researchers, food was classified to which group it belongs. Each food group consumed in a day is counted as one score, regardless of the frequency of consumption during the same day. The dietary diversity score in a day is a tally of food consumed from the different food groups. According to the guidelines, a score of 5 out of 10 food groups in a day is the minimum requirement for obtaining adequate micronutrients from the diet. For the purpose of the study, the dietary score was calculated as an average for the number of days of data collection per respondent.

Consultation Meeting

To get a better understanding of the situation in the community during the period of data collection, the team conducted two consultation meetings with the village researchers; 1) At the end of 1st cycle, and 2) After completing analysis of the data. In both meetings, the village researchers provided feedback on the methods used---the advantages and their challenges encountered when collecting data. The discussion during the 2nd consultation meeting is mentioned in the discussion section.

Results

The 1st cycle of data from 9 researchers is presented first, followed by 2nd cycle of data from 3 researchers who voluntarily continued the study. The dietary diversity score data was obtained from the visual photos that were sent by researchers. Meanwhile, the food source data for 1st cycle were collected from the record sheet filled in by researchers and for 2nd cycle from the kobo application software that were uploaded online by researchers.

The purpose of switching to the use of kobo application software in the 2nd cycle was to make it easy for researchers to collect data, and for faster processing and analyzing of data by the team, but unfortunately, it was found that consumed food items indicated in the online questionnaire were fewer when verified with the photos. For instance, green leafy vegetable appeared on the photo but it was not indicated in the questionnaire. Therefore, it was decided to identify consumed food groups based on the photo's to have a

more accurate representation of the researchers' diets. While for the food sources, the online data was the basis because there was no other method of obtaining the data.

1st cycle

For 9 researchers, an average of 31 days of data collection were reported; 39 days was the maximum and 22 days was the minimum. Of the food consumed, grains (rice) were consumed most frequently, followed by vegetables and fish (figure 1).

The average dietary diversity score of all researchers was 4.6, and only one respondent achieved a mean score of 6.4; which is slightly above the minimum requirement of 5 out of 10 food groups. Two out of 9 researchers were women; unfortunately, they did not obtain the minimum score of 5, with only 4.3 and 4.1.

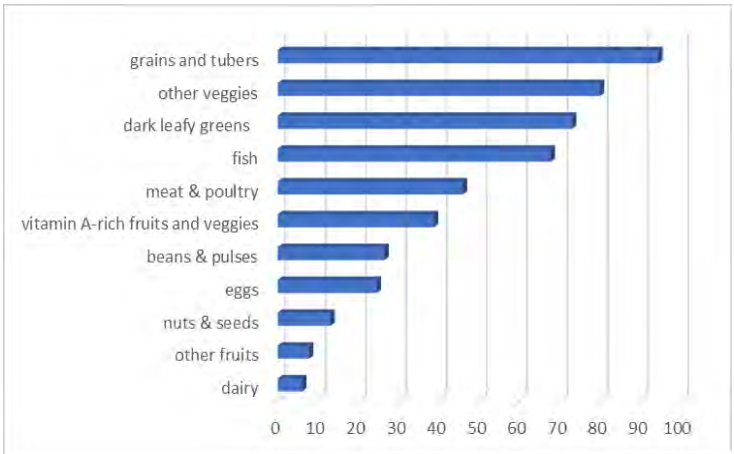

Figure 1. Food groups consumed on a daily basis by researchers (%)

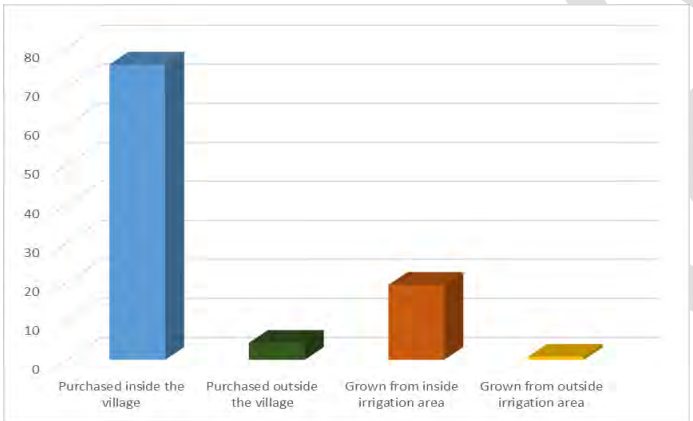

Figure 2. Sources of food items consumed (%)

The food consumed were mostly purchased, and 20% were grown inside the irrigation area (figure 2). Six out of 9 researchers grow food inside the irrigation area, whereby, majority was rice followed by vegetables and fish (figure 3).

In terms of fish grown, it implies that the fish comes from capture fishery and not from aquaculture production since there were no small-scale aquaculture farmers among the researchers. Only a limited number of food items consumed like vegetables, rice, and beans were grown outside the irrigation area.

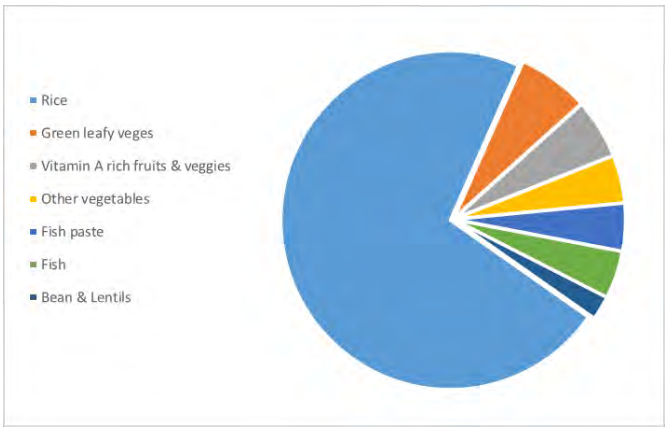

Figure 3. Types of food grown inside the irrigation area (%)

2nd Cycle

The three researchers who continued the study in the 2nd month showed a high variance in days of data collection; 29 days, 17 days, and 7 days. The researchers decreased their dietary diversity score by 10%-30% when compared to the 1st cycle.

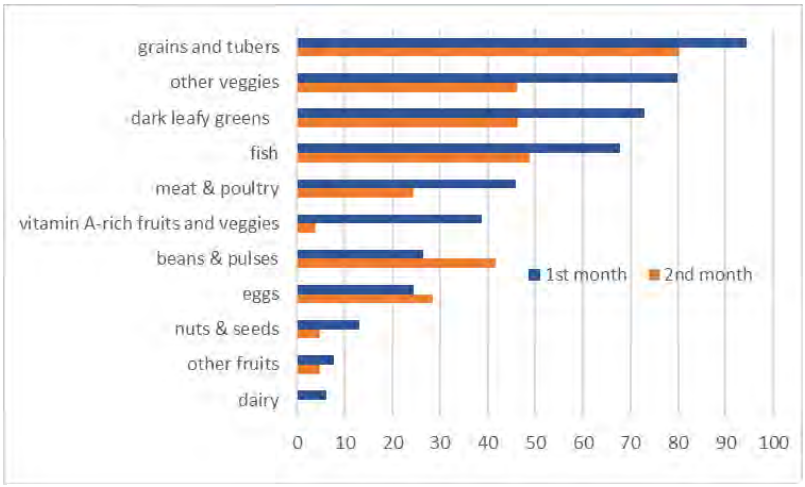

Figure 4. Comparison of food groups consumed on a daily basis for 2 cycles (%)

The common food consumed was grains (rice), followed by fish and vegetables (figure 4). A comparison of 1st and 2nd cycle shows that there was a decreased consumption for most of the food groups except for beans and eggs (figure 4). This can be attributed to the season; the 2nd cycle of data collection is in the middle of the rainy season which might have an effect on the amount of food that were available in the area.

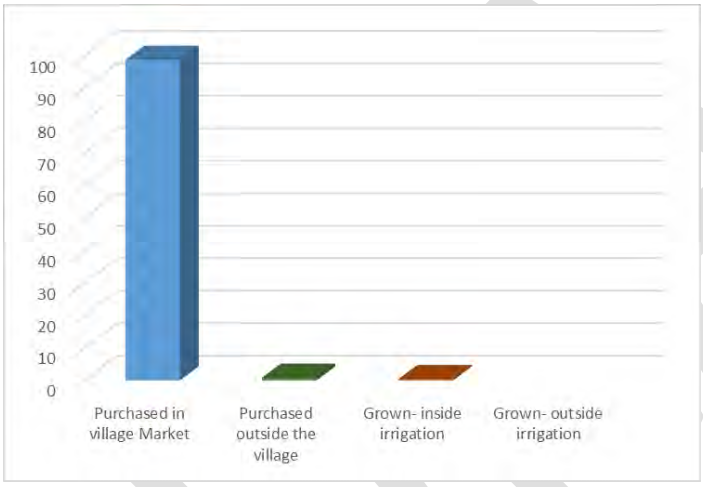

Figure 5. Sources of food items consumed by researchers (%)

Majority of the food items consumed were purchased with 98% (figure 5), the same trend observed from the 1st cycle of data collection. The very low number of food items reported that were sourced from home production may imply that researchers were unable to continue growing food because of the monsoon season. Note that two researchers who continued indicated consuming food from home food production-inside the irrigation area in the 1st cycle but not in the 2nd cycle.

Moreover, fish was the only food item reported as grown inside the irrigation area or caught from inside irrigation.

Discussions

Next to rice, fish is widely consumed in Myanmar which contributes at least 50% of animal protein in the diet (Belton et al, 2015). The Ayeyarwady Delta where Kyonkadun, Pyapon is situated has the highest consumption of fish in the country with 19.4-25.1 kg/capita/ year in the country (ibid). From the community meeting, it was indicated by the village researchers that the fish consumed was sourced from aquaculture and capture fishery, pointing out that those who live inside the irrigation area are consuming more wild fish when compared to those living in the village because of the available water in the channel. However, this is not the case during dry season (February to April) when water is low and there is scarcity of fish, which implies the food accessed for consumption is dependent on the season.

The poor diversity of diets among researchers reflects issues on affordability and accessibility of certain foods. They indicated that having homestead gardens whether it is a large or small portion of land can support

diversifying their diets, especially for those who live inside the irrigation area where gardens are situated, they added that once a farmer cultivates their land and plant diverse vegetables and crops, there is a higher likelihood that they will get a variety of foods for consumption. Similarly, studies by Hirvonen & Hoddinott (2014) in rural Ethiopia, Jones (2017) in Malawi and Islam et al (2018) in rural Bangladesh supports that diverse food production at home increases dietary diversity. But in most cases, according to the researchers, farmers do not have diverse produce, and for those who live inside the village, they lack the space to grow food, hence, they rely on the market to purchase food for consumption which is also revealed in the study. At the market, there is less variety of food available and it is usually expensive, so they stick to monotonous diets.

Although the study results suggest that during mid monsoon season, there is lower diversity of food consumed by the three researchers who continued to participate, they were unaware of this shift in consumption patterns. When probed further, one of the researchers mentioned that during the second cycle of data collection, he stayed more often in the village because of work---eating less variety of food when compared to living with his family inside the irrigation area. Hence, affecting the results for the 2nd cycle.

The use of food photography and software application in collecting data for this study are novel approaches for village researchers, they stressed that it is more appealing and applicable for younger generation because they are tech-savvy and have considerable amount of free time because of fewer workload compared to older farmers. Studies by Volpe (2018) and Fasseta (2016) revealed the applicability of digital photo diaries for young individuals. Meanwhile, the three researchers have different preferences regarding the use of viber phone application versus kobo application software. One person favored viber application because it gives notification that photos were sent, while kobo application does not, adding that sending questionnaire in kobo with poor internet connection is cumbersome. For the other researcher, using kobo application is faster because after taking photo no writing is necessary, just ticking of boxed and uploading the questionnaire online. While the 3rd researcher did not have any preferences of which software to use because his grandchildren were helping him in the whole process of data collection. These accounts demonstrate the applicability of using photo and technology in low resource settings to collect daily food intake data of individuals; studies revealed that photos are better method because it is faster and has minimal errors when compared with food recall (McClung et al, 2017, Blair et al, 2018).

For the researchers, at the end of the study, the experience provided them valuable information on the variety of food that needs to be consumed every day to improve nutrition. Additionally, the exercise of collecting photos of their food became a reflective analysis of their food eating patterns which can support modifying their behavior towards adopting nutritious diets, similar to the study by Blair et al (2018). However, challenges remain to translate knowledge into practice, since it remains difficult to have a diverse diet, equivalent to a nutritious diet, because it is inaccessible and unaffordable for many. A recent report by the World Food Programme, “Fill the Nutrient Gap Analysis of Myanmar” revealed that only four out of ten households are able to afford a diet that meet the nutrient needs (WFP, 2019).

When conducting the study, multiple challenges were encountered by the researchers and the study team; 1) Non-consistent food journaling (e.g. no daily entry, incorrect entry in the questionnaire) among the researchers, it could be because it is voluntary and has no incentive, as well as the lack of training which reduced the adherence affecting the quality of the data, 2) Poor internet connection that slows down the researcher when collecting data and thus may have led to reduced interest---which explains the inconsistent entries, and 3) Poor quality image making it difficult to visualize the photos thus can affect tallying the Minimum Dietary Diversity for Women score.

Implications of the study

There are few implications of this study;

1) From the experience, we challenge for future discussion if collecting data for a longer period of time to reflect the consumption patterns of few individuals is a better approach than to use a one-time interview by 24-hour recall for a large population in the MDDW tool, as well as question the appropriateness of the tool since only one out of 9 respondents reached the minimum diversity score. Thus, a future study of a larger sample size in the same season and location is needed to verify the results using a standard of one-time 24-hour recall as per the guideline

2) By keeping on file the photos collected, it can support providing visual information on the current diets of a community in the Ayeyarwady Delta, which can be of value to the National Nutrition Centre and the Food and Agriculture Organization of the United Nations (FAO) since they are currently developing a food based dietary guideline and healthy food plate guide for the Myanmar population,

3) By using a participatory action research approach, we were able to build on local knowledge together with the individuals that we were engaged in, providing them an opportunity to make decisions on what works best, as well as take action on their new learning, thereby creating ownership and feeling of being empowered.

Conclusion

The study demonstrated the applicability of using photos and software applications to document diets among rural individuals in Myanmar. Moreover, it is appropriate for young people as target respondents because of its contemporary or the modern element of the study. By pursuing this method, it is recommended to provide appropriate training to ensure good quality data and conduct consultation meeting with the respondents (the village researchers) to enable co-construction of knowledge, and for them to be able to reflect on the experience which can contribute to developing an empowered individual who can support in identifying solutions for their communities.

Acknowledgements

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Focus Group Discussion and Key Informant Interview Guideline

Below is a list of topic to explore during the FGDs and KII with different stakeholders. Each case study will have some specific constraints and topics to explore, therefore FGDs and KII need to be tailored to the case. The list below is indicative and team leaders need to update the list based on the context and the outputs of workshop and background information analysis.

Each FGD/KII should not exceed 1.5 hour, hence a special attention should be given to not asking question already answered in the Workshop, unless we need to in-depth the information such as the main weakness/constraints identified during the workshop.

For each topic, some specific questions relates to the creation of Fisher Group managing lease. Those topics should be asked only for case studies in areas where those groups have been formed and operate the fishery. It is not relevant in the traditional lease system. In the case of newly formed groups it is necessary to conduct FGDs and KII in a way that the information collected highlight and identify the changes in management and (positive AND negative) outputs and outcomes related to those changes.

The column on the right indicate which whose stakeholder group the topic should be explore. We define:

- Lease/sublease, as the lease owner representative, it could be an individual (KII) or a group of person (FGDs);
- Fishers of the lease, as fishermen fishing inside the studied area either private owned lease or co-management lease;
- Fishers outside of the lease are fishers in the village that are not allowed to fish inside the individual lease fisheries management system because they are not selected
- Fisher Group Committee correspond to representatives of Fisher Group that operate a leased area or a tender;
- DoF correspond to local DoF representative in charge of the studied area;
- Local authorities correspond to the local authority of the village or village track where the studied area belongs;
- Trader/collectors/retailers are local fish traders involved in marketing fish sourced in the studied area.
- Women/gender group corresponds to women and men involved in the fisheries supply chain
- Private Sector (processors, aquaculture, and farmers) – corresponds to SME and commercial businesses relevant to fisheries

A. Recent changes in the management of local fisheries and how changes are made	FGD/KII
Can you tell us the history of the fisheries management system in the last 10 years in your area (How the fisheries management was established, who organized, etc.)? and focus on • Main changes in management system and fishing technique • How (and by who) the changes were decided?	✓ Fishers of the lease ✓ Fishers outside of the lease ✓ Fisher Group Committee ✓ Lease/sublease owner
Specific to case study with a recent change from lease to Fisher Group/ co-management	
Why DoF / local authorities decided to support the change from private lease to Fisher Group lease? • Can you explain why and what are the reasons behind this decision? • Who made the decision for this change?	✓ DoF/local authorities
B. **Current Management system – How fisheries is managed today?**	
• Can you explain the rules and regulations of the fisheries (access fee, closed season, protected area, fee collection)? • Who develop the regulations and rules of the current fisheries management system? • Who take decision regarding the management of the fishery resources? • Are women and poor involved in the management and regulation development? • Do you think these regulations and rules are being implemented/enforced in this current fisheries management system?	✓ Fishers of the lease ✓ Fishers outside of the lease ✓ Fisher Group Committee ✓ DoF/government ✓ Lease/sublease owner ✓ Gender (woman)

B1.Access rights and access control
• Who control the access to the fishery resources?
  • Explain in details the access rules?
  • Who cannot access? And who can access?
  • If you cannot access – explain why.
• What do you think about access right? Is it fair, too restrictive, too open?
• How illegal fishing is controlled?
  • Give trend since 5 years on how the intensity/pressure of illegal fishing. Give a quantitative indicator of conflict/ arrest of illegal fisher
  • If not performing well, please explain why?
  • If performing well, please explain why?	

B2.Specific to case study with a recent change from lease to Fisher Group/ co-management	

• What was the revenue from the lease before the Fishery Group (2014-2015) and now (floor price)
• Under lease and sub-lease type of management: Who was fishing and who got access to the resources
• How much was the access rights?
• And how to get access to the resources – how to be connected to the sub-lease holder?
• Currently with the new system:
  • For the local fishermen, does it change something in terms of access or just the cost (fee of access)? Is it the same fisher that fish the area compare to before?
  • With the Fisher group/co-management approach:
  o How does the fee is collected?
  o How the purchase of license is controlled?
  o Does closed season is respected?
  o How illegal fishing is controlled? How is illegal fishing compared to previous management system (private lease)
• Does this new management system should continue?
• Does some rules and/or organisation of the system should be changed?
• What rules and/organisation of the system is very important to make it sustainable? What are the main risk to fail?
 	
• <u>Specific Respondent</u> : fisher not member of Fisher Group :
  • Why are you not part of the Fisher Group? (Explains – give detailed reasons)
	✓ Fishers of the lease
	✓ Fishers outside the lease
	✓ Fisher Group Committee
	✓ DoF/government
	✓ Lease/sublease owner

C. Performance of Fisheries management system	

C1. Productivity
• Based on your own observation, are fisher's catch increased or decreased in the last five years?
  • Can you provide us an estimated catch in 2013 (tons per fisher per day in peak seasons? Or provide units);
  • Present (tons per fisher per day in peak seasons? Or provide units)?
  • What are the reasons of this trend increase/decrease)?
	✓ Fishers of the lease
	✓ Fishers outside the lease
	✓ Fisher Group Committee
	✓ Lease/sublease owner
	✓ Traders/retailers
	✓ Processors
	✓ Gender (woman)

Access and access rights (see questions above in the "Current management section- B1)	✓ Fishers outside the lease ✓ DoF/government

Specific questions related to r<u>estricted access</u> due to conflict with agriculture/aquaculture
• *In case access to fishing ground is limited or totally banned because of dikes/fence from aquaculture and rice farming:*
  • *Can you explain the issue (why, when, who) and how important it is for fish catch and income from fisheries?*
  • *Does it generate conflicts?*
  • *What does DoF do to mitigate the conflict?*
  • *What does Local authorities do to mitigate conflict?*
  • *What does Fisher Group do to mitigate conflict?*
	✓ Fisher Group Committee
	✓ Lease/sublease owner
	✓ DoF/ Local authorities

C2. Income & revenue from fisheries	

• Can you give an estimate of revenue generated by fisheries for average full time fishing HH? • Within HH portfolio, how much fisheries represent of the total income? • What are the types of fishing gears used in the lease area? Provide the license price of each of the gear. • What are the fish species caught in the lease area? Provide the price of each fish species/viss?	✓ Fishers of the lease ✓ Fishers outside the lease ✓ Fisher Group Committee ✓ Lease/sublease owner ✓ Traders/retailers ✓ Processors ✓ Gender (woman)
C3. Benefit Sharing	
• What do you think about fisheries resource sharing under the current management system? • Is it equitable? • If not, which stakeholder group benefit most • Which one benefit less? • Does poor and women benefit from the system • What should be modified to make it more equitable?	✓ Fishers of the lease ✓ Fishers outside the lease ✓ Fisher Group Committee ✓ Lease/sublease owner ✓ Traders/retailers ✓ Processors ✓ Gender (woman)
C4. Conservation	
• How does the management system contribute to the conservation of fish stock? • Any Protected area or Re-stocking activities • Since when it was implemented? Describe activity and characteristic of the conservation practice. • What type of species used to restock the lease? • How does it influence fish stock and biodiversity compared to before without protected area/stock enhancement? • Any species disappeared • Any new species are now more abundant? • Why , what are the underlying reason behind disappearance of species?	✓ Fishers of the lease ✓ Fisher Group Committee ✓ Lease/sublease owner ✓ DoF/ Local authorities
Specific to case study with a recent change from lease to Fisher Group/ co-management	
• How does the new management system contribute to species diversity? • Any species disappeared or at contrary new species are now more abundant with the new system in place? (need to adapt the question if system never changed?) • Why, what are the underlying reasons behind disappearance of species?	✓ Fisher Group Committee ✓ DoF/ Local authorities
C5. Trading and financial services	
Can you explain how fish is traded: • How many collectors / informal contract between fisher and collector (access to loan/payment of fishing gear/ selling at low price etc.…) • Describe contractual relationship between fishers and collectors. • What are the volume and commodities/species traded from this fisheries • What are the main seasonal specificity in terms of volume /species • What is the trend of trade (volume and price) • What are the species with high demand (and by whom)? Are they new? • What is/are the destination(s) of the product • How to improve selling price for fisher? What could be done? Access to loans: • How is access to financial service (to purchase fishing gears for example) for fishermen? • Describe the type of contract between money lenders and fisher • Is it linked to trading/trader/ lease or sub-lease?	✓ Fishers of the lease ✓ Fishers outside the lease ✓ Traders/retailers ✓ Lease/sublease owner (collector) ✓ Processors ✓ Aquaculture farmers ✓ Gender (woman)
Specific to case study with a recent change from lease to Fisher Group/ co-management	
• Does the new management with a Fisher Group changed/modified financial services and access to financial services? • Does the new management system with a Fisher Group changed/modified trading of fish?	✓ Fishers of the lease (FG) ✓ Fisher Group Committee ✓ Traders/retailers

For you: does Fisher Group is efficient from trading point of view? • What the positive/merits of the system • What the barriers and point where the system can improve.	
Barriers	
• What do you think are the barriers to the sustainable management and development of the fisheries in the lease area? • What are the possible solutions?	✓ Fishers of the lease (FG) ✓ Fisher Group Committee ✓ Traders/retailers ✓ DoF/ Local authorities
C6. Woman/gender group	
• How women are involved in the lease? What activities they can be involved with? • What is the difference in the involvement of men with the current system compared with the involvement of women? • How the benefit is shared between women and men with in the household? • Aside from you, is there any member of your family involved in the current lease management system (fisher, collector, and processor)? • Do you think you can be a sub-lease owner/leader of CFG? If yes, why? If not, why? • Have you been involved in fishing with your husband before? If No, why? • How women benefits in this type of lease management system? • Is there any connection between the sub-lease owner and collector as women? Are they given priority than men? In your case? How?	✓ Gender (woman) ✓ Women Association
C7. Aquaculture	
• How long you have been doing aquaculture in the area? • How did you avail the area for aquaculture? Please provide us a short history, including licensing with the government. • Can you describe your aquaculture investment? Type of investment (small or commercial), what is the current investment, type of fish cultured, source of fingerlings, period of culture, income per year (net)? • What are your plans for your aquaculture business in the next five years? • Do you think there is any effect or impact your aquaculture activities in the capture fisheries or lease area? Why? • What are the possible solutions/mitigations if there is impact to capture fisheries? • What are your recommendations to sustain capture fisheries in the lease area?	✓ Aquaculture farmers

• Add Central Weaknesses/Constraints identified during workshop (Top 3)
  • Explain the underlying constraints;
  • Explore solutions based on his/their own perception
 	
• Explore solutions/entry point mentioned in the workshop.
  • How they can lift constraints?
  • What does it requires implementing those solutions?
  • Who are the main actors/responsible to solve those weakness/constraints?
	✓ Fishers of the lease
	✓ Fishers outside the lease
	✓ Traders/retailers
	✓ Lease/sublease owner (collector)
	✓ DoF/ Local authorities
	✓ Processors
	✓ Aquaculture farmers
	✓ Gender (woman)

Ayeyarwady Region (MMR017)				
Sr	Name of the Leasable Fisheries	Area of the Lease (Acre)	1993-94 Lease value (Kyat)	MIMU Code
	Kyonpyaw Township			**MMR 01 7005**
1	Kyon Ka Dun	92	350,000	**152037**
2	Nat Chaung	25	40,000	**157390**
3	Kyon Kwe	12	5,000	
4	Than Lyat Sun	20	20,000	
5	Thaung Gyi	15	8,500	**162216**
6	Wea Gyi	30	76,000	**163103**
7	Ma Gyi La Hae	125	500,000	
8	Myo Gyi Pya Thar gyi	34	72,000	
9	Paik Taw	50	95,100	**159021**
10	Pyin Ma Pin Hla	96	357,000	**159658**
11	Nat Sin Ngu	52	125,000	**151359 / 161841**
12	Doke Yaik	29	37,500	**151333**
13	Taw Win	33	60,000	
14	Daik Pyet Tar Kyin (Ywar Ma)	2	500	**151328**
15	Kyon Kha Yin	14	15,000	**161900**
16	Eik Ka Dut Chaung	37	85,000	**MMR01 7005 045**
17	Ah Htaung (Ywar Ma)	14	5,000	**150062**
18	Chin Hlyar	16	8,000	**151215**
19	Kyar Man	120	460,000	**150773**
20	Pauk Tha Myauk			
21	Inn Ye' Gyi	640	2,000,000	**153176**
22	Ah Htet Da Ka	28	32,000	
23	Baw Zoke	125	550,000	**150765**
24	Ga Nein	131	562,000	**151599**
Ayeyarwady Region				

Sr	Name of the Leasable Fisheries	Area of the Lease (Acre)	1993-94 Lease value (Kyat)	MIMU Code
	Kyonpyaw Township (cont)			
25	Eik Ka Dut Chaung Phyar	170	607,000	**MMR01 7005 045**
26	Kyon Ta Nee	37	68,000	**155963**
27	Ga Yet Hla	52	101,000	
28	Shar Khae Gyi	53	102,850	**160239**
29	Shar Khae Lay	11	6,050	**160239**
30	Man Set Ku	68	174,240	**157386**
	Kyaungone Township			**MMR01 7007**
1	Auk Da Ka	205	818,000	**159706**
2	Ah Pin Nhit Se (Upper)	87	315,000	**152046**
3	Pyant Gyi	150	620,000	
4	Kyee Aing	85	309,000	**155119**
5	Dar Lal Kwin	14	18,000	
6	Laung Taing	12	13,000	**159998**
7	Kin Mon Chon	70	150,000	
8	Yae Ma Gyi Chaung	260	940,000	**153872**
9	Nga Phae Aung Pine	12	10,000	
10	Htan Chaung Ah Twin	83	250,000	
11	Ah Pin Nhit Sae (Lower)	78	210,000	**152046**
12	Ah Lal Da Ka	79	220,000	**159706**
13	Nga Bat Chaung	128	520,000	
14	Kyee Taw	91	363,000	**153749**
15	Kone Sa Bae Yone	276	1,240,000	**159705**
16	Sa Khan Gyi	87	300,000	
Ayeyarwady Region				

Sr	Name of the Leasable Fisheries	Area of the Lease (Acre)	1993-94 Lease value (Kyat)	MIMU Code
	Kyaunggone Township (cont)			**MMR01 7007**
17	Between Gon Min & Ah Pin Nhit Sae	2	200	**151714 / 155720**
	Tar Kyin			
18	Ka Nyunt Aing	175	700,000	
19	Ma Gyi Zin	86	300,000	**163606**
20	Ah Pin Hnit Sae & Yoe Da Yar Dat	10	5,000	**152046 /**
	Tar Kyin			
21	Between Gon Min & Gon Min Yoe	27	52,000	**151714**
	Tar Kyin			
22	Ka Nyin Chaung	14	17,100	
23	Chaung Phyar	65	165,000	
24	Nyaung Chae Htaut	60	160,000	
25	Tin Chae	35	77,000	
26	Tu Myaung	83	257,500	**154831**
27	Ma Yan Yoe (Kone ?)	26	51,000	**163141**
28	Yae Tar Gyi	67	165,000	**163444**
29	Hlay Lone Aing	29	71,000	
30	La Har Kyike	266	1,199,000	
31	Thae Kon	56	110,000	**162343**
32	Ah Shey Chaung	93	325,600	**150277**
33	Htein Ta Pin	54	136,700	
34	Htein Ta Pin (Upper)	56	143,000	
35	Htein Ta Pin (Mouth)	115	462,110	
36	Thin Gan Chaung (Kone ?)	101	385,000	**154659**
Ayeyarwady Region				

Sr	Name of the Leasable Fisheries	Area of the Lease (Acre)	1993-94 Lease value (Kyat)	MIMU Code
	Myaungmya Township			**MMR017014**
1	Myitkyo Htone	16	12,705	**161844**
	Einme Township			**MMR01 7015**
1	Kyun Kyar Kut Phae Chaung	32	71,390	
2	Kyon Da Yei (Lower)	56	127,050	**150422 / 158785**
3	Kyon Da Yei (Upper)			**150422 / 158785**
4	Kyon Put (Lower)			
5	Pyin Ma Win Lo			
6	Hlae Seik			**152042**
7	Lel Taw Chaung	13	36,500	**156866**
8	Thit Ngout To inn	34	88,000	
9	Kyon Pa Di (North)	51	100,500	**152770**
10	Kyon Pa Di (South)	14	18,600	**152770**
11	Kyon Kauk	25	49,000	**152651**
12	Ka Man Gyi (Upper)	22	32,500	**153283 / 153284**
13	Ka Man Gyi (Lower)	55	13,000	**153283 / 153284**
14	Ka Man Ka Lay	16	15,000	**153283 / 153284**
15	Kyon Put Ka Thit Inn	63	169,000	
16	Chan Chaung Inn	54	130,000	
17	Htein Chaung Inn	27	68,000	
18	Kyon La Mu Ma Gyi Chaung	23	28,000	**157076 / 157072**
19	Ma Gyi Chaung Wa	27	40,000	**157072**
20	Kyon La Mu Inn	10	8,000	**157076**
21	Boe Aung Ni	33	70,500	**150331**
22	Kyon Ka Ni Inn	55	110,500	**155747 / 155820**
23	Boe Gyi Hlaw	26	37,000	**150872**
Ayeyarwady Region				

Sr	Name of the Leasable Fisheries	Area of the Lease (Acre)	1993-94 Lease value (Kyat)	MIMU Code
	Einme Township (cont)			**MMR01 7015**
24	Twin Gyi Zee Phyu Kone	10	8,500	**154847**
25	Moe Hein U To Inn	77	205,000	**160837**
26	Ta Kaw Inn	29	55,000	**160834**
27	Kyon Ka Bo Inn	48	88,000	**161689**
28	Pwae Sar Pa Tet Inn	96	340,000	**159474 / 218682**
29	Kyon Tone Inn	65	150,000	**158917**
30	Kyon Ta Loat	14	12,500	**155931**
31	Pha Yar Chaung Inn	30	60,000	**160990**
32	Taw Chaung Gyi Inn	35	75,000	


ဧရာဝတီတိုင်းဒေသကြီး
မအူပင်ခရိုင်ငါးလုပ်ငန်းဦးစီးဌာန
မအူပင်ခရိုင်အတွင်းရှိ အင်းများအတွင်း ငါးမွေးကန်
စာရင်းများ အစစအရာ

ငါးကန်ဆက်စပ်အင်း (၅၈)အင်း ဖြစ်ပေါ်လာမှု အခြေအနေ

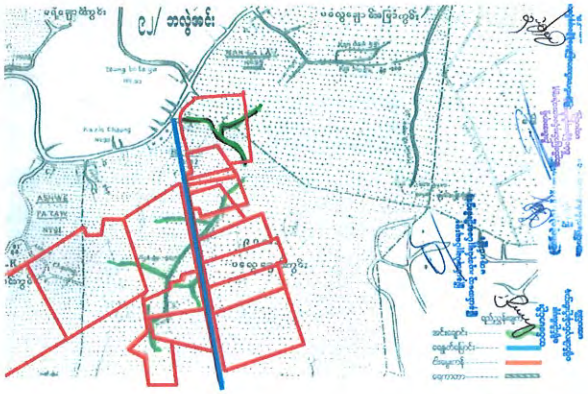
မအူပင်ခရိုင်၊ မအူပင်မြို့နယ်အတွင်းရှိ ဂရန်အင်းများအတွင်း၌ ငါးမွေးကန်များဖြစ်ပေါ် တည်ရှိခဲ့မှုအခြေအနေမှာ နိုင်ငံတော်အေးချမ်းသာယာရေးနှင့် ဖွံ့ဖြိုးရေးကောင်စီလက်ထက် (၁၉၉၆-၁၉၉၇) ခုနှစ်လက်ထက်က မြေအောက်ရတနာမြေ ဖော်ထုတ်ရေး အစီအစဉ်ဖြင့် တိုင်းရင်းသား လုပ်ငန်းရှင် ကုမ္ပဏီများအား ရေနက်ကွင်းဒေသများရှိ မြေလွှတ်မြေရိုင်းများကို လုပ်ကိုင်ခွင့်ပြုခဲ့ပြီး စိုက်ပျိုးရေးလုပ်ငန်းများကို လုပ်ကိုင်ဆောင်ရွက်စေခဲ့ပါသည်။

တိုင်းရင်းသားလုပ်ငန်းရှင် ကုမ္ပဏီများကို အနည်းဆုံး မြေဧရိယာ (၅၀၀၀)ဧက စိုက်ပျိုးလုပ်ကိုင်ခဲ့သည့် ကုမ္ပဏီများကိုသာ ပြည်ပသို့ ဆန်စပါးတင်ပို့ရောင်းချခွင့် ပြုခဲ့ပါသည်။ ကုမ္ပဏီများမှ မြေလွတ်မြေရိုင်များကို အကောင်အထည်ဖော်၍ စိုက်ပျိုးရေးလုပ်ငန်းအား သီးသန့်လုပ်ကိုင်ဆောင်ရွက်စေခဲ့ရာ ဆုံးရှုံးမှုနှင့် အရှုံးများဖြစ်ပေါ်လာသဖြင့် နိုင်ငံတော်မှ စပါးစိုက်ပျိုးရသည့်နေရာများကိုစပါးစိုက်ပျိုးစေ၍စပါးစိုက်ပျိုးရန်အခက်အခဲရှိသည့် ရေနက်ကွင်းဒေသအတွင်း ငါးမွေးမြူရေးလုပ်ငန်းအား တွဲဖက်လုပ်ကိုင်ရန် ခွင့်ပြုဆောင်ရွက်ခဲ့သဖြင့် ၂၀၀၀-၂၀၀၁ ခုနှစ်မှစ၍ ကုမ္ပဏီလုပ်ငန်းရှင်များမှ ငါးမွေးမြူရေးလုပ်ငန်းများအား ပြောင်းလဲလုပ်ကိုင်ဆောင်ရွက်လာခဲ့ခြင်းကြောင့် အင်းနယ်မြေများအတွင်း ငါးမွေးကန်များ ပြောင်းလဲဖြစ်ပေါ်တည်ရှိလာခြင်း ဖြစ်ပါသည်။

မအူပင်မြို့နယ်ရှိ ငါးမွေးကန်ဆက်စပ်အင်း (၅၈)အင်းမှ (၂၀၁၇-၂၀၁၈) ခုနှစ် ရရှိအင်းခွန်ငွေစုစုပေါင်းမှာ (၁၅၁၅၉၄၉၄၁/-)ကျပ် ဖြစ်ပါသည်။

၉၂/ဘလွဲအင်း

၁



မှတ်ချက်။ ။ အင်းနယ်မြေ ဘလွဲတူးမြောင်း (၁၀%) သာကျန်ရှိ။

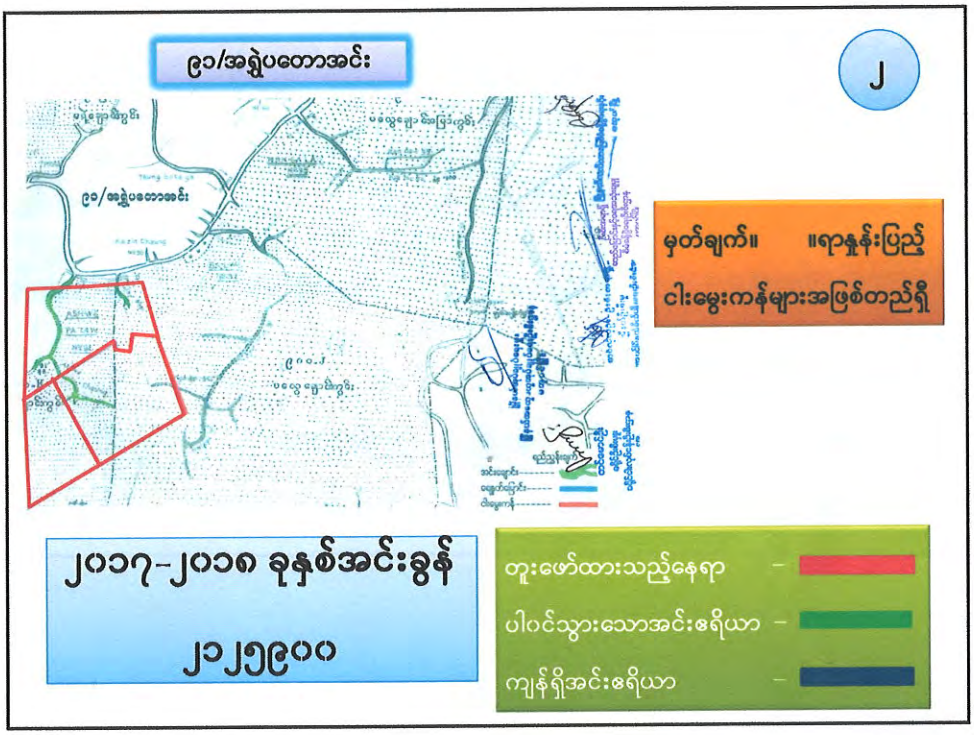
၂၀၁၇-၂၀၁၈ ခုနှစ်အင်းခွန်

၇၇၃၁၀၀

တူးဖော်ထားသည့်နေရာ –

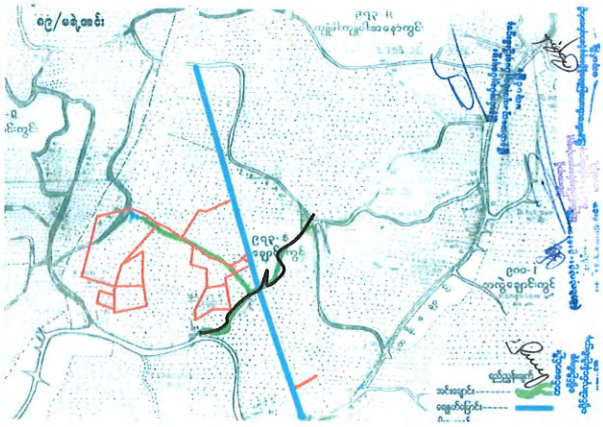
ပါဝင်သွားသောအင်းဧရိယာ –

ကျန်ရှိအင်းဧရိယာ –


၉၁/အရွဲပတောအင်း
J
မှတ်ချက်။ ။ရာနှုန်းပြည့်
ငါးမွေးကန်များအဖြစ်တည်ရှိ
၂၀၁၇-၂၀၁၈ ခုနှစ်အင်းခွန်
၂၁၂၅၀၀
တူးဖော်ထားသည့်နေရာ
ပါဂင်သွားသောအင်းဧရိယာ
ကျန်ရှိအင်းဧရိယာ

၉၉/မရဲ့အင်း

၃



မှတ်ချက်။ ။ ကန်ပတ်မြောင်း နှင့် ကုန်ထုတ်မြောင်းမပါ။ အင်းဧရိယာ(၂၀%)သာကျန်ရှိ။

၂၀၁၇-၂၀၁၈ ခုနှစ်အင်းခွန်

၈၈၅၀၀

- တူးဖော်ထားသည့်နေရာ –
- ပါဝင်သွားသောအင်းဧရိယာ –
- ကျန်ရှိအင်းဧရိယာ –

၂၃/ထနီးကလေးအင်း

၄

၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၂၀၉၄၀၀

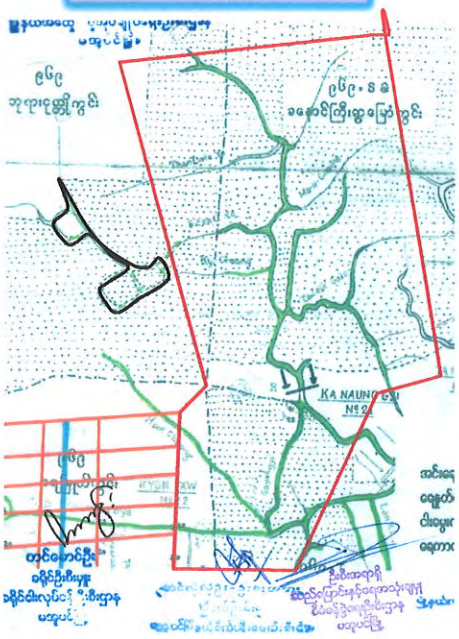
တူးဖော်ထားသည့်နေရာ –

ပါဝင်သွားသောအင်းဧရိယာ –

ကျန်ရှိအင်းဧရိယာ –

မှတ်ချက်။ ။ကန်ပတ်
မြောင်းနှင့် ကုန်ထုတ်
မြောင်းမပါ၊အင်းဧရိယာ
(၁၀%)သာကျန်ရှိ၊

၂၁/ခနောင်ကြီးအင်း



၅

၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၁၂၈၅၁၀၀

မှတ်ချက်။ ။ကန်ပတ်မြောင်းနှင့်ကုန်ထုတ်
မြောင်းမပါ၊ အင်းဧရိယာ(၃၀%)သာကျန်ရှိ၊

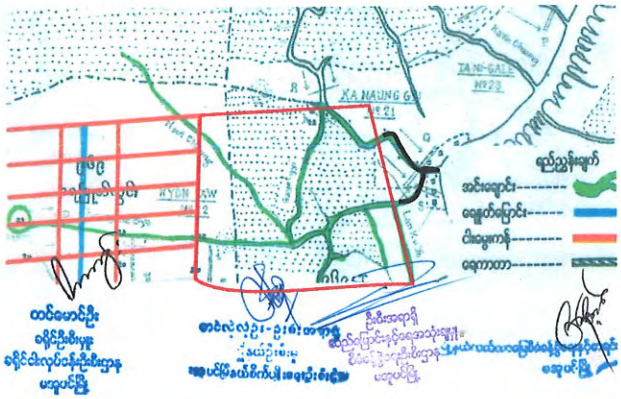
တူးဖော်ထားသည့်နေရာ –

ပါဝင်သွားသောအင်းဧရိယာ –

ကျန်ရှိအင်းဧရိယာ –

၂၂/ကျုံတော်အင်း

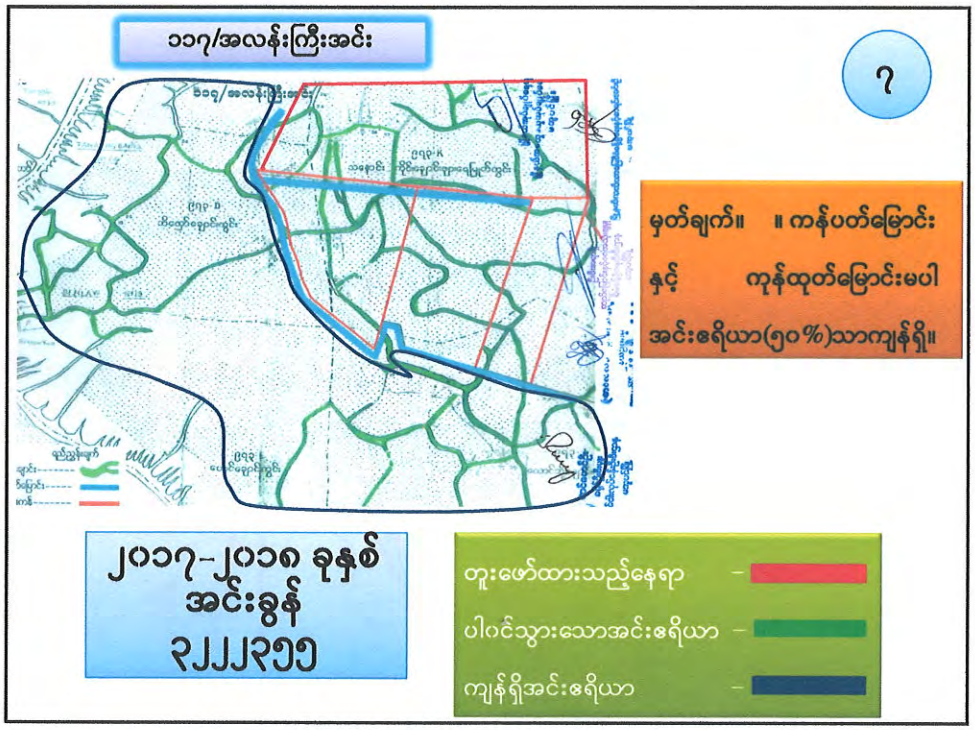
6

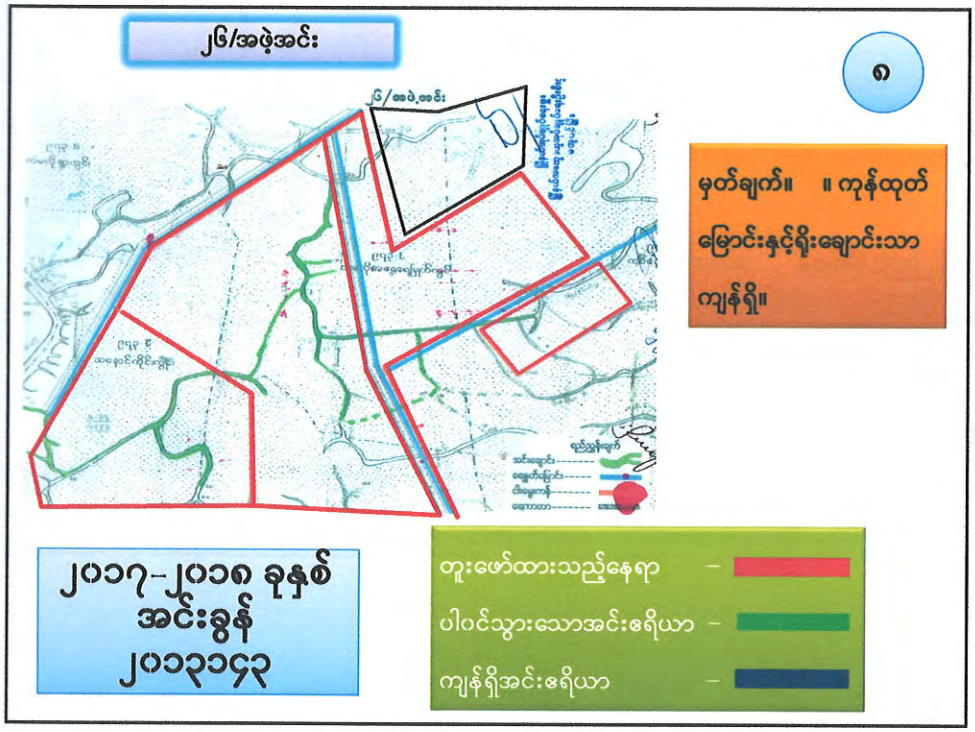


မှတ်ချက်။ ။ ကန်ပတ်မြောင်းနှင့်ကုန်ထုတ်မြောင်းမပါ၊ အင်းဧရိယာ(၂၀%)သာ ကျန်ရှိ

၂၀၁၇-၂၀၁၈ ခုနှစ် အင်းခွန် ၁၁၂၇၃၇

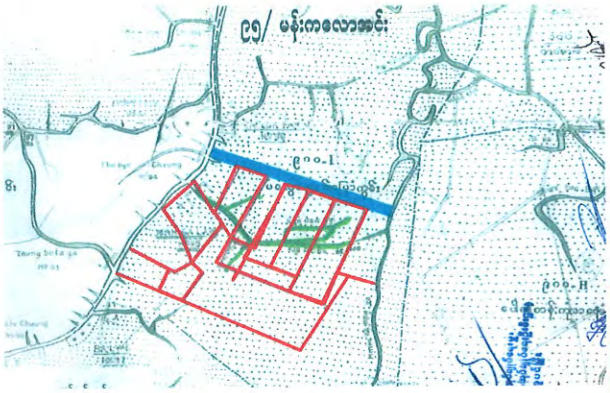
တူးဖော်ထားသည့်နေရာ	–	
ပါဂင်သွားသောအင်းဧရိယာ	–	
ကျန်ရှိအင်းဧရိယာ	–	


၁၁၇/အလန်းကြီးအင်း
?
မှတ်ချက်။ ။ကန်ပတ်မြောင်း
နှင့် ကုန်ထုတ်မြောင်းမပါ
အင်းဧရိယာ(၅၀%)သာကျန်ရှိ။
၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၃၂၂၂၃၅၅
တူးဖော်ထားသည့်နေရာ –
ပါဂင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –


၂၆/အဖဲ့အင်း
၈
မှတ်ချက်။ ။ ကုန်ထုတ်မြောင်းနှင့်ရိုးရောင်းသာကျန်ရှိ။
၂၀၁၇-၂၀၁၈ ခုနှစ် အင်းခွန် ၂၀၁၃၃၄၃
တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –

၉၅/မန်းကလောအင်း

၉



မှတ်ချက်။ ။ ရာနှုန်းပြည့်ငါးမွေးကန်များအဖြစ်တည်ရှိ။

၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၄၈၅၈၀၀

ကူးဖော်ထားသည့်နေရာ –

ပါဂင်သွားသောအင်းဧရိယာ –

ကျန်ရှိအင်းဧရိယာ –

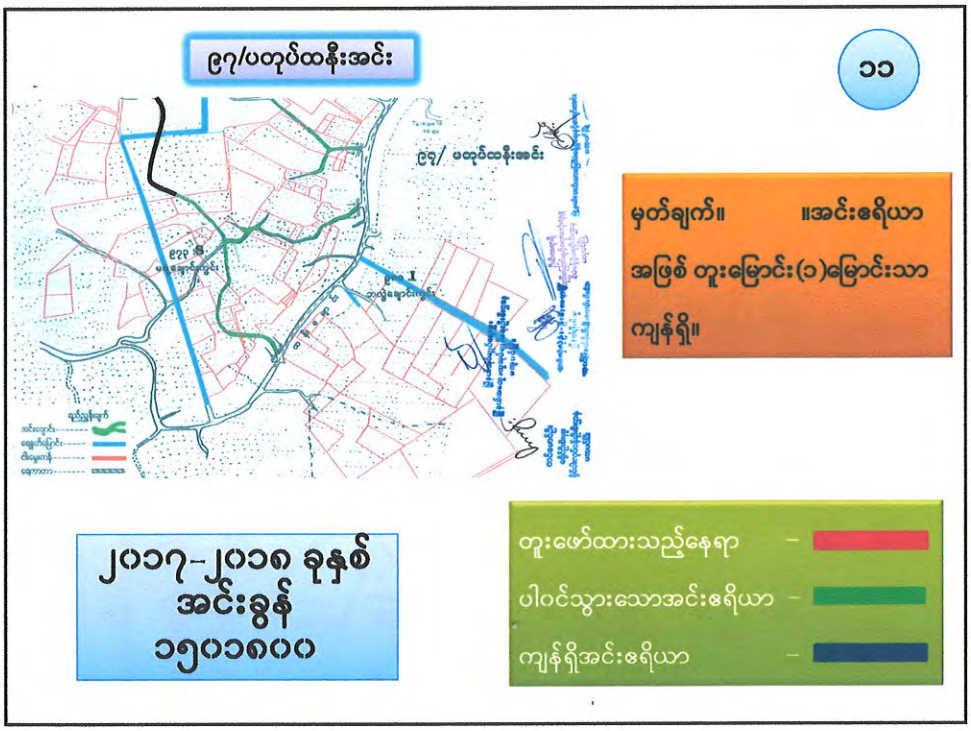
၁၀၈/ကျုံဝါးအင်း

၁၀

၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၁၇၇၁၆၀

မှတ်ချက်။ ။ အင်းနယ်အဖြစ် ခတ္တိယ
မိုးမခတူးမြောင်းနှင့် သောင်ကားကွင်း
အင်းနယ်ကျန်ရှိ။

တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –


၉၇/ပတုပ်ထနီးအင်း
၁၁
၉၇/ ပတုပ်ထနီးအင်း
မှတ်ချက်။ ။အင်းဧရိယာ
အဖြစ် တူးမြောင်း(၁)မြောင်းသာ
ကျန်ရှိ။
၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၁၅၀၁၈၀၀
တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –

၁၈/ပလောင်အင်း

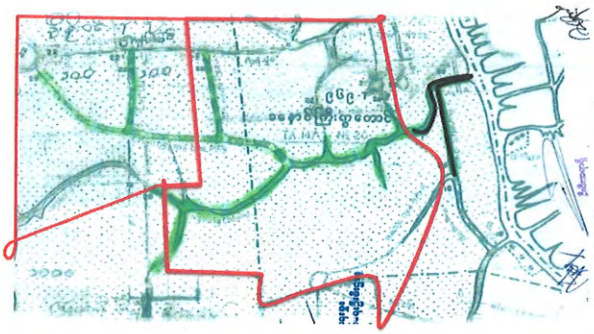
၁၂

၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၃၃၈၂၁၀၀

မှတ်ချက်။ ။အော့ဒ်ချက်ကုမ္ပဏီ
လုပ်ကိုင်ခွင့်ရဧရိယာအတွင်း(၂၀%)သာ
ကျန်ရှိ

တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –

၂၀/တမာအင်း



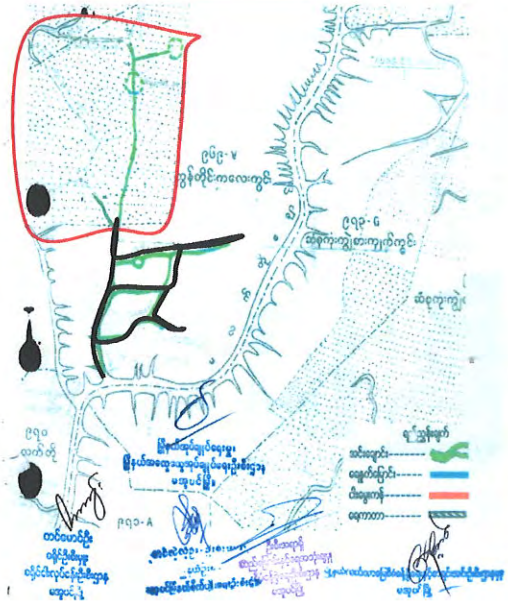
၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၂၅၀၈၅၀၀

မှတ်ချက်။ ။ ကန်ပတ်မြောင်းနှင့် ကုန်ထုတ်
မြောင်းမပါ၊ အင်းဧရိယာ(၁၀%)သာကျန်ရှိ ။

တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –

၁၄/တဝမ်းကလေးအင်း

၁၄



၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၅၃၁၅၀၀

မှတ်ချက်။ ။ ကန်ပတ်မြောင်းနှင့်
ကုန်ထုတ်မြောင်းမပါ၊
အင်းဧရိယာ(၅၀%)သာကျန်ရှိ ။

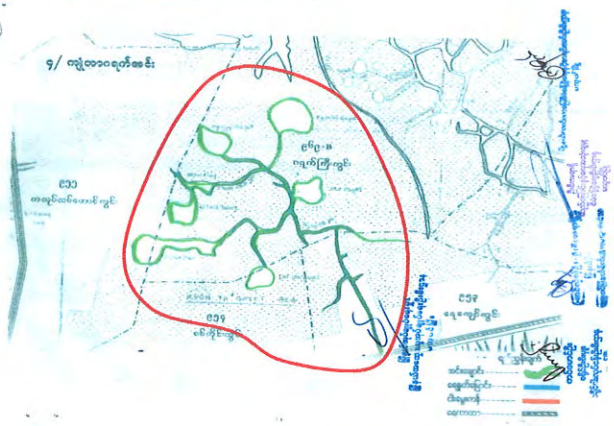
တူးဖော်ထားသည့်နေရာ –

ပါဂင်သွားသောအင်းဧရိယာ–

ကျန်ရှိအင်းဧရိယာ –

၄/ကျုံတာဂရက်အင်း

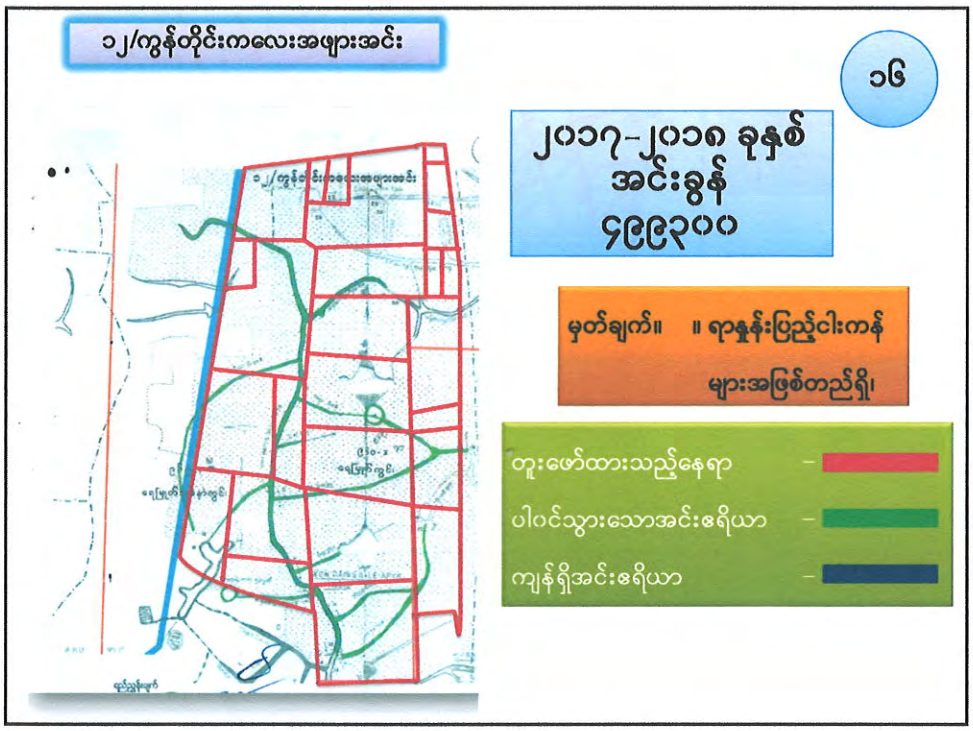
၁၅



မှတ်ချက်။ ။ ရာနှုန်းပြည့် ငါးမွေးကန်များအဖြစ် တည်ရှိ။

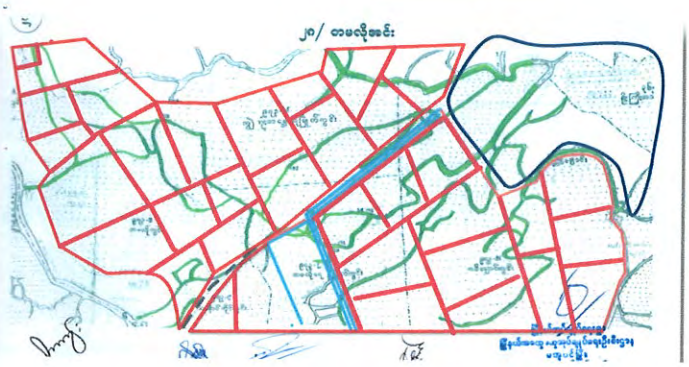
၂၀၁၇-၂၀၁၈ ခုနှစ် အင်းခွန် ၁၇၇၁၆၀၀

- တူးဖော်ထားသည့်နေရာ –
- ပါဝင်သွားသောအင်းဧရိယာ –
- ကျန်ရှိအင်းဧရိယာ –


၁၂/ကွန်တိုင်းကလေးအဖျားအင်း
၁၆
၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၄၉၉၃၀၀
မှတ်ချက်။ ။ ရာနှုန်းပြည့်ငါးကန်
များအဖြစ်တည်ရှိ၊
တူးဖော်ထားသည့်နေရာ –
ပါဂင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –

၂၈/တမလိုအင်း

၁၇

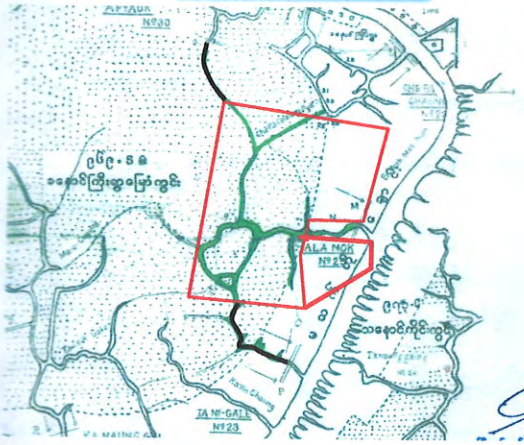


၂၀၁၇-၂၀၁၈
ခုနှစ်
အင်းခွန်
၂၀၅၃၅၀၀

မှတ်ချက်။ ။ ကန်ပတ်မြောင်းနှင့် ကုန်ထုတ်
မြောင်းမပါ၊ အင်းဧရိယာ(၃၀%)သာကျန်ရှိ

တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –

၂၅/အလန်းအုပ်အင်း



၁၈

မှတ်ချက်။ ။ကန်ပတ်
မြောင်းနှင့် ကုန်ထုတ်
မြောင်းမပါ၊အင်းဧရိယာ
(၃၀%)သာကျန်ရှိ၊

၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၁၅၆၂၂၀၀

တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –

၆/မလက်တိုအလယ်မက်ကွန်အင်း

၂၀၁၇-၂၀၁၈ ခုနှစ် အင်းခွန် ၂၈၉၉၀၀၀

မှတ်ချက်။ ။ မလက်တိုကျေးရွာ ဦးမောင်လှိုင်ကြည်မြောင်းမှ ပနော်ကျေးရွာဘုရားအထိ လက်တက်မပါ ချောင်းလုံးအရှည် (၂.၅) မိုင်ခန့်ရှိပါသည်။

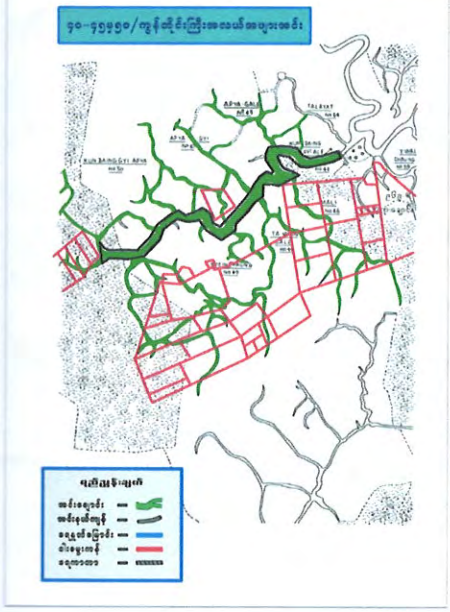
လေလံချောင်းချရန် တင်ပြထားပါသည်။

တူးဖော်ထားသည့်နေရာ –

ပါဝင်သွားသောအင်းဧရိယာ –

ကျန်ရှိအင်းဧရိယာ –

၄၀-၄၅မှ၅၀/ကွန်တိုင်းကြီးအလယ်အဖျားအင်း



၂၀

၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၃၅၄၃၂၀၀

မှတ်ချက်။ ။ ကန်ပတ်မြောင်းနှင့်ကုန်ထုတ်
မြောင်းမပါ၊ အင်းဧရိယာ(၄၀%)သာကျန်ရှိ၊

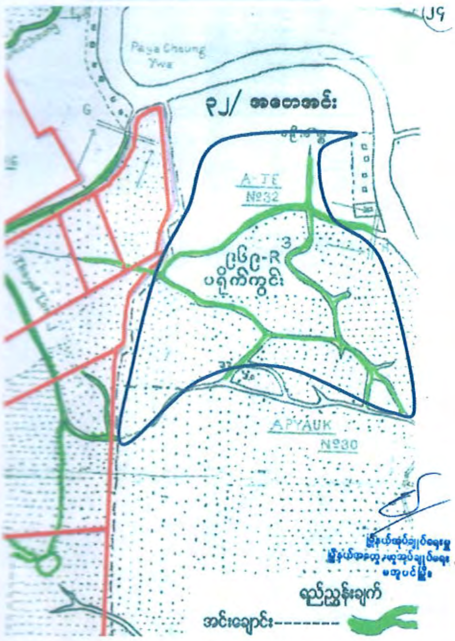
ဂူးဖော်ထားသည့်နေရာ –

ပါဂင်သွားသောအင်းဧရိယာ –

ကျန်ရှိအင်းဧရိယာ –

၃၂/အတေအင်း

၂၀



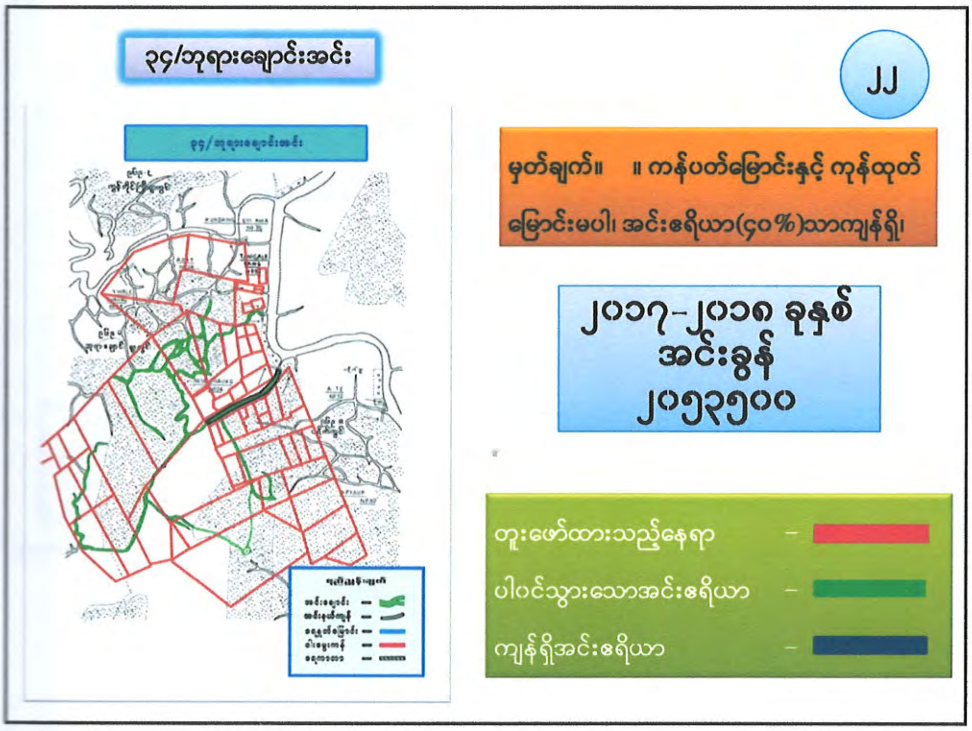
၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၅၃၁၅၀၀

မှတ်ချက်။ ။ ကန်ပတ်မြောင်းနှင့်ကုန်ထုတ်မြောင်းမပါ၊ အင်းဧရိယာ(၄၀%)သာကျန်ရှိ၊

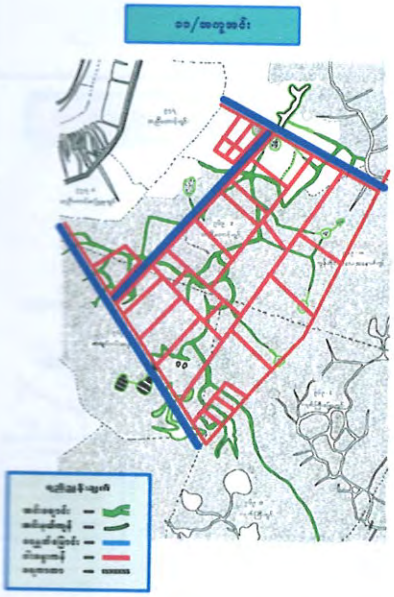
တူးဖော်ထားသည့်နေရာ –

ပါဝင်သွားသောအင်းဧရိယာ –

ကျန်ရှိအင်းဧရိယာ –


၃၄/ဘုရားချောင်းအင်း
၂၂
၃၄/ဘုရားချောင်းအင်း
မှတ်ချက်။ ။ ကန်ပတ်မြောင်းနှင့် ကုန်ထုတ်မြောင်းမပါ၊ အင်းဧရိယာ(၄၀%)သာကျန်ရှိ၊
၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၂၀၅၃၅၀၀
တူးဖော်ထားသည့်နေရာ -
ပါဝင်သွားသောအင်းဧရိယာ -
ကျန်ရှိအင်းဧရိယာ -

၁၁/အကူအင်း



၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၂၂၆၀၅၀၀

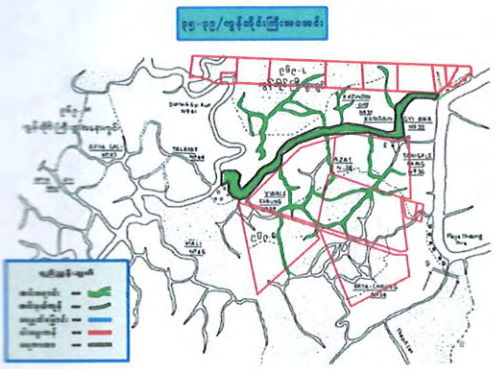
၂၃

မှတ်ချက်။ ။ ကန်ဝတ်မြောင်းနှင့် ကုန်ထုတ်
မြောင်းမပါ၊ အင်းဧရိယာ(၂၀%)သာကျန်ရှိ။

တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –

၃၅မှ၃၉/ကွန်တိုင်းကြီးအဝအင်း

၂၄



မှတ်ချက်။ ။မအူချောင်၊ ကျီးချောင်း၊ ကဇင်းပင်ရိုး၊ အဝိုင်းချောင်းလုံး၊ ကွန်တိုင်းကြီးရွာအစမှ အိုင်ကကြီးရွာအဆုံးထိ အင်းဧရိယာ (၃၀%) သာ ကျန်ရှိ။

၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၃၅၄၃၂၀၀

- တူးဖော်ထားသည့်နေရာ –
- ပါဝင်သွားသောအင်းဧရိယာ –
- ကျန်ရှိအင်းဧရိယာ –

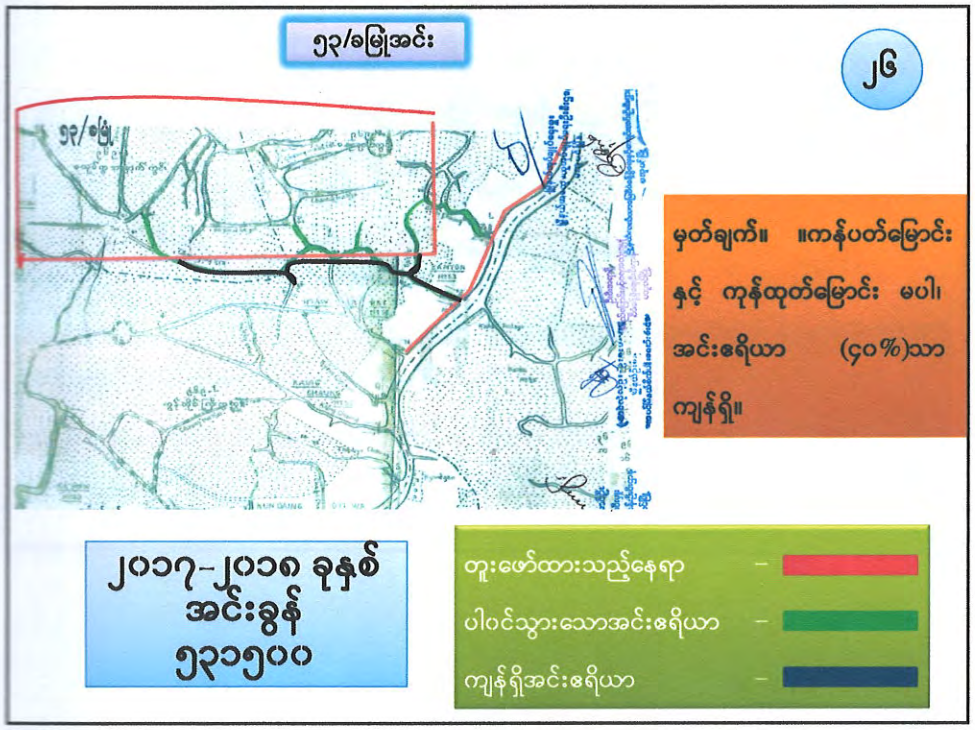
ဒေါပင်ပုံအင်း

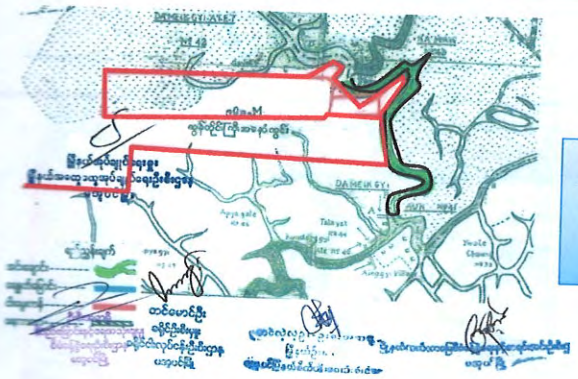
၂၅

၂၀၁၇-၂၀၁၈ ခုနှစ် အင်းခွန် ၅၃၁၅၀၀

မှတ်ချက်။ ။ ကန်ပတ်ကျောင်းနှင့် ကုန်ထုတ် မြောင်းမပါ၊ အင်းဧရိယာ (၈၀%) ခန့်သာကျန်ရှိ။

- တူးဖော်ထားသည့်နေရာ -
- ပါဝင်သွားသောအင်းဧရိယာ –
- ကျန်ရှိအင်းဧရိယာ –


၅၃/ခမြဲအင်း
၂၆
မှတ်ချက်။ ။ကန်ပတ်မြောင်းနှင့် ကုန်ထုတ်မြောင်း မပါ၊ အင်းဧရိယာ (၄၀%)သာ ကျန်ရှိ။
၂၀၁၇-၂၀၁၈ ခုနှစ် အင်းခွန် ၅၃၁၅၀၀
တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –



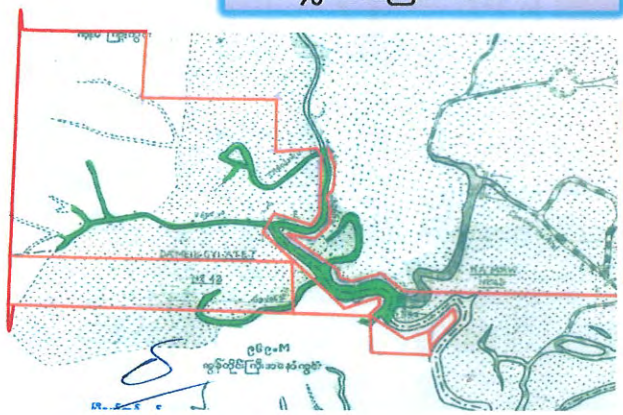
၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၂၁၂၅၉၀၀

ခုတ်ချက်။ ။ ကန်ပတ်မြောင်းနှင့် ကုန်ထုတ်
မြောင်းမပါ၊ အင်းဧရိယာ(၃၀%)သာကျန်ရှိ

တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –

၄၂/ဓမိတ်ကြီးအထက်အင်း

၂၈



မှတ်ချက်။ ။ ရာနှုန်းပြည့်ငါးမွေးကန်များအဖြစ်တည်ရှိ၊

၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၇၀၈၇၀၀

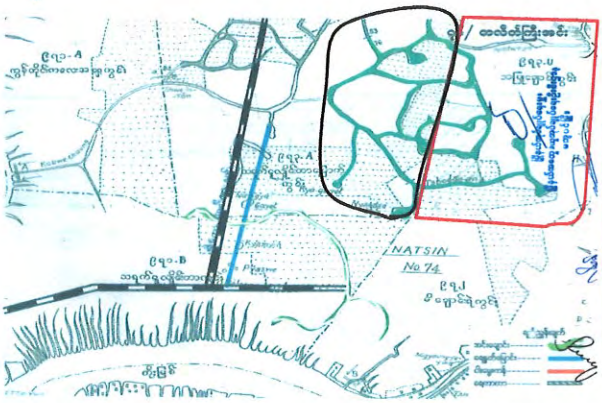
တူးဖော်ထားသည့်နေရာ –

ပါဝင်သွားသောအင်းဧရိယာ –

ကျန်ရှိအင်းဧရိယာ –

၇၆/တလိပ်ကြီးအင်း

၂၉



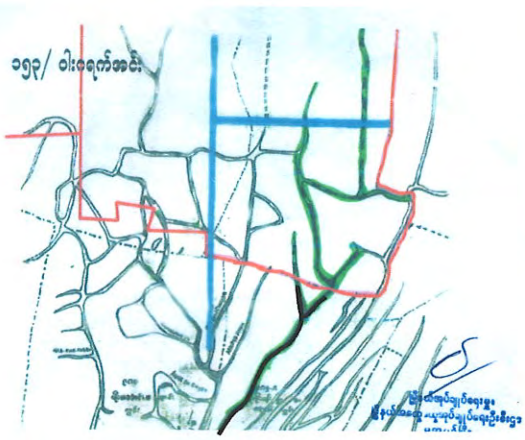
မှတ်ချက်။ ။ ကန်ပတ်မြောင်းနှင့် ကုန်ထုတ်မြောင်းမပါအင်းဧရိယာ လယ်ပြင် (၅၀%) သာကျန်ရှိ။

၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၁၂၄၀၁၀၀

- တူးဖော်ထားသည့်နေရာ –
- ပါဝင်သွားသောအင်းဧရိယာ –
- ကျန်ရှိအင်းဧရိယာ –

၁၅၃/ဝါးဂရက်အင်း

၃၀



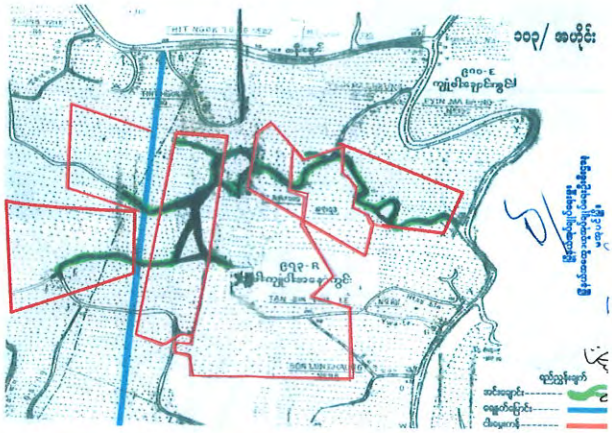
မှတ်ချက်။ ။ ကန်ပတ်မြောင်းနှင့် ကုန်ထုတ်မြောင်းဓပါ အင်းဧရိယာ (၅၀%)သာကျန်ရှိ။

၂၀၁၇-၂၀၁၈ ခုနှစ် အင်းခွန် ၂၆၅၇၄၀၀

- တူးဖော်ထားသည့်နေရာ –
- ပါဂင်သွားသောအင်းဧရိယာ –
- ကျန်ရှိအင်းဧရိယာ –

၁၀၃/အဟိုင်းအင်း

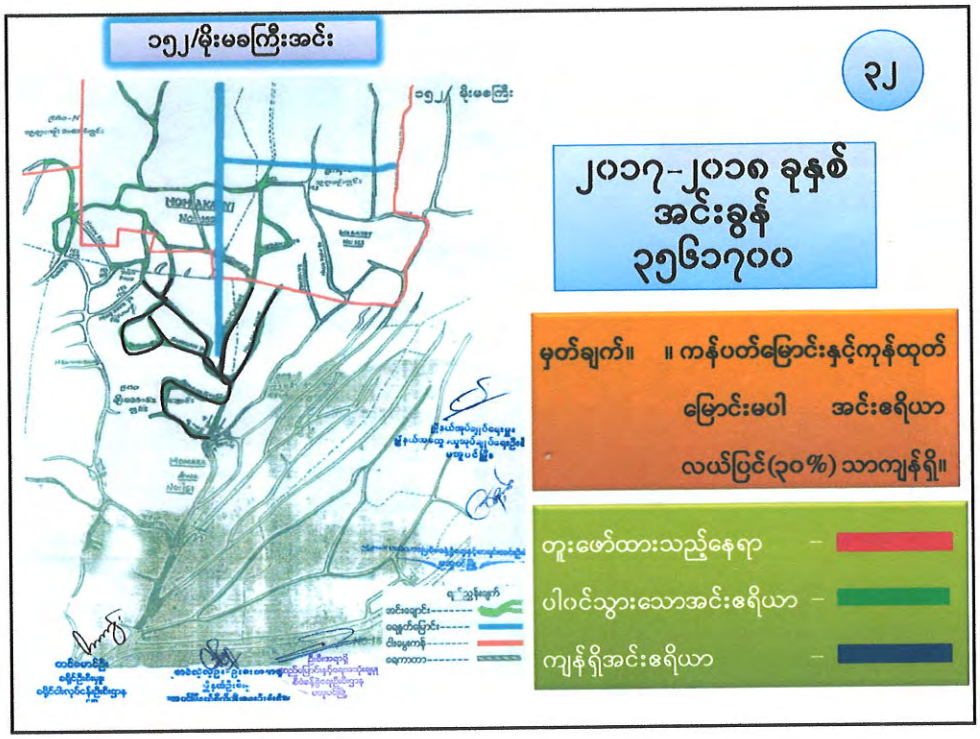
၃၁



မှတ်ချက်။ ။ ရာနှုန်းပြည့် ငါးမွေးကန်များအဖြစ်တည်ရှိ၊

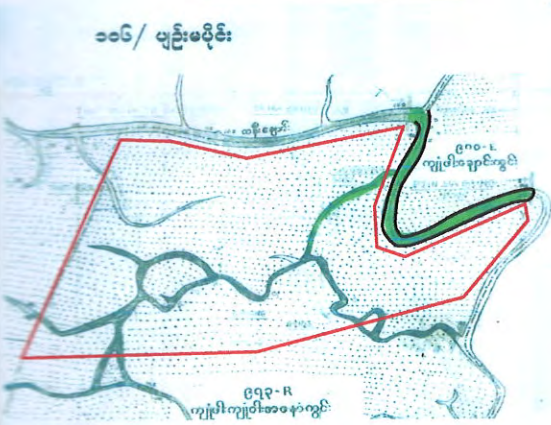
၂၀၁၇-၂၀၁၈ ခုနှစ် အင်းခွန် ၃၁၈၉၉၀၀

- တူးဖော်ထားသည့်နေရာ –
- ပါဝင်သွားသောအင်းဧရိယာ –
- ကျန်ရှိအင်းဧရိယာ –


၁၅၂/မိုးမခကြီးအင်း
၃၂
၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၃၅၆၁၇၀၀
မှတ်ချက်။ ။ ကန်ပတ်မြောင်းနှင့်ကုန်ထုတ်
မြောင်းမပါ အင်းဧရိယာ
လယ်ပြင်(၃၀%) သာကျန်ရှိ။
တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –

၁၀၆/ပျဉ်းမပိုင်အင်း

၃၃



မှတ်ချက်။ ။ အင်းနယ်ထနီး ချောင်းလုံးသာကျန်ရှိ။

၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၅၃၁၄၇၀

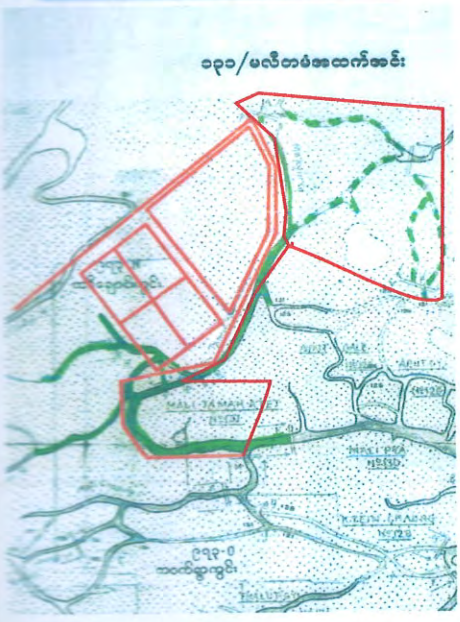
တူးဖော်ထားသည့်နေရာ –

ပါဝင်သွားသောအင်းဧရိယာ –

ကျန်ရှိအင်းဧရိယာ –

ခရေ/မလီတမံအထက်အင်း

၃၄



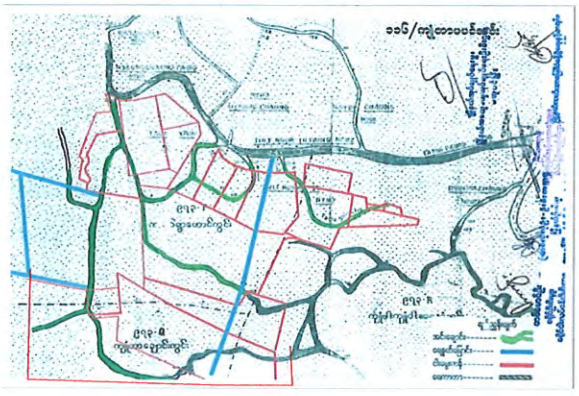
၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၈၈၅၇၉၀

မှတ်ချက်။ ။ ရာနှုန်းပြည့်ငါးမွေးကန်
အဖြစ်တည်ရှိ။

တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –

၁၁၆/ကျုံတာပပင်အင်း

၃၅



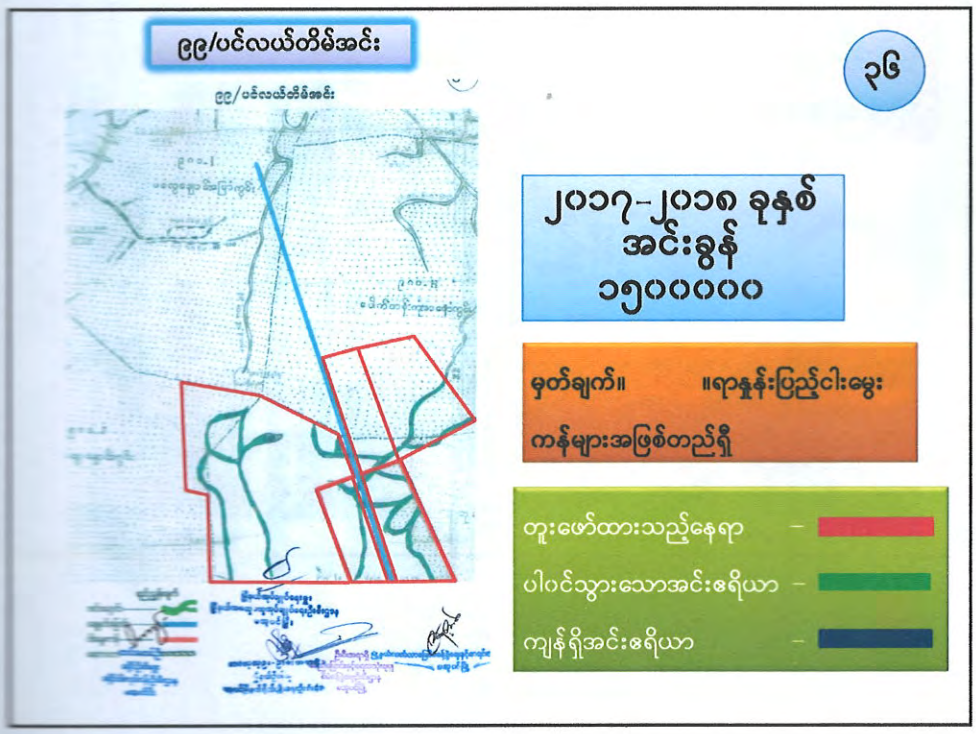
၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၃၂၂၆၁၈၁

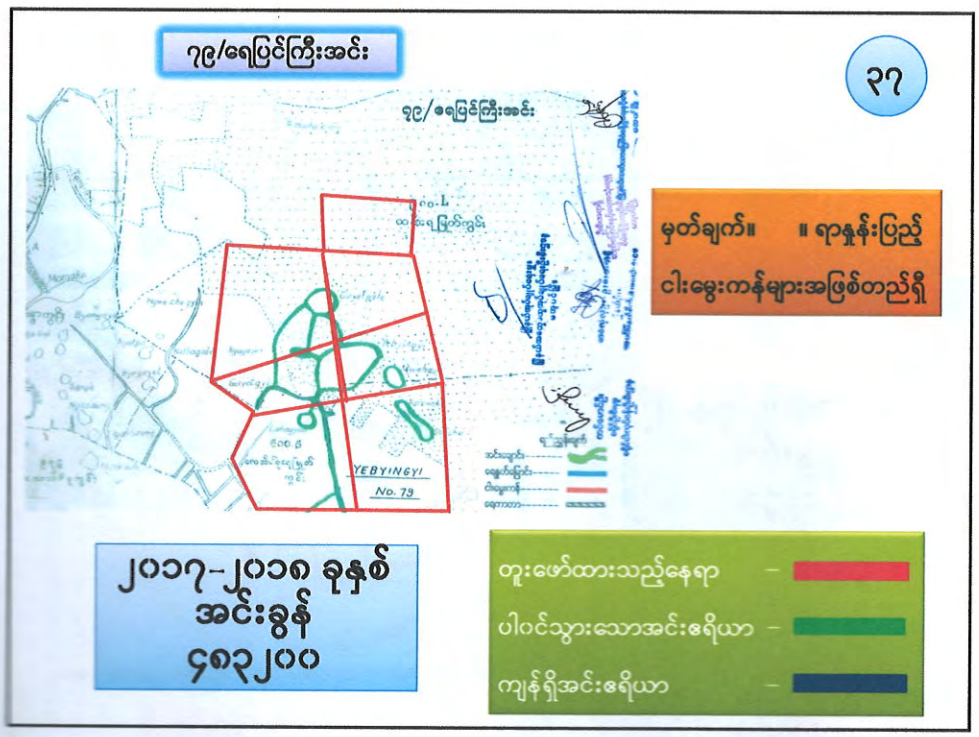
တူးဖော်ထားသည့်နေရာ –

ပါဂင်သွားသောအင်းဧရိယာ –

ကျန်ရှိအင်းဧရိယာ –

မှတ်ချက်။ ။ အင်းကျန်မရှိ
ရာနှုန်းပြည့် ငါးကန်အဖြစ်တည်ရှိ


၉၉/ပင်လယ်တိမ်အင်း
၃၆
၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၁၅၀၀၀၀၀
မှတ်ချက်။ ။ရာနှုန်းပြည့်ငါးမွေး
ကန်များအဖြစ်တည်ရှိ
တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –


၇၉/ရေပြင်ကြီးအင်း
၇၉/ရေပြင်ကြီးအင်း
YEBYINGYI
No. 79
မှတ်ချက်။ ။ ရာနှုန်းပြည့်
ငါးမွေးကန်များအဖြစ်တည်ရှိ
၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၄၈၃၂၀၀
တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –

၁၄၁/အပြောင်ကြီး
၁၄၂/အပြောင်ကလေး

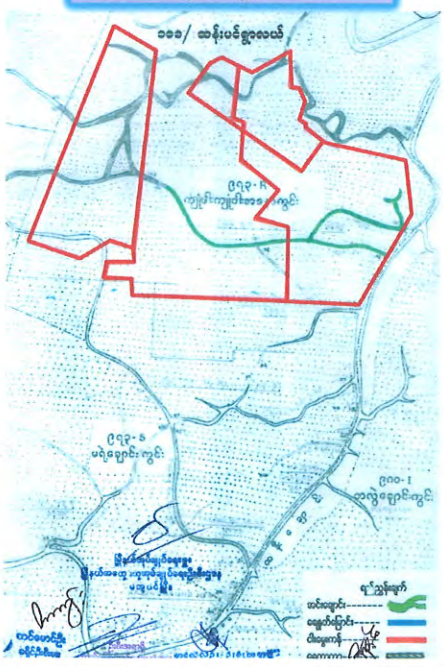
၃၈
၃၉

၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၄၈၃၂၀၀

မှတ်ချက်။ ။ ရာနှုန်းပြည့် ငါးမွေးကန်များအဖြစ်တည်ရှိ

- တူးဖော်ထားသည့်နေရာ
- ပါဝင်သွားသောအင်းဧရိယာ
- ကျန်ရှိအင်းဧရိယာ

၁၀၁/ထန်းပင်ရွာလယ်အင်း



၄၀

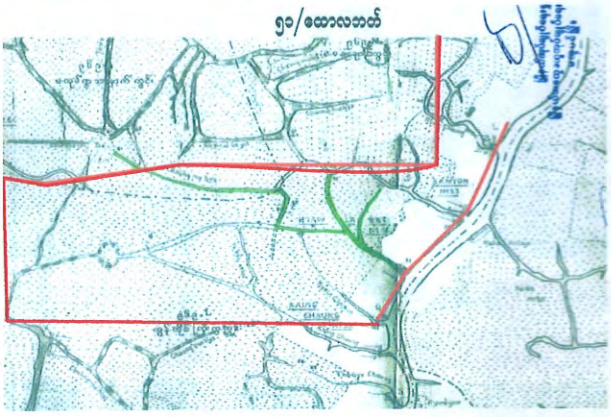
၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၄၀၇၀၀၀

မှတ်ချက်။ ။ရာနှုန်းပြည့်ငါးမွေး
ကန်များအဖြစ်တည်ရှိ

တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –

၅၁

၅၁/ထောလဘတ်အင်း



မှတ်ချက်။ ။ ရာနှုန်းပြည့် ငါး မွေးကန်များ အဖြစ်တည်ရှိ၊

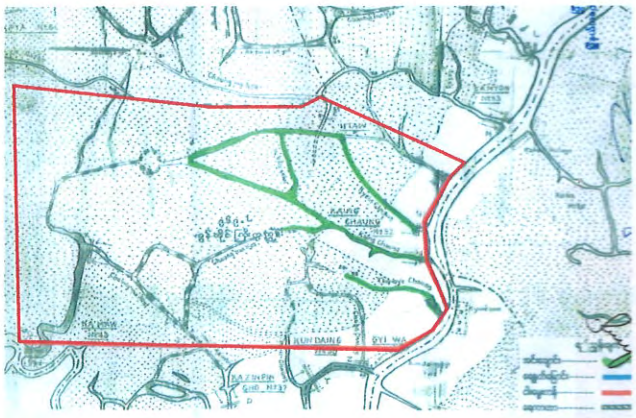
၂၀၁၇-၂၀၁၈ ခုနှစ် အင်းခွန် ၁၂၄၀၁၀၀

တူးဖော်ထားသည့်နေရာ –

ပါဝင်သွားသောအင်းဧရိယာ –

ကျန်ရှိအင်းဧရိယာ –

၅၂/ကိုင်းရောင်းအင်း



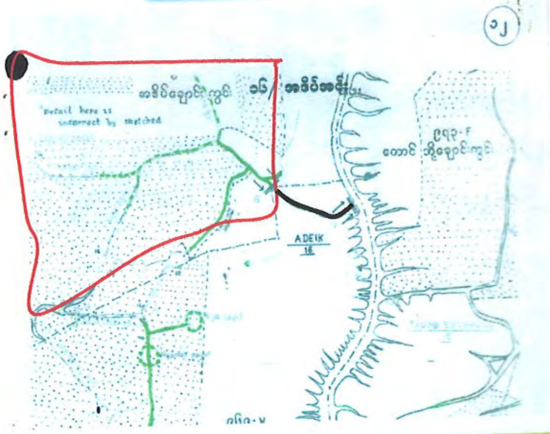
မှတ်ချက်။ ။ ရာနှုန်းပြည့် ငါးမွေးကန်များအဖြစ်တည်ရှိ၊

၂၀၁၇-၂၀၁၈ ခုနှစ် အင်းခွန် ၃၅၄၅၀၀

- တူးဖော်ထားသည့်နေရာ –
- ပါဂင်သွားသောအင်းဧရိယာ –
- ကျန်ရှိအင်းဧရိယာ –

၁၆/အဒိတ်အင်း

၄၃

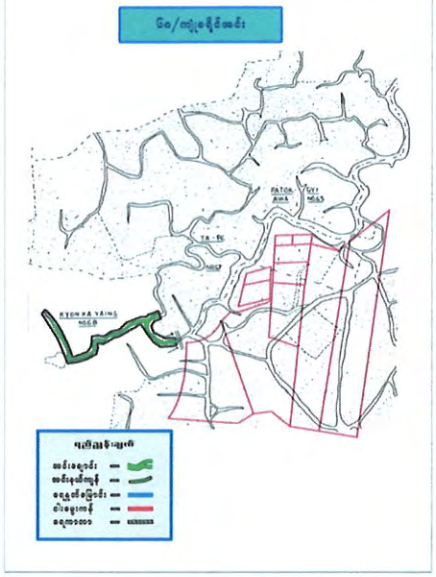


မှတ်ချက်။ ။ ကန်ပတ်မြောင်းနှင့်
ကုန်ထုတ်မြောင်းမပါ၊
အင်းဧရိယာ(၅၀%)သာကျန်ရှိ ။

၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၁၄၁၇၃၀၀

တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ –
ကျန်ရှိအင်းဧရိယာ –

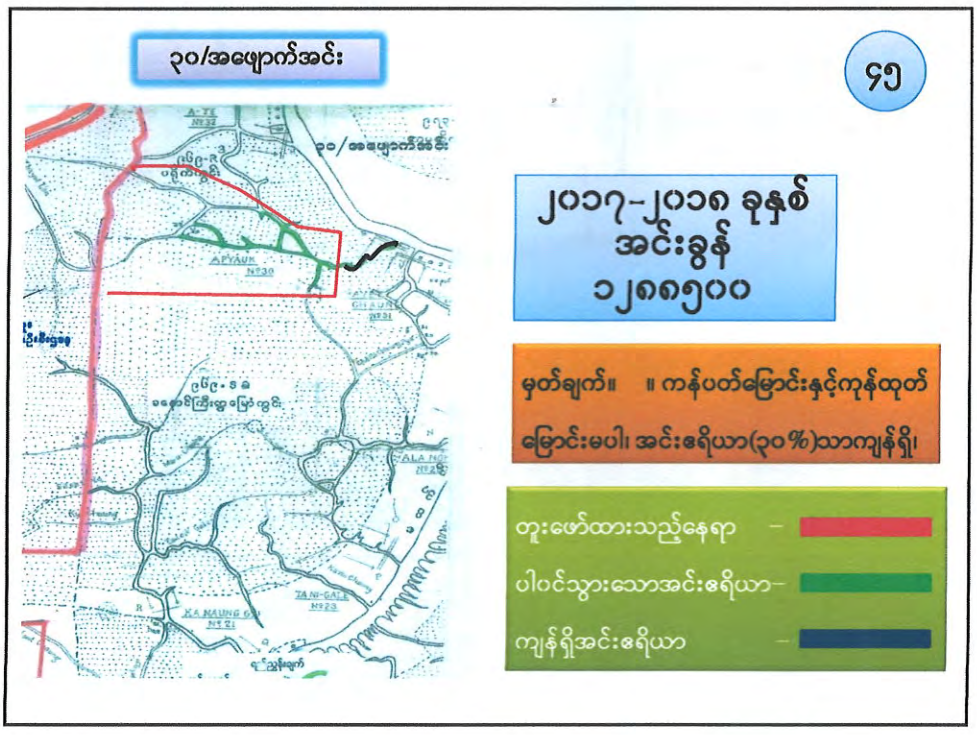
၆၈/ကျုံခရိုင်အင်း

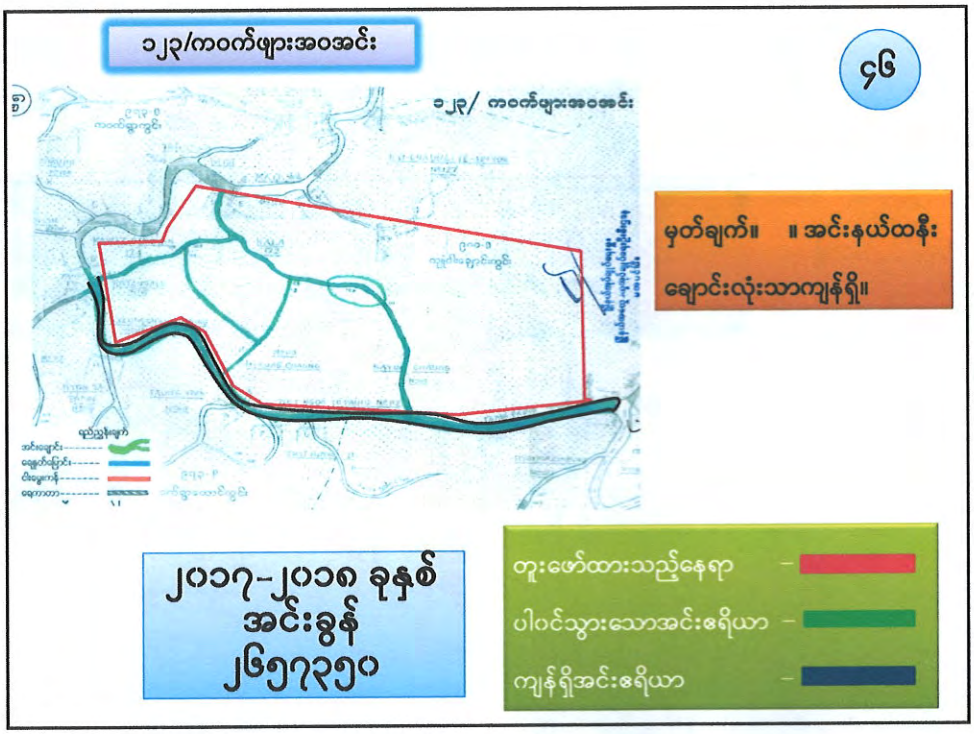


၂၀၁၇-၂၀၁၈ ခုနှစ် အင်းခွန် ၅၀၇၄၀၀

မှတ်ချက်။ ။ ကန်ပတ်မြောင်းနှင့် ကုန်ထုတ်မြောင်းမပါ၊ အင်းဧရိယာ(၃၀%)သာကျန်ရှိ ။

- တူးဖော်ထားသည့်နေရာ –
- ပါဝင်သွားသောအင်းဧရိယာ –
- ကျန်ရှိအင်းဧရိယာ –


၃၀/အဖျောက်အင်း
၄၅
၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၁၂၈၅၁၀၀
မှတ်ချက်။ ။ ကန်ဝတ်မြောင်းနှင့်ကုန်ထုတ်
မြောင်းမပါ၊ အင်းဧရိယာ(၃၀%)သာကျန်ရှိ၊
တူးဖော်ထားသည့်နေရာ –
ပါဝင်သွားသောအင်းဧရိယာ–
ကျန်ရှိအင်းဧရိယာ –


ခ၂၃/ကဝက်ဖျားအဝအင်း
၄၆
ခ၂၃/ ကဝက်ဖျားအဝအင်း
မှတ်ချက်။ ။ အင်းနယ်ထနီး
ချောင်းလုံးသာကျန်ရှိ။
၂၀၁၇-၂၀၁၈ ခုနှစ်
အင်းခွန်
၂၆၅၇၃၁၀
တူးဖော်ထားသည့်နေရာ
ပါဝင်သွားသောအင်းဧရိယာ
ကျန်ရှိအင်းဧရိယာ

၄၇
၄၈
၄၉

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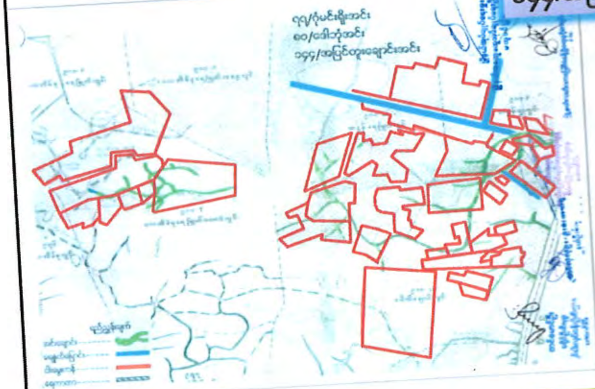

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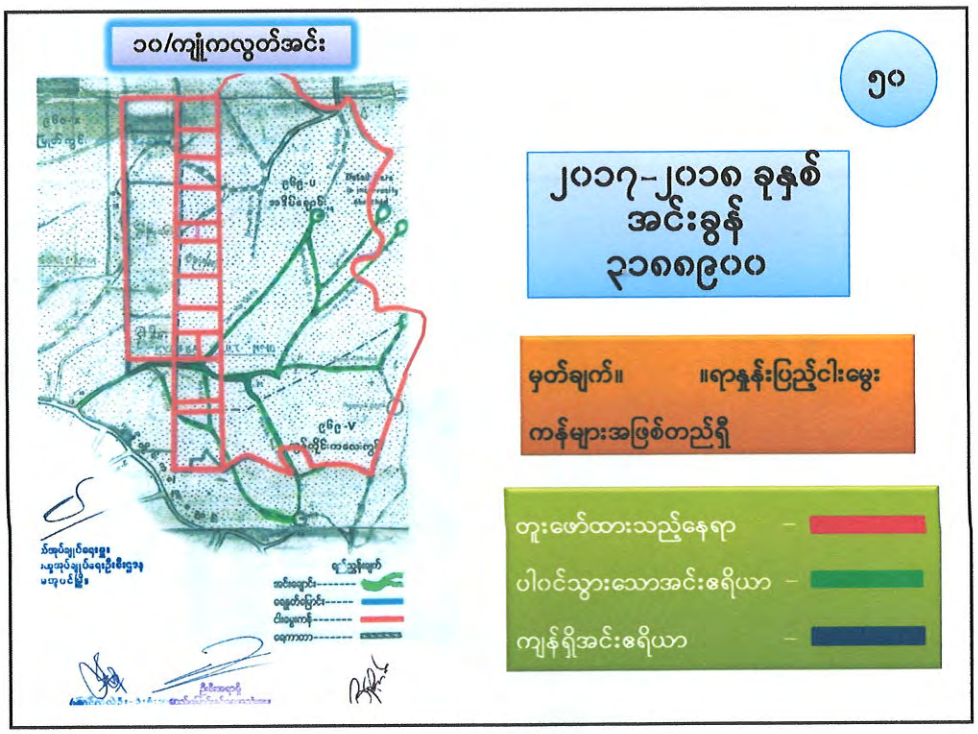
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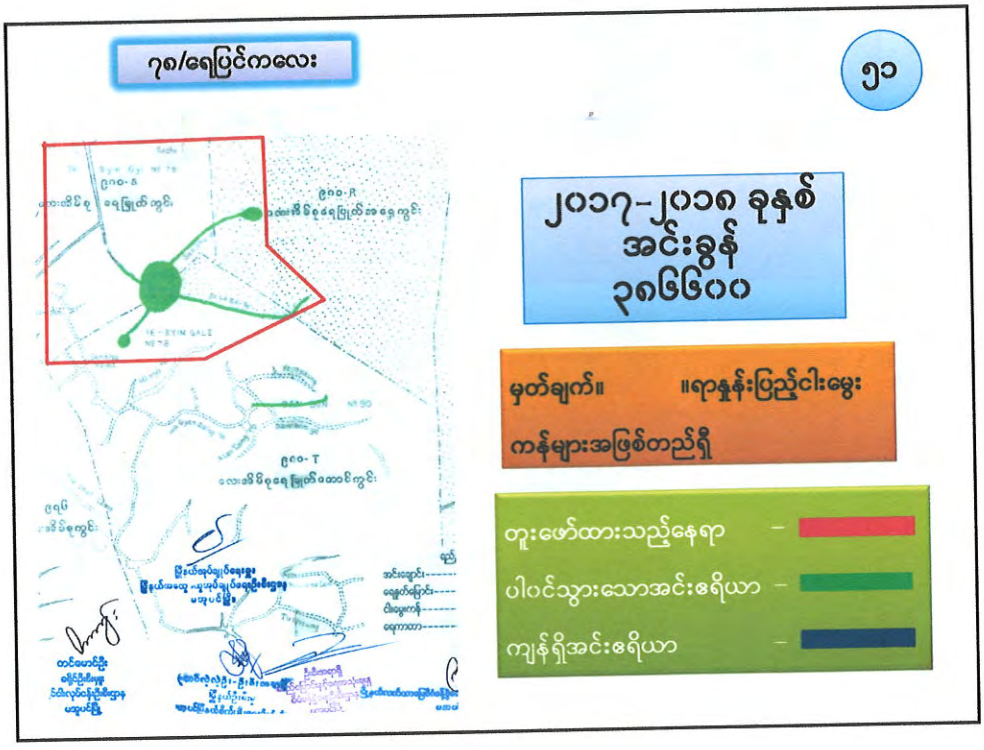
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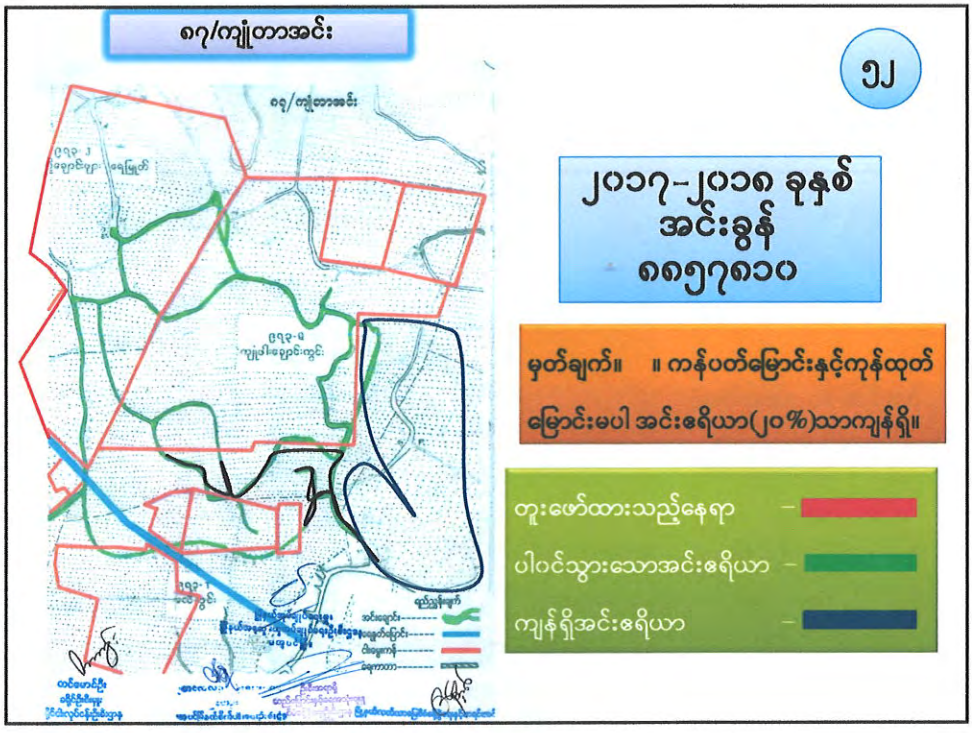
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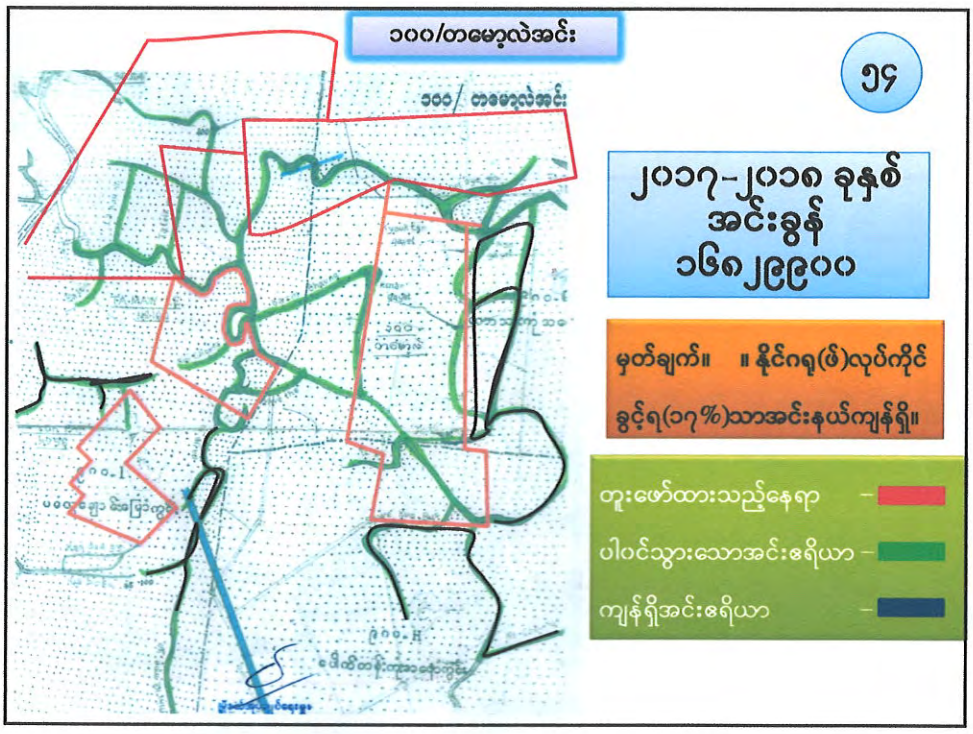
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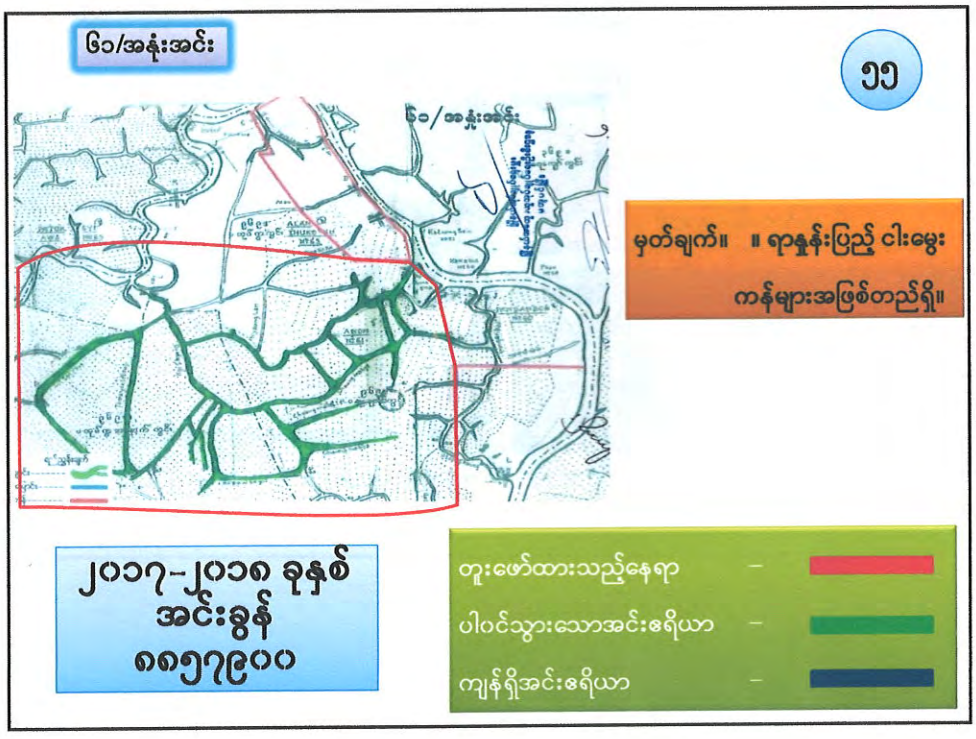
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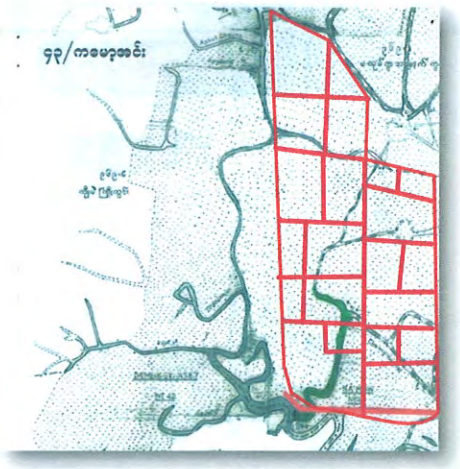

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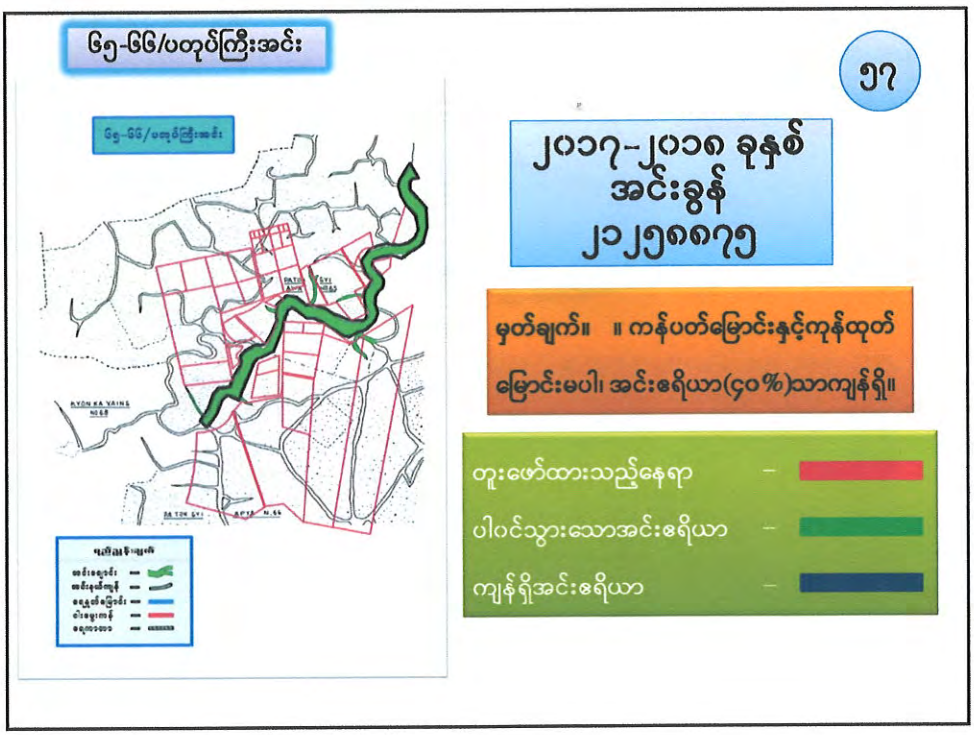
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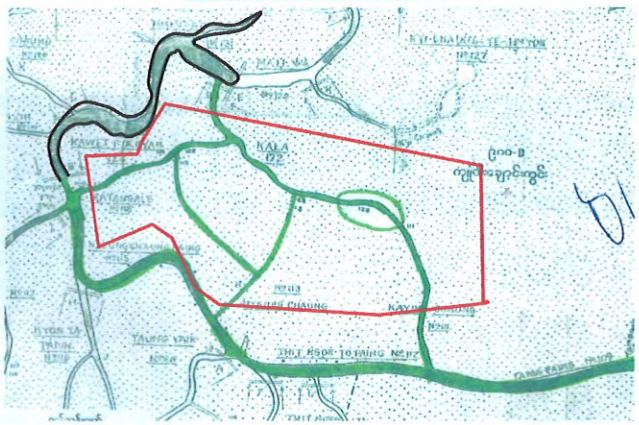

၅၈

မှတ်ချက်။ ။ ထနီးချောင်းလုံးသာကျန်ရှိ။

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နံငေဗ်းဒွးဒွီးနံ့ဝဒ္ဓလဲးပုဝဒ္ဓဗိုဝဒ္ဓဂထိုဗ

ဒြိုဆဂြဂွဆါ်ဂဓုံယွါဲကံးငယြိုနံဗ

The history of aquaculture pond in leasable fisheries areas

The reason for aquaculture ponds encroaching upon lease areas in Maubin District is as follows. In 1996-1997, the SDPC allowed “ethnic” companies to access virgin land and deep-water areas for agriculture farming. These “ethnic” companies had farming operations over minimum 5000 acres, with the objective to produce rice for export markets. After experiencing some losses for farming in areas deemed not suitable for agriculture operations, the Union Government allowed the companies to operate aquaculture operations instead. As a result, since 2001-2002, there have been growing aquaculture operations in these deep-water areas. This change in government’s policy is having an impact on overlapping leasable fisheries operations. In 2017 – 2018, a total of MMK 151,594,941 were collected from the 58 leasable fisheries in Maubin District .

COVID-19 and Small-Scale Fisheries in Southeast Asia: Impacts and Responses

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Abstract

This paper describes the impacts of and responses to COVID-19 of small-scale fisheries in six selected countries in Southeast Asia, including Indonesia, Malaysia, Myanmar, Philippines, Thailand, and Vietnam. The paper used a structured case study approach to analyse the impacts and responses and relied heavily on existing reports and data sources in each country. The pandemic has further revealed the vulnerability of small-scale fishing households in the region. Given the few assets of fisher households, their ability to cushion the negative impact of crises and shocks is limited. Fishers made adaptive responses such as direct fish marketing, online marketing, and home delivery services. While short-term responses of providing food and financial assistance have been helpful, long-term support to address pandemics such as COVID-19 and other stressors will require developing more resilient fishing households. The paper recommends several approaches and interventions to improve household resilience and to be better prepared for similar challenges and threats in the future. These include: i) strengthening the fishing households' social network of friends, relatives, and neighbours to serve as both a social safety net and a bridge towards the transition to financial inclusion; ii) diversifying livelihood to reduce dependency on the fishery and provide for additional sources of income and food; iii) promoting financial inclusion through savings, credit, digital payment products, and insurance; iv) value chain upgrading through post-harvest fish handling and processing methods; and, v) providing access, especially for women, to social protection measures such as government health insurance and social security.

Keywords: pandemic, vulnerability, coastal livelihood, coping, fishers

Introduction

Southeast Asian countries were hit hard by COVID-19. The health and economic impact of COVID-19 has been significant across the region, but the virus has not spread as quickly as in other parts of the world (CSIS, 2020; United Nations, 2020). This is partly due to the draconian measures taken by countries in the region, such as cross-border travel restrictions and lockdowns (Marschke et al., 2020). However, actions to control the spread of COVID-19 in the region have been uneven (Fig. 1). The pandemic has brought about real suffering for people, especially vulnerable groups, in the region and highlighted prevailing inequities, risks and challenges ranging from lack of social protection to human rights, damaged ecosystems and biodiversity loss (Love et al., 2020).

The rapid spread of COVID-19 throughout Southeast Asia (SEA) has affected the region's small-scale fishers and fish value chain actors in capture and culture fisheries (CSIS, 2020; Clavelle, 2020; FAO, 2020a; FAO, 2020b; Knight et al., 2020; Love et al., 2020; Bennett et al., 2020). Fisher and fisher household's livelihoods, nutrition, and health have been affected. Fishers have met difficulties due to the national lockdown

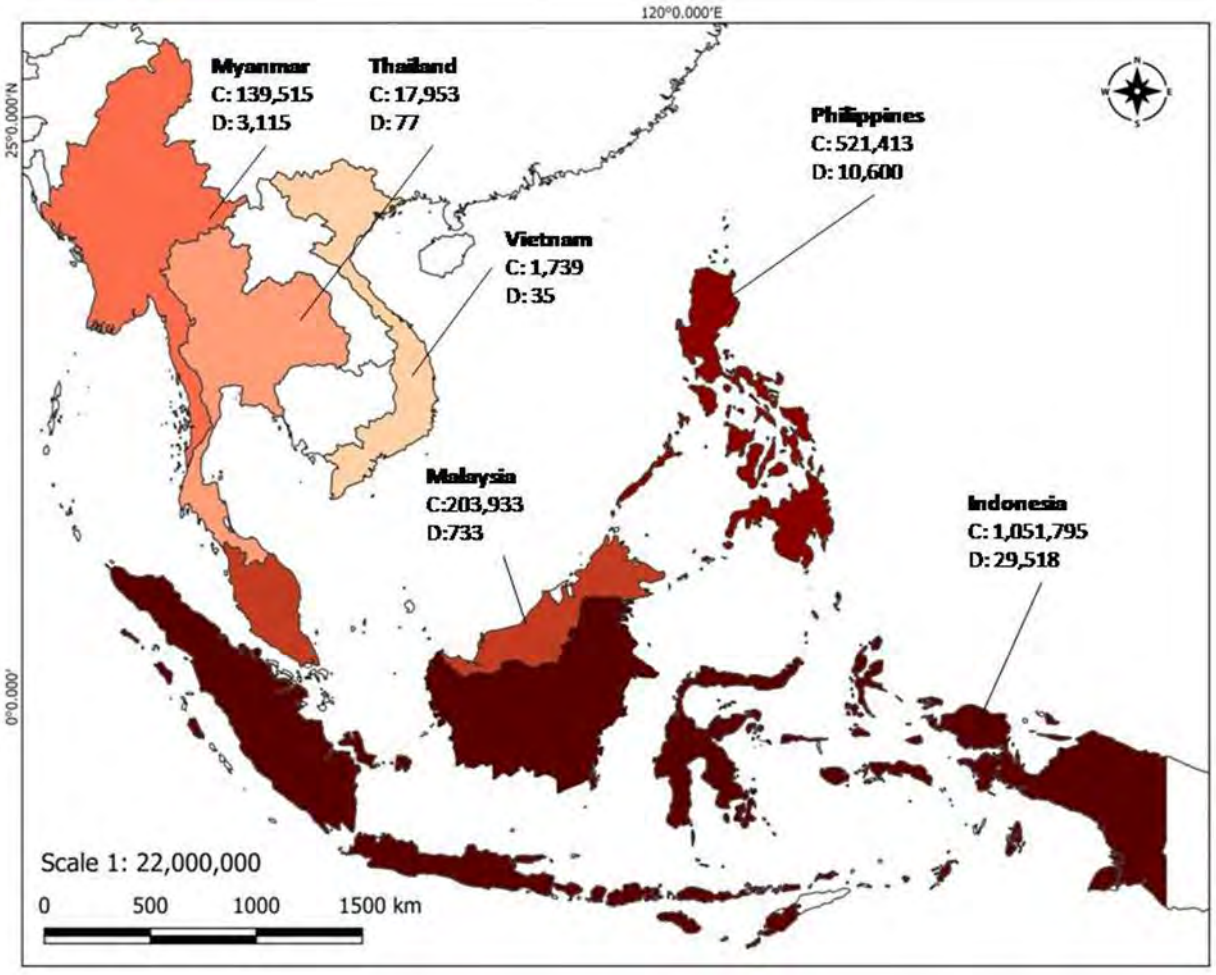

Fig. 1. Total number of confirmed COVID-19 cases (C) and deaths (D) as of 30 January 2021 in Indonesia, Malaysia, Myanmar, the Philippines, Thailand, and Vietnam. (Source: https://covid19.who.int).

measures in many countries that prohibit them from going out to sea to fish or from selling their fish. Due to reduced demand for seafood from local markets, restaurants, and hotels, the collapse of prices has reduced fishing activity. Input suppliers, traders, processors, transporters, financiers, and others in the small-scale fisheries value chain have seen a decrease in activities. Access to ice, fuel, bait, and fishing gear has been restricted due to suppliers closing due to limited fishing activity. Trade has slowed as transportation restrictions prevent the movement of products. Seafood processing facilities are closed or operating at reduced capacity.

The existing challenges and vulnerabilities faced by the small-scale fisheries sector in SEA – poverty; market access; financial services; livelihoods; poor access to public services such as health care, clean water, and sanitation; social protection; political and economic marginalisation; gender inequity; natural disasters – have been exacerbated due to COVID-19 (Knight et al., 2020; Marschke et al., 2020). Small-scale fishers have been especially vulnerable since many depend upon daily catch to feed and support their families. Many fishers have become deeper in debt as they borrow from informal financial sources to support themselves and their families (Drury O'Neill et al., 2019; Marschke et al., 2020). Women are especially vulnerable, facing a higher risk of infection as they most often work in the post-harvest sector where they have greater direct interaction with potentially infected fish sellers and buyers (Drury O'Neill et al., 2019).

It is not all bad news, as small-scale fishers, households, and communities in the region are adapting to the pandemic and showing resilience (FAO, 2020a; Belton et al., 2021). Fishing practices are changing, new markets and alternative marketing strategies are being developed, and improved post-harvest handling, hygiene, and sanitation practices are being employed. Safety-at-sea and safety in the market practices are being implemented. Governments, non-governmental organisations, the private sector, and donors are taking a variety of actions to support the small-scale fisheries sector, including providing economic relief and public services, development of markets, developing or strengthening social protection measures, financial inclusion, and capacity building (Love et al., 2020).

The purpose of this paper is to report on the impacts

of and responses to COVID-19 of small-scale fishers, households, and communities in six selected countries in Southeast Asia (Indonesia, Malaysia, Myanmar, Philippines, Thailand, and Vietnam). The paper uses a structured case study approach to the analysis of the impacts and responses. The paper provides a national and regional perspective on the emerging lessons learned to date. The pandemic has further revealed the vulnerability of small-scale fishing households in the region. The paper recommends several approaches and interventions to improve household resilience and be better ready for future challenges and threats.

Materials and Methods

The COVID-19 pandemic and associated lockdowns in the SEA countries have forced the use of existing data sources rather than collection of primary data. The paper used a structured case study approach to analyse the impacts of COVID-19 and the responses of the fishers. This desk study relied heavily on existing reports and data sources in each country. These include official government data available, other studies collected, posts of relevant government agencies on official social media accounts, and news carried by major national dailies. No primary data collection was undertaken. A uniform outline was used in each case country. The topics included in the outline were: i) the disruption of small-scale fisheries (i.e., ability to fish, fish processing, selling); ii) coping strategies (i.e., selling, markets, value-added, alternative livelihoods); iii) relief and support received (i.e., government food and cash, low interest loans, fish marketing); and iv) emerging lessons. The small-scale fisheries in each country were described in terms of types of fishing boats, engines, and gears used, and the location of their operation. The roles of women in fisheries played before and during the pandemic were identified and described.

Country Case Studies

The case studies of the six countries are presented in this section. A summary of characteristics of small-scale fisheries in the six countries selected for case studies is shown in Table 1. These included information on the boats and engines they use (not using boats or using boats of <10 GT; using engines of 25 to 50HP), gears (hook and line, bag net, trammel net, lift net, driftnets, gillnets, longlines, traps, and other passive gears), and location of fishing activities (inland, inshore, nearshore; within 15 km from the shoreline). A summary of the case studies is presented in Table 2.

Indonesia

Disruption to small-scale fisheries

Indonesia was under total lockdown from March to May 2020 in response to the COVID-19 pandemic. The lockdown affected the domestic transportation of seafood products, impacting seafood supply throughout the value chain. Estimates show a 70 % decline in fish supply for hotels, restaurants, and cafés, and a 40 % reduction in household fish consumption.

Table 1. Summary characteristics of small-scale fisheries in six Southeast Asian countries.

	Indonesia	Malaysia	Myanmar	Philippines	Thailand	Vietnam
Boat /engine	<10 GT[a] <4 HP[b]	Not using boat or use boat of 24 ft and smaller, and with engine power (if any) of 25 HP[c,d]	Use vessels less than 30 ft long and with engine power (if any) of less than 25HP	With no boats or use boats 3GT and below	<10 GT	Small fishing boats and small engines, 45–50 HP
Gear	Seine nets, gill nets, traps and other traditional gears such as shellfish collections, seaweed collections and cast net	Handlines, longline, hook and line, bag net, trammel net, lift net, traps, and other Use traditional, sustainable fishing gears[c,e]	Driftnets, gillnets, and longlines.	Hook and lines, traps, fish coral, lift nets, gillnets, scoop nets, cast nets, seine nets, and other passive gears	Hook and lines, gillnets, falling nets, and traps	Scoop nets, cast nets, seine nets, lift net, hook and line, traps
Fishing zone	Nearshore, inland	Operate not more than 5 nautical miles from shore	Inshore and area within 10 nautical miles from the shoreline	Inland and waters within 15 km away from the shoreline	Inshore[g]; operate within 12 nautical miles from shoreline[h]	Near and inshore[e,f]

[a]Halim et al., 2019; [b]Ayunda et al., 2018; [c]Islam et al., 2014; [d]Samah et al., 2019; [e]Teh and Pauly, 2018; [f]Pomeroy et al., 2009; [g]DOF, 2015; [h]MD, 2018.

Table 2. Summary matrix of the impacts of COVID-19 in six Southeast Asian countries.

Indicators	Indonesia	Malaysia	Myanmar	Philippines	Thailand	Vietnam
Main policy response to COVID-19						
National lockdown	Yes, gradual, decentralised[a]	Yes[b]	Yes[c]	Yes, gradual, decentralised[d]	Yes	Yes, in selected areas
Health protocols	Yes	Yes	Yes	Yes	Yes	Yes
Disruptions						
Less fishing activities	Yes	Yes with curfew[e]	Yes[f]	Yes	Yes, with curfew	Yes[g]
Low demand	Yes	Yes	Yes	Yes	Yes	Yes
Low prices	Yes	Yes	Yes	Yes	Yes	Yes
Difficult marketing	Yes	Yes	Yes	Yes	Yes	Yes
Income loss	Yes	Yes	Yes	Yes	Yes	Yes
Coping strategies						
Continued fishing	Yes, mostly for food	Yes, mostly for food	Yes, mostly for food	Yes, mostly for food	Yes	Yes
Direct selling of fish	Yes, community and online	Yes, community	Yes, Community	Yes, community and online	Yes, community and online; Fishers intensified processing	Yes, community
Others	Women fish traders sold other agri-products and intensified fish processing	Continued to receive government's monthly cash and fuel subsidy				
Relief and support received						
Cash and in-kind (food) relief assistance	Yes; from the government and private sector	Yes, one time government cash support	None	Yes; government and private sector[h]	Yes, also daily subsistence goods; from government and private sector[i]	Yes, from the government
Low interest loan	None	None	Yes, from the government	Yes, zero interest loan from the government	Yes, from the government and private sector	Yes, from the government
Provision of livelihood support	Yes, from the government[j]	Yes, from the government and the private sector[k]		Yes, from the government[l]		
Others						
	Fundraising activities by the private sector					

Notes: Lockdown: [a]decentralised and gradual way starting March, national State of Emergency starting April 2020; [b]known as Movement Control Order (MCO), enhanced MCO from March to May, with national travel ban and lockdown in five states, conditional MCO starting May; [c]First lockdown on April 18 (related to the 1st wave), eased May to July – assumed the problem was over; instated August to September (related to the 2nd wave); [d]known as community quarantine under different strictness levels ---Enhanced/General- modified, with the national government classifies local governments under levels of community quarantine; Reduction in fishing: [e]Unemployed labor returning to villages from Myanmar and abroad has resulted in increased fishing pressure by those without incomes seeking access to food. [f]others voluntarily stopped fishing; [g]voluntary reduction in fishing efforts for some fishers; Cash and in-kind relief: [h]the national government provided one time cash and food assistance, while the local governments provided food assistance; [i]the national government provided financial assistance (around USD160 per person from April to June 2020, while the local governments also provided food and daily subsistence goods. Provision of livelihood support: [j]government support for campaigns to increase fish demand and online marketing, opening of cold storage for public use, fish in relief packages; [k]improvement in food storage and distribution infrastructure, alternative livelihood assistance, fisheries association and the government bought their catch; [l]provision of production inputs in fishing and fish cage farming, fish in relief packages from the local government.

Fishing in Indonesia is dominated by small-scale fishers (SSF). The SSF, along with small fish farmers, small fish processors, and traders, were heavily affected by the COVID-19 pandemic (Rare Indonesia, 2020). During the lockdown, transportation uncertainty and irregularity, the lower purchasing power of the consumers, and the closure of businesses (restaurant, catering, and hotels) forced local traders to sell fish in local markets at much lower prices than before COVID-19 (Mardhia et al., 2020). For tuna fisheries in the Moluccas, the price decline ranged between 25 % and 37 %, while the hand-liners suffered a price decline that ranged between 17 % and 21 % (MDPI, 2020). Similarly, in Cirebon, West Java, the low seafood prices led to low income for fishers who were facing high operation cost. By June 2020, fishers were not fishing anymore since the operational cost was higher than the revenue.

The decline in fish prices and rise in transportation costs led to lower fish supply and impacts on the economic welfare of fishers. The total fishing income of small gillnet fishers in Bengkulu, in the southern part of Sumatera Island, were estimated to be IDR78,985,000.00 (USD5596.08) from March to December 2020 (during COVID-19), which was much lower than their fishing income of IDR189,937,142.86 (USD13451.64) earned from October 2019 to February 2020 (before COVID-19) (Kholis et al., 2020). In South Sulawesi, half of the 185 fishers who participated in a survey identified the low demand for fish from traders and the decline in the price of fish as primary reasons for the decrease in their income (Campbell et al., 2020). A survey by Rare Indonesia (2020) showed that 70 % of the traders in South-East Sulawesi (n = 37) felt that COVID-19 was negatively impacting their fisheries business.

Coping strategies

The survey by Rare Indonesia (2020) in South Sulawesi showed that the fishers continued fishing throughout 2020. Similarly, Campbell et al. (2020) found that 80 % of men and women fishers continued to fish, and 65 % to 76 % of men and women traders continued to sell fish during the pandemic. Despite the lower-income earned than before COVID-19, fishers and traders viewed their continued activities as their contribution to food security (Rare Indonesia, 2020). Moreover, the processing sector turned to online selling of their products.

At the household level, the role of women is crucial in securing household resilience during the pandemic. Wives helped to sell the fish through retail marketing to households in nearby communities. Often, wives created an alternative livelihood during the pandemic, such as selling food and drinks and taking part-time jobs such as becoming a housemaid (Field Observation, Cirebon, July 2020).

Relief and support

The support to SSF came from various sources in the form of financial and non-financial types of interventions and initiatives that were taken during the early stage of COVID-19 lockdown. There were fundraising activities by fisheries associations, as in the case of the blue swimming crab association where a fundraising campaign helped raise enough to provide funds for 2 weeks (IDR250,000 [approximately USD15]) for each family of mini-plantpickers (mostly women) and fishers (a total of about 24,000 families). A private group set up a crowd-funding site to help raise funds for fishers. The government helped fishers in marketing through 'Warung Kemensos' (social stalls/shops) and online marketing, distribution of MSMEs products in hospitals, and inclusion of fish in the food packages under the local central government aid programs (e.g., "Program Keluarga Harapan", "Bantuan Pangan Non Tunai").

Emerging lessons

The pandemic highlighted the vulnerability of the fishers to disruptions in their livelihood and their high dependence on fishing. The inclusion of fish as a staple food for Indonesians provided the fishers with a ready market for their fish. The cash assistance that fishing households received was able to help households meet basic food needs. However, this assistance did not cover all fishers affected by the pandemic.

The pandemic also highlighted the importance of cold storage facilities. The cold storage facilities of both the government and private sectors were utilised at their maximum capacity to store fish to sell at a better price or to store fish for distribution to cities and provinces. Digital marketing platforms for fish products emerged. Many sellers in coastal communities creatively utilised this platform to channel their products. Some initiated their own simple reselling of fish products utilising online messaging applications in their areas to meet the demand of households.

Malaysia

Disruption to small-scale fisheries

In Malaysia, the COVID-19 pandemic and its associated government preventive measure of the Movement Control Order (MCO) beginning 18 March 2020 onwards disrupted supply chains and limited the movement of people. The shorter fishing hours and difficulty in selling fish in the market reduced the income and welfare of fishers. For example, about 13,000 fishers in Sarawak experienced drastic demand reduction as customers feared going out when ordered to stay at home (Abdullah, 2020). Moreover, the demand for fish from restaurants and hotels was significantly reduced by 30 %. According to the Malaysian Association of

Hotels, the average occupancy rate of hotels in Malaysia dropped sharply from 60 % in 2019 to 33 % in January to August 2020 (Ganesan, 2020). The reduction of work hours and restrictions of movement was for both men and women. The decrease in catch may have also reduced the income of women workers involved in fish processing in the coastal areas due to disruptions in the supply chain.

Coping strategies

In Malaysia, the small-scale fishers are poor, and they depend on government subsidies to sustain their livelihoods. The average income of fishers was MYR700 (USD175) to 800 (USD200) per month before COVID-19, lower than the national minimum wage of MYR1,200 (USD300) per month. The small-scale fishers depend on the MYR250 (USD62) monthly income support from the government and diesel subsidy of MYR0.53 (USD0.13) per litre to travel to the sea to catch fish. During the MCO implementation, the small-scale fishers suffered income loss and relied on the Malaysian Fisheries Development Authorities (LKIM) and fisher associations to buy their catch.

Relief and support received

The Malaysian federal government announced a number of economic stimulus packages to assist vulnerable groups such as small-scale fishers affected by the MCO. Overall, the Malaysian Government has allocated MYR1 billion (USD0.25 billion) for the nation's food security fund under the second stimulus package. Specifically, it includes an allocation of MYR200,000 (USD50,000) special funds to fisher associations to assist them to develop short-term agri-food projects that can produce food within 3 to 6 months and ensure the food supply is sufficient (Idris, 2020). In addition, MYR100 million (USD25 million) was allocated towards the development of food storage and distribution infrastructure. There are currently about 126,595 fishers in Malaysia (Department of Fisheries Malaysia, 2019).

In August 2020, the Ministry of Agriculture and Food Industry allocated MYR1.17 million (USD0.3 million) to implement the Economic Stimulus Package under the myFisheries Community (myKP) program to assist fishers in 13 areas nationwide. The stimulus package included fishing equipment, fish aggregating devices (fish shelter [*unjam*] or fish houses [*tukun*]), and cabins at the myKP Fisheries Transformation Centre (FTC) (Malay Mail, 2020). In September 2020, under the Prihatin Supplementary Initiative Package totalling MYR7 billion (USD1.73 billion), the government provided a one-off cash payment of MYR1000 (USD247) to households belonging to the bottom 40 income group (monthly earning less than MYR4000 [USD990]), where most fishing households belong. The Sarawak Government allocated MYR600,000 (USD148,404) to LKIM to buy the catch from the fishers to maintain the income of fishers (Ling, 2020). In the 2021 national budget, announced on 6 November 2020, the Malaysian Government allocated funds totalling MYR151 million (USD37 million) to raise the monthly living allowance of every fisher from MYR250 (USD62) to MYR300 (USD74) (Bernama News, 2020).

Emerging lessons

Fishers are suppliers of fish, a valuable protein source for the population. Adequate local fish supply helps stabilise the price of fish. Fishers, however, are highly vulnerable to disruptions such as those brought on by the COVID-19 pandemic. The small-scale fishers in Malaysia have hardly any savings, have little cash flow to sustain their livelihood in the event of a catastrophe, and do not have enough social protection.

Help for the fishing community is needed to enhance their resilience. This includes providing social infrastructure and safety nets (such as Employees Provident Fund or social security funds), and other assistance to prepare them for catastrophes similar to COVID-19. Moreover, fisher's cooperatives or associations need to be strengthened through capacity-building initiatives to make them more functional and organised. A more functional and organised fisher association can help the fishers market their fish products in the markets and increase their ability to deal with catastrophes such as the COVID-19 pandemic.

Myanmar

Disruption to small-scale fisheries

The health measures taken by the Government of Myanmar (GoM) to combat the COVID-19 pandemic were impositions of lockdown (i.e., 'stay at home'), curfews, and transport restrictions (air, road, river, and sea). The international and domestic airports were closed to all but relief flights, in addition, land borders were shut. These measures disrupted the movement of people and fisheries products as well. The main export markets for Myanmar's aquatic food are China and Thailand; hence the closure of the borders had a serious impact on exports during the first half of 2020.

Small-scale fisheries, both inland and coastal, are of great importance to the people of Myanmar. Women account for about 50 percent of the workforce in the Myanmar fisheries sector when secondary elements such as processing and trading are included. Inshore fishing activities involve many women and children who participate in gleaning or trapping marine resources close to shore and using non-motorized dugout canoes (Tezzo et al., 2018). The annual inland fishery production amounts to 900,000 tons, while marine capture (coastal and offshore) amounts to

1,150,000 tons (FAO, 2020a). Overall, the small-scale fisheries annual production is over 2 million tons and more when an unaccounted yet estimated 200,000 tons of unregistered 'hidden harvest' is added.

WorldFish carried out a telephone survey from March 2020 to August 2020 to show some of the direct effects of disruptions in the supply and consumption of food, including fish and other aquatic products (Belton et al., 2021). Results showed that inland small-scale fisheries fell dramatically from February, when 88 % of fishers said that they were able to fish, to 12 % in June, and then to 20 % in July. These figures need to be taken in the context in that the peak inland fishing months correspond to the lowest water levels when fish are aggregated from December to February. In addition, the inland fisheries closed season is from May to July inclusive, however, many fishers and non-fishers fish (i.e., farmers, farm labourers, unemployed labour returning to villages) during closed seasons. The number of fishing days per month dropped from 20 in February to 4 in July. In April, 50 % of fishers reported consuming their catch, although the quantities consumed were small at about 2 kg.household^{-1}. Twenty-one percent of fish traders were inoperative during the period from February to April when the lockdown closed wet markets and all restaurants, including hotels and tourist sites. By June, 47 % of traders were not operating. For small-scale inland capture fisheries, the highest sales were reported during March to May, followed by a total collapse in July. Prices for fish declined gradually over the survey period as consumers either had no access to markets or producers stopped supplying fish due to the low demand.

Moreover, the monitoring by WorldFish and OIKOS within five fishing villages in the buffer zone of Lampi Island, Myanmar's only Marine National Park, demonstrated the precarious nature of artisanal fishers' livelihoods. Most of the 1,000+ fishers operating in the area fish for cuttlefish and squid marketed directly to Thai buyers who provide ice and food items to the fisher families. The price for fresh cuttlefish pre-COVID-19 was USD5.5 kg^{-1}. Once the border closed and the trade stopped, fishers could only attain USD1.85 kg^{-1} on the local market. Furthermore, their access to food was limited.

Relief and support

The Government of Myanmar set up a COVID-19 Economic Relief Plan (Ministry of Planning and Finance, 2020), and by mid-November 2020, 1,600 applications were received from the Myanmar Fisheries Federation, a private sector coordinating body representing fisher and farmer members. Of these requests, 400 were approved to receive loans to help mitigate the negative impacts of COVID-19. It is expected that further loans will be authorised before the end of 2020. Aside from loans, fisher communities received health information on COVID-19 prevention. In some cases, there were also soap and masks provided.

Emerging lessons

COVID-19 is having a negative impact on small-scale fisheries in Myanmar due to reduced movement restricting the flow of products to the traditional wholesale centres and consumers' access to wet markets. Prices of products dropped while the transport cost increased due to control measures and the increased time taken to complete journeys (often without a return trip cargo). Closed borders reduced the export market options, especially to China and Thailand. Unemployed labour returning to villages from Myanmar and abroad has increased fishing pressure by those without incomes seeking access to food. By mid-November 2020 the positivity rate for COVID-19 had started to drop (Ministry of Health and Sports, 2020) although travel restrictions are likely to remain in place until a vaccination system is in place, hence it is assumed that the SSF sub-sector will continue to experience setbacks. A further shock to the fisheries sector has been the recent political turmoil after 1 February 2021. The impact will not be known until mid-2021.

Philippines

Disruption to small-scale fisheries

The national government of the Philippines placed a number of provinces and cities under Enhanced Community Quarantine (ECQ) in mid-March 2020 in response to the COVID-19 pandemic. The ECQ meant "stay at home" as mobility and transportation (air, water, land) were restricted. Despite the pandemic and associated measures, the country's total fisheries production during the first three-quarters of 2020 was higher by 1.24 % compared to the first three-quarters of 2019 (3,181,377.15 MT vs. 3,142,428.90 MT) (Philippine Statistics Authority, 2020). By sector, however, the municipal (small-scale) fisheries sector recorded lower production by 1.83 % (843,817.01 MT vs. 828,393.10 MT), which is in contrast with higher commercial fisheries production by 6.71 % (730,066.69 MT vs. 779,039.27 MT) and aquaculture production by 0.34 % (1,568,545.20 MT vs. 1,573,944.78 MT). The municipal fisheries production decline was highest during the second quarter of 2020 (7.02 %), coinciding with the early months of the strictest level of the community quarantine. It recovered during the third quarter when selected sectors of the economy were partially opened, but the recovery was not enough to cover the dip in the second quarter.

Considered the poorest (Philippine Statistics Authority, 2017), the municipal (small-scale) fishers' lives were difficult during the pandemic. Stories of fishers (men and women) publicly shared (e.g., Novio, 2020; Mirasol, 2020; Cabico, 2020a) on social media

platforms of various fisheries groups described the hardship caused by limited fishing and marketing activities and the need to fend for themselves given the lack of a meaningful social assistance package, especially in the early months of the community quarantine. The women in the fishing households who usually carry out the fish marketing were greatly affected (i.e., had to stop or had to walk to reach buyers) by the mobility and transportation restrictions. Moreover, similar to experiences with past disasters, the burden of food insecurity was predominantly placed on women during the pandemic.

Although the government issued a directive that fishing was exempted from restrictions, there was confusion in the early months of implementation. Small fishers were apprehended by maritime authorities for allegedly violating quarantine protocols (Mirasol, 2020; Pedrajas, 2020; Miraflor, 2020; Novio, 2020), and local government units (LGUs) disobeyed the national order allowing fishing and the free-flow of fish amid the COVID-19 pandemic (Ocampo, 2020; Biong, 2020a). The lack of transportation (especially from March to May) reduced fish marketing. The closure of the ice plants and the hours of queues at checkpoints resulted in fish spoilage (Mirasol, 2020). The fishers of high-valued species (e.g., crabs, oysters, lobsters, groupers) were affected by the closure of restaurants, cancellation of events, and temporary closure of wet markets and fish ports (Gubalani, 2020; Letigio, 2020; Marzan, 2020).

The pandemic highlighted the power dynamics between the small-scale fishers and the commercial fishers who had the means to continue and sustain their fishing and trading operations. The commercial fishers continued to encroach in the municipal fishing grounds reserved for the small-scale fishers and their presence increased during the pandemic (Cabico, 2020b; Novio, 2020).

Coping strategies

The fishers were recognised as "food security front-liners" (Cator, 2020; DA-BFAR, 2020) and to play a crucial part in the fight against COVID-19. The government allowed fishing activities to continue and the free flow of fishery products by issuing food passes and local transport permits to fishers. But most small-scale fishers continued to fish for food, resorted to direct selling to neighbours for a lower price, and relied on government support. With strict transportation restrictions during the early months of the community quarantine, selling fish, particularly by women meant selling nearby or walking farther distance for a longer time to reach particular buyers. Other women have organised themselves and started a market for their catch or started to sew and sell cloth masks.

Relief and support received

Republic Act No. 11469, passed in March 2020, details the initial response measures of the government to the COVID-19 pandemic. Among other provisions, the fiscal package targeting the vulnerable groups included a cash aid program for senior citizens and low-income households, social protection measures for displaced workers, loans and credit guarantees for small businesses, and agricultural sector support. Specifically, the support by the national government to small-scale fishers during the pandemic included: i) loan provision of PHP25,000 (USD521) each at zero interest rate under the PHP2.8 billion (USD58.33 million) Survival and Recovery (SURE) Aid Program (Mirasol, 2020); ii) subsidy in the form of PHP2,000 (USD41), a voucher for food items and a cash voucher worth PHP3,000 (USD62) under the Cash and Food Subsidy for Marginal Farmers and Fisherfolk Program; iii) livelihood support programs through provision of fishing gears and boats under the Special Area for Agricultural Development Program, the PHP21.9 million (USD456,250) worth of production inputs (that includes fingerlings and seaweed dispersal, production-related technology demonstration projects) under the *Ahon Lahat, Pagkaing Sapat Laban sa Covid program* (Tecson, 2020); and, iv) provision of marine floating fish cages project to fishers associations under the Targeted Actions to Reduce Poverty and Generate Economic Transformation program.

Meanwhile, the local government units (LGUs) played a greater role in supporting the small-scale fishers during the early months of the community quarantine by providing them with food packs and buying fish for relief operations (DA-BFAR Memorandum dated 23 April 2020; Biong, 2020b). In July 2020, the DA Communications Group (2020) reported 442 LGUs procured directly from farmers and fishers for their food packs, generating PHP2.6 billion (USD54.2 million) in sales.

Emerging lessons

While the pandemic and the accompanying policy of community quarantine highlighted the fishers' role in maintaining food supply amid crisis, it exposed their poverty, vulnerability, and marginalisation. They were unprepared and lacked any viable way to cushion the impact of disruptions on their livelihood. Most of the support (loan, cash, food packs, and fishing inputs) came in the middle-to-end of the year, signifying the lack of systematic program support for them, which was long overdue by the small-scale fisheries sector.

The pandemic also reminded of the importance of the fight against illegal fishing, the importance of shifting to value-addition or processing seafood products, and the importance of fisheries storage facilities. Direct fish marketing and home delivery services flourished. The direct procurement by LGUs from the fishers has

created a sure market for the catch while ensuring food security.

Thailand

Disruption to small-scale fisheries

In early 2020, the COVID-19 pandemic made adverse impacts on the small-scale fishery of Thailand, despite immediate enforcement of restrictive measures and a comparatively low number of COVID-19 cases. When the government enforced a nationwide lockdown and curfew measures starting in early April 2020, travel across provinces, and country borders were restricted, and domestic and international flights were suspended. These government control measures, although necessary, affected the economy of the country, especially the fisheries and service sectors.

The fisheries sector in Thailand includes the artisanal (small-scale) fishery and the commercial fishery (DOF, 2015). In 2020, there were about 57,000 registered fishing vessels in Thailand (MD, 2020), of which around 47,000 were small scale fishing vessels (DOF, 2020a). The small-scale fisheries contribute around 10 % of the total marine capture fishery production (DOF and CCCIF, 2017).

The lockdown measures caused differential impacts on fishing activities in the country. Small-scale fishers stopped fishing or decreased fishing effort due to low fish demand and price; other small-scale fishers continued fishing within their locality when the fishing time was not within the curfew hours (or secured a permit document when the fishing time was within the curfew hours). But there was difficulty maintaining the quality of fish and fishery products delivered outside the provincial areas due to travel restrictions (Chanrachkij et al., 2020).

Most activities were discontinued in factories for fish processing because of a shortage of raw materials since many fishers stopped fishing (Chanrachkij et al., 2020; Kaewnuratchadasorn et al., 2020). It was also difficult to sell the processed products due to limited transportation services and reduced demand from consumers (Chanrachkij et al., 2020).

With travel restrictions and a limited period of market operations, traders could not deliver the fish and fishery products to major fish markets. The suspension of most tourism activities due to the pandemic resulted in a significant decrease in the demand for fish and fishery products from this sector, including hotels and restaurants. Consumers' access to fish and fishery products was limited due to restriction measures in local markets (Chanrachkij et al., 2020). The health protocols as the government's main policy, such as stay-at-home and work from home, were also considered as one of the reasons for the limited access of consumers.

Coping mechanisms

Small-scale fishers extended their market channels and value-added to fish and fishery products (Chanrachkij et al., 2020). Many fishers turned to e-commerce or online selling of fish and fishery products. This became a family coping strategy in which young family members, who were more adept in information technology, actively facilitated online selling. Fishers also resorted to direct selling of their catch to customers in their community and intensified fish processing (e.g., sun drying); thus, they still earned some income when the fish price was low.

Relief and support received

The relief measures available for small-scale fishers (for both women and men) were financial assistance, food and daily subsistence goods, and low-interest bank loans. The national government provided financial assistance (THB5,000 or around USD160 per person for each month from April to June 2020) to registered farmers in the agricultural sector and temporary workers or freelancers outside the agricultural sector (OPM and UN, 2020). DOF (2020b) reported that more than 200,000 fishers in small-scale and commercial fisheries received financial assistance from the national government. The local governments also provided food and daily subsistence goods (Chanrachkij et al., 2020). The Department of Fisheries (DOF) and the government banks (i.e., the Bank for Agriculture and Agricultural Cooperatives and the Government Savings Bank) partnered to provide low-interest bank loans to fishers under the programs "Quick Loan Support for Persons Affected by COVID-19" (maximum of THB10,000 or around USD320) (Bangkokbiznews, 2020) and "Loan for Enhancement Liquidity for Fishery Entrepreneurs Project" (maximum of THB5 million or around USD0.16 million) (DOF, 2020c).

Emerging lessons

During the COVID-19 pandemic, e-commerce became a common fish marketing strategy supporting small-scale fishers and improving consumers' access to fish and fishery products. However, the skills in online marketing and fish handling techniques of small-scale fishers, especially women and young people, still need to be enhanced to maximise the potential of this marketing strategy while ensuring the safety and quality of fish and fishery products, respectively (Chanrachkij et al., 2020; Kaewnuratchadasorn et al., 2020). Moreover, to offset the decreased demand for seafood from the tourism sector, the promotion of fishery products to local consumers at affordable prices should be strengthened (Kaewnuratchadasorn et al., 2020). Lastly, the establishment of small-scale fishers' groups could foster coordination among fishers, government, non-government organisations, and other relevant stakeholders in developing

resilience strategies to mitigate the impacts of pandemics and other disasters in the future, such as the provision of micro-finance schemes to cushion the economic effects of similar disruptions in the future (Chanrachkij et al., 2020).

Vietnam

Disruption to small-scale fisheries

Vietnam is lauded as one of the countries with successful measures against COVID-19 with their strict enforcement of "tracing and chasing" efforts since early 2020. Although the pandemic and the associated preventive measure of quarantine affected the economy as a whole, it did not significantly disrupt the SSF during the first wave (February to May 2020), except in few areas where lockdown was imposed. However, the disruptions experienced in coastal provinces such as Hai Phong, Quang Ninh, Quang Nam, and Da Nang or even Binh Thuan and Ninh Thuan provinces, did not last long.

During the second wave of COVID-19 (from June to August), there were also no major adverse impacts as the local authorities were already experienced and well-prepared to mitigate the problem. The form of disruptions in the SSF included i) the reduction in fishing efforts due to difficulty in transporting their catch to the market; and ii) the low demand for fish due to the closure or limited access to domestic markets (including local and central markets); and, the drastic reduction in tourism activities.

Among women in fisheries, their activities of fish selling, processing, or buying inputs for fishing trips continued. The difference was on the frequency of holding these activities when fishing activities were limited or reduced by COVID-19, especially during the first wave. Women organisation such as the women union and other similar social groups (e.g., youth union, veteran association) significantly contributed to enhancing awareness on COVID-19 and how to prevent it.

Relief and support measures

Although the impacts of COVID-19 are not significant to the SSF of Vietnam, the Government of Vietnam still provided relief measures such as financial assistance, food subsidy, and low-interest bank loans. Everyone impacted by COVID-19 was provided assistance, especially the poor. The significant policies of support for the people to overcome the adverse impacts of COVID-19 were: i) Financial support package of VND61.58 trillion (USD2.67 billion) for the poor and enterprises affected by the COVID-19, of which more than VND52 trillion (USD2.25 billion)to support six eligible groups (including the poor, the people with meritorious services, people who lost their job, and others), VND9.5 trillion (USD411.64 million) to support enterprises; ii) Directive No. 11/CT-TTg dated 4/3/2020 relating to urgent tasks and measures to reduce difficulties for production and business, ensuring social security to cope with COVID-19; iii) Official Letter No. 897 / TCT-QLN dated 3/3/2020 on the extension of tax payment deadline and exemption of late payment interest; iv) Decree 41/2020/ND-CP dated 8 April 2020 of Government extending the time limit for payment of value-added tax, corporate income tax, personal income tax, and land rental; and, v) Resolution No. 42 of Government on support for social security to ensure a basic standard of living for the people, especially the poor and the unemployed. There were other policies implemented to ensure domestic food supply and food reserves and to promote agricultural production to maintain stability countrywide.

Emerging lessons

The cooperation and collaborative efforts of the government, all economic sectors, and the people are important against disruptions like the COVID-19 pandemic and its associated preventive measures. The pandemic presented an opportunity to use new strategies that work and can be applied in the future. This includes online commerce, safe (distancing) at work, safe transportation and delivery of food products. The pandemic also showed that the implementation of financial and investment support could help the people of Vietnam rise above the adverse impacts of the pandemic. However, other helpful strategies need to be explored, such as safe access to the food chain, safe food production management, and safe linkage between enterprises and cooperatives.

Discussion

Small-scale fisheries significantly contribute to the socio-economic well-being of coastal communities in Southeast Asia as providers of food, livelihood, and income, particularly to the poor, vulnerable, and marginal sector (Pomeroy, 2012; Teh and Pauly, 2018). Fisher households are prone to various crises and shocks that put a lot of stress on their already vulnerable condition, making them less economically resilient. Given the few assets of fishing dependent households, their ability to cushion the negative impact of crises and shocks is limited. Women, who work primarily on fish post-harvest activities, have been significantly impacted. The COVID-19 pandemic has delivered another serious threat to the livelihoods of these coastal households and communities.

The pandemic and the accompanying policies (in various names, but all meant as "stay at home") in the six countries demonstrated the far-reaching impacts on the fisheries and on the small-scale fishers and their livelihood. It has also highlighted the importance of the fisheries sector, the problems that have long existed and presented an opportunity to reshape it and learn lessons. It took a pandemic to highlight the

role of the fisheries and the small-scale fishers. For example, in the Philippines, it emphasised the fishers' role in maintaining food supply amid crisis. In Myanmar, the unemployed labour returning to villages resulted in increased fishing pressure by those without incomes seeking access to food.

The effects of COVID-19 varied at different times and in different ways across the SSF in the six countries, reflecting the differences in their economic and social situation. The transportation and mobility restrictions caused fish trading to decline, if not halt, especially for high-value marine fish species sold at hotels and restaurants. Fish sales were redirected to local markets, and the use of e-commerce increased (Table 3). The effects are similar to that in many other parts of the world of the impacts of COVID-19 on the fisheries systems, in general (FAO, 2021; Love et al., 2020; Northrop et al., 2020);and, on the SSF (Bennett et al., 2020; Kaewnuratchadasorn et al., 2020; Chanrachkij et al., 2020; Campbell et al., 2020).

The pandemic has exposed the poverty, vulnerability, and marginalisation of small-scale fishers. They were unprepared and lacked viable ways to cushion the impact of fishing and market closures on their households. The pandemic has further exposed the political and economic marginalisation by many governments to the small-scale fisheries sector. The small-scale fishers had to fend for themselves in the early months of the pandemic, while most government support to the fishers came in the middle-to-end of the year, signifying the lack of systematic program planning and action to support the small-scale fisheries sector. Indonesia, Malaysia, the Philippines, Thailand, and Vietnam all supplied financial help and food subsidies designed as short-term coping strategies to address immediate challenges brought about by the pandemic. The financial help provided to fishing households was critically important to purchase necessities. Malaysia and the Philippines provided support for fishing gear and improved post-harvest infrastructure. Myanmar, the Philippines, Thailand, and Vietnam provided low-interest loans to fishers. Indonesia and Malaysia strengthened their fish marketing systems.

The pandemic also showed fishers making positive changes to their livelihoods. Fishers in Indonesia, the Philippines, Thailand, and Vietnam made adaptive responses such as direct fish marketing, online marketing, and home delivery services. Also, direct procurement by the local government in Malaysia and the Philippines from the fishers created a sure market for their catch and at the same time ensures food security. There is a need to learn from the pandemic to be able to identify new and better approaches that will consider the impact of similar threats or disruptions on livelihood in the future. These adaptive responses can be carried forward, learned from, and further enhanced to address future shocks.

Table 3. Summary matrix of the lessons learned from COVID-19 in six Southeast Asian countries.

Indonesia	Malaysia	Myanmar	Philippines	Thailand	Vietnam
• Fishers are vulnerable to disruptions • Fish in relief packages create sure and direct market for catch • Importance of cold storage during glut • Online marketing works for fish	• Fishers are vulnerable to disruptions • Need for social infrastructure and safety nets • Need to strengthen fisheries cooperatives	• Fishers are vulnerable to disruptions • Negative impact on the small scale fishers	• Fishers are vulnerable to disruptions • Fishers maintain food supply amid crisis • Need for social infrastructure and safety nets • Direct marketing and online marketing work for fish • Importance of cold storage during glut	• Fishers are vulnerable to disruptions • Online marketing • Direct marketing • Fish handling techniques • Promotion of fish to local consumers • Establishment of fishers groups to develop resilience strategies	• Online marketing • Financial help matters

Emergency relief is usually delivered to an area due to a natural disaster, such as a typhoon, flood, or drought. While there was no physical damage resulting from the COVID-19 pandemic, the impacts may be more damaging as whole national, and international economies and societies have been affected. The economic and social disruptions have reverberated from individual fishing households through global seafood value chains. The COVID-19 pandemic has highlighted the need to think more broadly about planning how to respond to disasters.

There is a need for long-term adaptive measures that can contribute to building specific and generalised household resilience to multiple shocks and stressors. In most cases, stressed fishing households with limited resources often resort to more extraction of the limited asset available to them, the fishery, and their natural capital. Fishers are forced by economic pressure to engage in unsustainable fishing practices in order to cope with either short or long-term stress i.e., education of children, health emergencies, etc.

The pandemic has emphasised the urgency for household resilience, a key concept for addressing the vulnerability of small-scale fishing households. A resilient fishing household should be able to evolve in response to changing stresses while maintaining its functionality even as capital (natural, financial, human, physical, social, and institutional) is restrained. There is a need for well-targeted actions to reduce inequalities by taking into account the heterogeneity in livelihood trajectories and unequal social vulnerability; to refocus and reallocate funds, specifically, programs for protecting and preventing the impact of COVID-19 for small-scale fishers, including the preparation of social safety net schemes (Tschakert and Hipsey, 2021).

Several approaches are recommended to improve fishing household resilience, and especially the integration of women (Stacey et al., 2019). The first is to strengthen the fishing households' social network of friends, relatives, and neighbours – social capital. This can serve as both a social safety net and a bridge toward the transition to financial inclusion. The second is livelihood diversification (Pomeroy et al., 2017) to reduce dependency on the fishery and provide for additional sources of income and food. Although the existence of livelihood alternatives beyond the fishery could be a crucial factor in building household resilience, the creation of such options is difficult to accomplish in practice. Income diversification can only sustain natural resources and improve human well-being if it truly transforms livelihoods by connecting local users in new ways to economies and societies (Hanh and Bonstra, 2018). In the case of COVID-19 pandemic, some fishing households use it as an opportunity to diversify their livelihoods through alternative fish marketing strategies. Fishers' wives assist in securing alternative livelihoods such as selling food and becoming housemaids.

The third is financial inclusion through savings, credit, digital payment products, and insurance that has all been found to increase resilience and cut risk (Pomeroy et al., 2020) to address the lack of financial cushion to mitigate disaster impacts. The fourth is value chain upgrading through post-harvest fish handling and processing methods (including market infrastructure improvements) to stabilise and increase local fishers' income through cost efficiencies and quality improvements that allow fishers to retain more value (Lomboy et al., 2019). Market "pull" investments may help the fishers to meet market requirements and link them to markets through fresh seafood sourcing and responsibly caught products. The fifth is the provision of access, especially for women, to social protection measures such as government health insurance and social security.

Conclusion

This paper describes the disruptions to and responses by the small-scale fisheries to the COVID-19 pandemic and the accompanying lessons learned in six countries in Southeast Asia. Fishing households are some of the most economically vulnerable people in the region, with one of the highest poverty rates. Fishing households are stressed by factors within fishery systems, as well as by ecological and social impacts outside their influence such as climate change, chronic pollution, resource degradation, fluctuating prices of commodities, conflicts over resource use that increase vulnerability and changes in management strategies that can asymmetrically affect different communities. COVID-19 has only added to this list of stressors.

Given the few assets of a fisher household, their ability to cushion the negative impact of crises and shocks is limited. While short-term responses of providing food and financial assistance have been helpful, long-term support to address not only pandemics such as COVID-19 but also other stressors will require developing more resilient fishing households. It requires addressing fundamental social, economic, and environmental reforms that affect coastal communities and livelihoods. Achieving progress in this direction means those providing assistance must engage coastal communities in a dialogue about the future they envision, the steps needed to get there, and the lessons learned along the way. In the recovery efforts, if the small-scale fishers are not left behind, then it will be a "best normal", otherwise, it will be a "worst normal."

A limitation of the study is that due to travel restrictions in each country resulting from COVID-19, it was impossible to conduct primary surveys of households to fully understand impacts and responses. When it is safe to travel again, it is recommended that surveys be conducted of fishing households to gain more knowledge about the impact and responses to COVID-19.

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COVID-19 impacts and adaptations in Asia and Africa's aquatic food value chains

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ABSTRACT

The COVID-19 pandemic is a shock affecting all areas of the global food system. We tracked the impacts of COVID-19 and associated policy responses on the availability and price of aquatic foods and production inputs during 2020, using a high frequency longitudinal survey of 768 respondents in Bangladesh, Egypt, India, Myanmar, Nigeria. We found the following: (1) Aquatic food value chains were severely disrupted but most effects on the availability and accessibility of aquatic foods and production inputs were short-lived. (2) Impacts on demand for aquatic foods, production inputs, and labor have been longer lasting than impacts on their supply. (3) Retail prices of aquatic foods spiked briefly during March-May 2020 but trended down thereafter, whereas prices of production inputs rose. These trends suggest a deepening 'squeeze' on the financial viability of producers and other value chain actors. (4) Survey respondents adapted to the challenges of COVID-19 by reducing production costs, sourcing alternative inputs, diversifying business activities, leveraging social capital, borrowing, seeking alternative employment, and reducing food consumption. Many of these coping strategies are likely to undermine well-being and longer-term resilience, but we also find some evidence of proactive strategies with potential to strengthen business performance. Global production of aquatic food likely contracted significantly in 2020. The importance of aquatic food value chains in supporting livelihoods and food and nutrition security in Asia and Africa makes their revitalization essential in the context of COVID-19 recovery efforts. We outline immediate and longer-term policies and interventions to support this goal.

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1. Introduction

Capture fisheries and aquaculture are a vital source of employment, income, and nutritious food for millions of people in Africa and Asia. COVID-19 and policy measures to contain its spread have seriously disrupted food value chains due to disturbances in transportation, trade, labor mobility, logistics, and temporary closures of institutions (e.g. schools) and places of business (e.g. markets, restaurants) [1–5].

Though important for protecting public health, emergency containment measures have contributed to a severe global recession that has depressed consumer spending power. Between 90 million and 150 million people are predicted to fall into extreme poverty as a result [6]. Most of these poverty increases will be in sub-Saharan Africa and South Asia [7]. This trend has already had dire consequences for food and nutrition security. The number of people experiencing extreme food insecurity increased by an estimated 45 million from February to June 2020 alone [8]. Low-income consumers spend a large share of their earnings on food and are likely to substitute relatively cheap staple foods such as rice or maize for more costly nutritious non-staples such as meat, eggs and aquatic foods (e.g. fish, crustaceans) when incomes decline [9]. These trends are rapidly undermining decades of progress on key human development indicators, including the Sustainable Development Goals [10].

The COVID-19 pandemic is a systemic shock that affects all areas of the global food system. A growing range of impacts on aquatic food[1] producers, value chain actors, and consumers is evident. This includes disruptions to international trade in aquatic foods, reconfiguration of domestic food value chains, and exposure of fishers and seafood processing workers to COVID-19 infection [11], immobilization of migrant fishers and fishworkers [12], delays in accessing critical production inputs for aquaculture such as broodstock and seed [13,14], changes in levels of fishing pressure [15], fluctuating consumer and producer prices, changing product preferences, and reduced levels of production [11, 16,17].

Taking into account these emerging patterns, we hypothesized the following:

1. COVID-19 and associated containment measures will disrupt aquatic food value chains, affecting the supply of production inputs, labor, and transport/logistics.
2. COVID-19 and associated containment measures will inhibit the mobility of workers and consumers and reduce employment and incomes. This will lead to lower demand for aquatic foods and lower derived demand for aquatic food production inputs, such as feed and fish seed.
3. Combined supply and demand side shocks will affect availability and prices of aquatic foods and inputs for aquatic food production. Depending on the circumstances, these effects may be short-term (e.g. due to hoarding by consumers) or longer-term (e.g. due to delayed stocking of ponds by farmers). They might also drive prices up (e.g. due to inability to access production inputs), or down (e.g. due to sluggish consumer demand for aquatic foods).
4. The confluence of points 1–3 will drive adaptations in the behavior of actors in aquatic food value chains, and reconfiguration of the structure of these chains (e.g. such as through the accelerated diffusion of e-commerce [18]).
5. Effects will be spatially and temporally uneven. They will be shaped by place specific contexts that include COVID-19 infection rates, stringency of policy responses, and seasonality of production. Effects will also be socially uneven, shaped by factors including gender, economic status, type and scale of business operations, and degree of political influence.

Over the course of 2020, we tracked the impacts of the COVID-19 pandemic and associated policy responses on the availability and price of aquatic foods and production inputs across the entire aquatic food value chain in three Asian and two African countries (Bangladesh, India, Myanmar, Egypt, Nigeria), over the course of 2020. To gain further insight into how the effects of the pandemic were experienced and how those affected adapted, we conducted semi-structured phone interviews with 63 respondents in Bangladesh, and online interviews with 100 aquatic food value chain actors and key informants from 17 sub-Saharan African countries.

The results provide insight into the pathways by which aquatic food value chain actors have been affected by the crisis to date. These results give rise to policy recommendations aimed at mitigating impacts in the present, assisting recovery, and building a more resilient aquatic food system in future. Public health interventions continue to play an important role in saving lives, but the deepening economic crisis demands a renewed emphasis on protecting livelihoods and human nutritional status. We contend that the revitalization of aquatic food value chains can contribute to these goals.

The remainder of the paper is organized as follows: First, we present the survey methodologies. Second, we summarize information on rates of COVID-19 infection and the stringency of COVID-19 policy responses in each of the five countries included in the high frequency survey. Third, we present quantitative findings on supply side and demand side shocks, prices and availability of aquatic foods and production inputs, and qualitative findings on actor responses. We conclude with immediate and longer-term policy recommendations to support a fast and equitable process of recovery in which aquatic foods and aquatic food value chains play a central role in supporting livelihoods and food and nutrition security in Asia and Africa.

2. Methodology

2.1. Survey

We conducted a multi-country survey of aquatic food value chain actors (n = 778 in eight value chain nodes), covering the period from February to October 2020, in three Asian countries[2] (Bangladesh, India, and Myanmar) and two African countries (Egypt and Nigeria). These countries were selected because of high levels of aquatic food production and consumption, and the presence of WorldFish offices. In India, we conducted three separate surveys, covering the states of Andhra Pradesh, Assam and Odisha.

Health precautions and movement restrictions made it impossible to visit the field to select survey respondents. Respondents were therefore identified from existing contacts of WorldFish country offices, with additional snowball sampling where necessary. Care was taken to include actors operating at a range of scales, drawn from major aquatic food producing and consuming areas in each survey location, and to include a mix of women and men respondents. The sampling technique means that survey results can be considered indicative of broad temporal trends but are not nationally or sub-nationally representative.

Survey implementation took place in two stages. The first round was implemented in May and covered the months of February, March, and April. Recall data for February was collected to provide a pre-pandemic "benchmark" for assessing subsequent months. From May to June and onward, data was collected from the same set of respondents on a fortnightly or monthly basis, with each interview covering the period of

[1] The term 'aquatic foods' refers to all foods captured or farmed in water. For the countries and value chain actors studied in this paper, aquatic foods are comprised predominantly of finfish and crustaceans.

[2] We also conducted regular interviews with 22 respondents in Timor Leste, but these are excluded from the results presented here due to the small sample size.

the preceding calendar fortnight or month, respectively. Extra questions were added to the survey instrument at the beginning of this second phase, but the questionnaire remained unchanged afterward. To incentivize continuous participation in the survey, respondents were provided with mobile phone top up credit, worth approximately USD 2 following each completed interview. Where respondent attrition occurred, efforts were made to find replacement respondents with similar characteristics.

Surveyed actors included hatcheries (78), feed mills (27), feed sellers (98), fishers (125), farmers (244), processors, comprised mainly of fish driers or smokers (42), traders (77), and retailers (79).[3] The combination of value chain segments and total number of respondents interviewed varied slightly between survey locations, reflecting the types and numbers of actors present. In each location, enumerators conducted the survey by telephone and recorded responses using the KoBoToolbox digital data collection platform. Where relevant, the questionnaire was translated into the local language. The questionnaire structure was standardized across the countries to facilitate direct comparability of results, but response options were country-specific, such as species of fish and types of feed.

The survey instrument was divided into two parts: a general section, and an actor-specific section. In the general section, respondents were asked a common set of questions about employing workers, and access to inputs, transportation, and buyers. The second section was comprised of questions specific to the type of business the respondent operated. These included number of days operated and reasons for any suspension of operations, as well as the quantity and value of inputs procured and/or products produced or sold, which varied by type of value chain actor. Data was first cleaned, and then analyzed using the Microsoft Power BI platform, allowing results to be presented online in an interactive format for public use. The complete survey results can be accessed from the WorldFish COVID-19 webpage [19].

2.2. Qualitative interviews

We implemented a qualitative phone survey of aquatic food value chain actors in Bangladesh to capture more nuanced details on the context in which observed trends from the multi-country structured survey were embedded. A semi-structured interview guide consisting of 10 groups of open-ended questions was designed to capture information of how COVID-19 had impacted participants' occupations, businesses or livelihoods, and their adaptations to these changes, impacts on their food consumption, and the nature of any assistance or support received.

Telephone interviews were conducted in two rounds, in May and September 2020. A list of potential participants was generated based on the prior contacts of the research team and then recruited by phone. During the first round, 44 participants (39 men, 5 women) were selected purposively to capture a diversity of actor types, sizes of business operation, and geographical locations.[4] During the second round, all respondents from the first round were re-interviewed, and an additional 18 women and one man were recruited and interviewed, totaling 63 participants.

2.3. Online survey and key informant interviews

Simultaneously, we conducted a survey with 100 respondents working in aquaculture across 17 sub-Saharan African countries. During May invitations to participate in the survey were posted on social media platforms including the Sustainable Aquaculture Research Networks in Sub Saharan Africa Facebook page [20]. Respondents self-selected themselves as survey participants. Twenty interviews were conducted online or by phone. However, this approach proved difficult due to connectivity and language issues, so a short online survey form was fielded, and answered by 80 respondents from mid-June to mid-July. Survey design was coordinated to include questions covering topics similar to those in the two surveys described above.

3. COVID-19 pandemic impacts and policy responses in surveyed countries

The COVID-19 pandemic spread rapidly throughout the world after it was first recognized in China in December 2019. COVID-19 was first recorded in India in January 2020, in Egypt and Nigeria in February, and in Myanmar and Bangladesh in March (Fig. 1). Reported cases initially increased fastest in Bangladesh, Egypt, and India. Case numbers gradually stabilized from July in Bangladesh, Egypt, and Nigeria, but continued to rise fast in India. Infection rates were initially low in Myanmar but increased sharply from August. By October, India had by far the highest rate of reported infections among the five countries (7078 per 100,000 inhabitants) and Nigeria had the lowest (304 per 100,000). Bangladesh, Egypt, and Myanmar had intermediate levels (approximately 1000–3000 per 100,000).

Governments instituted a variety of containment policies and economic interventions intended to mitigate the impacts incurred by the pandemic and associated restrictions. Containment policies included a mix of phased full and partial "lockdowns" implemented at national (e.g. in India) or sub-national (e.g. in Myanmar) scales. To slow the rate of transmission, restrictions were placed on the movement of people, such as air transport and inter-state or intra-state movements by road. Operation of businesses and institutions such as markets and schools were severely curtailed, as were social gatherings like weddings, funerals, and religious or sports events.

The stringency of the application of these measures varied between countries and over time, as measured by a "response stringency index" (100 = most stringent). The index peaked in April and declined at different rates afterward in most countries (though it remained high in Myanmar where cases increased rapidly from August onward). This reflects policy choices made based on infection rates and economic and political considerations (Fig. 2).

Economic policies introduced to mitigate impacts incurred by the pandemic and the moves to contain it mainly took the form of: (1) economic stimulus policies targeting sectors of the economy such as exporters; (2) financial relief for businesses in the form of loans, debt relief or restructuring, and reduced fees and taxes; and (3) forms of social protection such as cash transfers to vulnerable households [23,24]. However, our results presented below suggest that the reach of such programs in the countries surveyed has been patchy, and the amounts of money disbursed often small.

4. Results

The results are structured in alignment with the hypotheses set out in the introduction. We compare selected results across surveyed countries and value chain nodes to identify common patterns and divergence. First, we evaluate general disruptions to aquatic food value chains, in terms of access to production inputs, buyers, transport, and employment. Second, we assess the impacts of these disruptions on prices and traded quantities of aquatic foods and inputs for aquatic food production. Third, we examine evidence of adaptive behaviors by actors in aquatic food value chains and how these are shaped by actors' social and economic status, drawing on the qualitative survey findings.

[3] The number of individual actors in listed here sums to 770 (two more than the 768 respondents noted in Section 2.1) because two actors changed business operations during the survey.

[4] The sample was not gender balanced, in part because many businesses in aquatic food value chains in Bangladesh are run by men, and in part because the team implementing the survey found it difficult to recruit women respondents willing to be interviewed at length by phone. Attempts were made to ensure a more gender balanced sample in the second round of the survey.

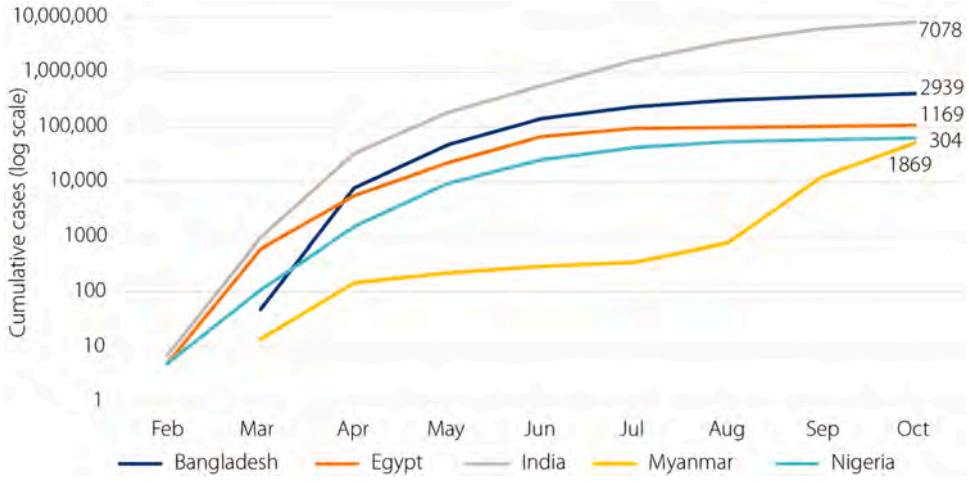

Fig. 1. Cumulative Covid-19 cases by country, February–October 2020, and cases per 1,000,000 inhabitants [21].[51]

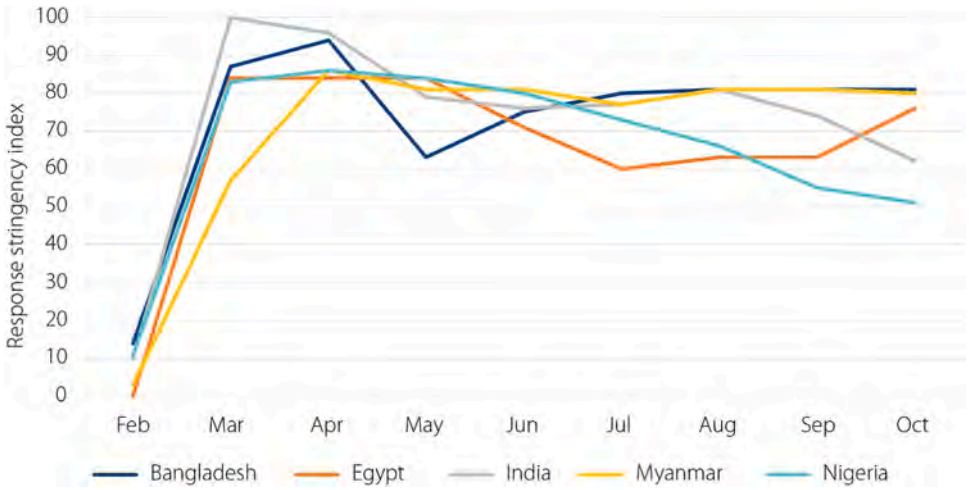

Fig. 2. COVID-19 response stringency index rating by country, February–October 2020 [22].[61]

4.1. Disruptions to aquatic food value chains

4.1.1. Purchasing and sales behavior

Bangladesh, India, and Nigeria experienced a "V shaped" supply side shock during early part of the pandemic. Our first indicator of value chain disruption is the share of respondents reporting whether they attempted to purchase inputs or sell products in each month (Fig. 3A,B). The largest impacts occurred in March and April during the height of lockdown restrictions. Nigeria and India were most severely affected; the share of respondents attempting to purchase inputs fell by 65% and 35% points, respectively, as compared to February. In both countries, this share did not reach or exceed pre-pandemic levels until August. Bangladesh recorded a similar though less pronounced trend, with a smaller initial drop in business activity and quicker recovery.

Impacts in Myanmar were initially rather limited, but the share of businesses attempting to make sales trended gradually downward until June, to around 20 percentage points below February's level, before recovering in August. Egypt followed the opposite pattern, with the share of businesses attempting to purchase inputs rising 25 percentage points between February and June. This trend reflects the relatively low incidence of COVID-19 infections in Egypt relative to other countries, and the highly seasonal nature of farmed fish production there, with production increasing from March onward as temperatures rise. In all five countries, the share of businesses attempting to sell products followed a similar temporal pattern to those attempting to buy inputs.

4.1.2. Access to buyers

Demand for aquatic foods and production inputs exhibited a "U-shaped" recovery in all countries except Myanmar. The ability to find customers is essential for businesses to continue their operations. We use the share of respondents able to find buyers for all the products they expected to sell as an indicator of access to customers. Businesses' access to customers can be mediated by mobility and access to transport for both buyers and sellers, and by the level of demand from customers. This dynamic is reflected in Fig. 3D.

The ability to find buyers follows a similar temporal pattern to the ability to access transport, but access to buyers is more deeply impacted and somewhat slower to recover than access to transport. By September, the share of businesses able to find buyers whenever anticipated had returned to February levels in only Egypt and Bangladesh, and fell again in Bangladesh during October. This suggests that lagged effects on demand persisted for several months after the most stringent rules imposed in response to COVID-19 were relaxed, and/or that new effects set in over time.

4.1.3. Employment

Demand for labor in aquatic food value chains followed a similar "U-shaped" pattern to demand for food and inputs. Enterprises in aquatic food value chains are important sources of employment and wage income for large numbers of people wherever clusters of these businesses exist, and hired labor is an important input for many enterprises in

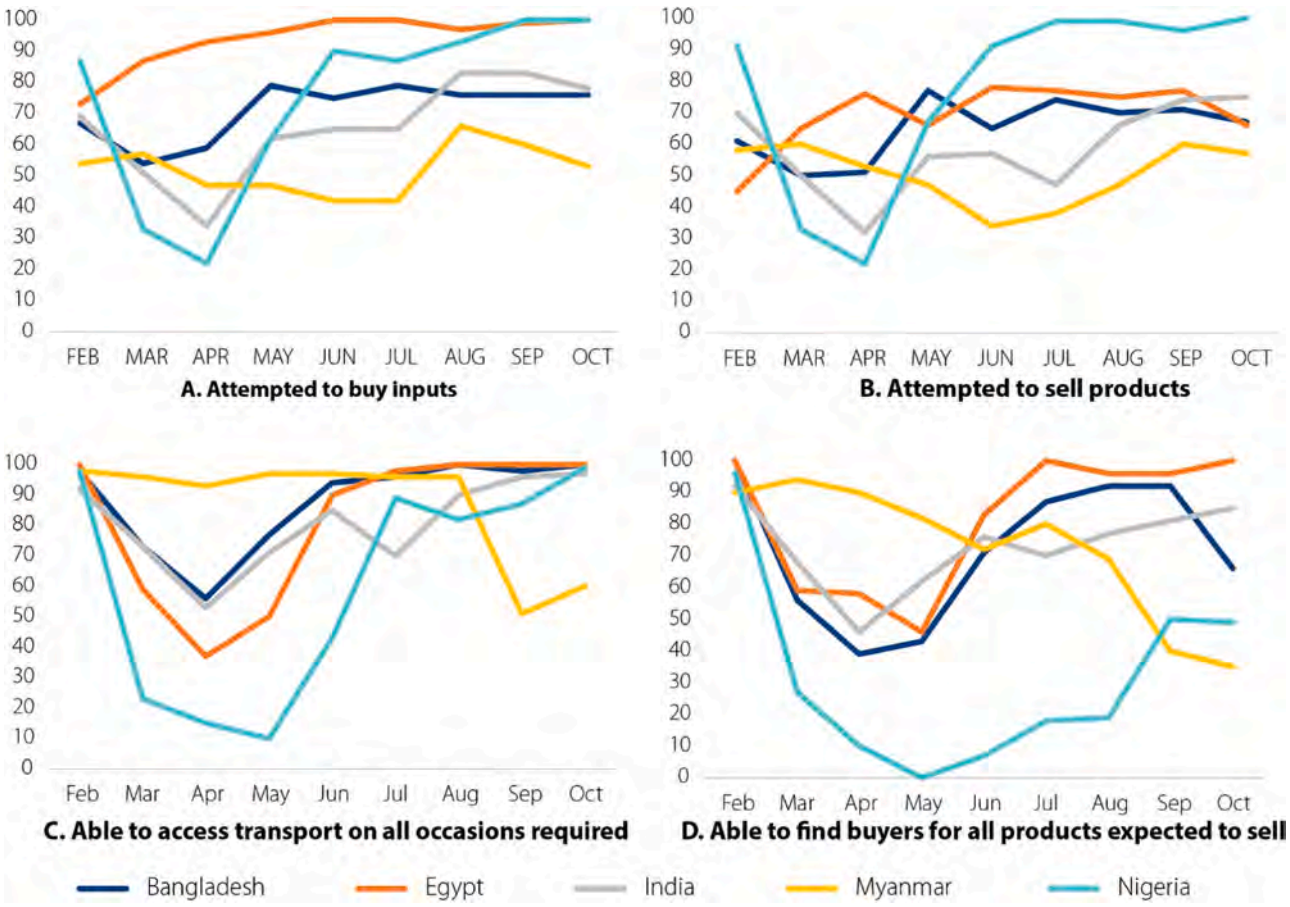

Fig. 3. Purchasing and sales behavior among respondents, February–October 2020 (% of respondents). N = 768.

aquatic food value chains [25]. The share of respondents employing casual workers fell below "baseline" February levels in most months in every country except Egypt, where the share of businesses employing workers increased over the course of the fish farming season, which runs from March to November.

On average across the five surveyed countries, the share of businesses employing male casual workers shrunk from 51% in February to 34% in April, and then climbed gradually again to reach 45% in October. Twelve percent of surveyed businesses reported hiring female casual workers in February. This share shrank to 5% in May and remained static before climbing to 10% in October (Fig. 4).

These figures suggest that COVID-19 had gender-differentiated impacts on men's and women's ability to access paid work in aquatic food value chains, with women's employment more severely impacted than men's. Further research is needed to understand and address the reasons for this trend. One possible explanation relates to the greater burden of unpaid care work falling on women during the pandemic, especially in the form of care for children removed from school as part of containment responses [26,27].

We asked respondents whether they had any difficulties hiring labor, in the expectation that health precautions and movement restrictions could reduce worker availability. About 15–18% of respondents experienced difficulties finding workers when needed between March and May, falling to 8% by October (similar to February levels), indicating that this was a temporary issue. This suggests that lower than usual rates of employment after May are mainly the effect of reduced demand for labor from businesses as they experienced reduced turnover or attempted to cut costs, with implications for the vulnerability of workers in these value chains.

Average nominal daily wages paid to workers climbed to a peak in July (15% higher than February levels for men, and 43% higher for women). Wages then declined to around February levels in October, when they stood at USD 5.05 and USD 3.73[7] daily, for men and women respectively – a large gender wage gap of 35%. Interestingly, reported daily wages for women workers converged with men's in July, possibly reflecting the retention of more skilled women workers and the shedding of less skilled positions. However, wage ratesdiverged again when employment rose.

4.2. *Impacts on the availability and price of aquatic foods and production inputs*

In this section, we summarize key results on quantities and prices of aquatic foods and production inputs traded in the five countries, from February to September 2000. For comparability, we normalized all values by creating indices in which February represents the base month for each country, with a value of 100. Deviations above or below this

[6] The COVID-19 response stringency index is created by the Oxford COVID-19 Government Response Tracker, which systematically collects information on 18 indicators based of common policy responses by governments to the pandemic, such as school closures and travel restrictions.

[6] The COVID-19 response stringency index is created by the Oxford COVID-19 Government Response Tracker, which systematically collects information on 18 indicators based of common policy responses by governments to the pandemic, such as school closures and travel restrictions.

[7] Calculated using a fixed April 2020 exchange rates, to control for exchange rate fluctuations.

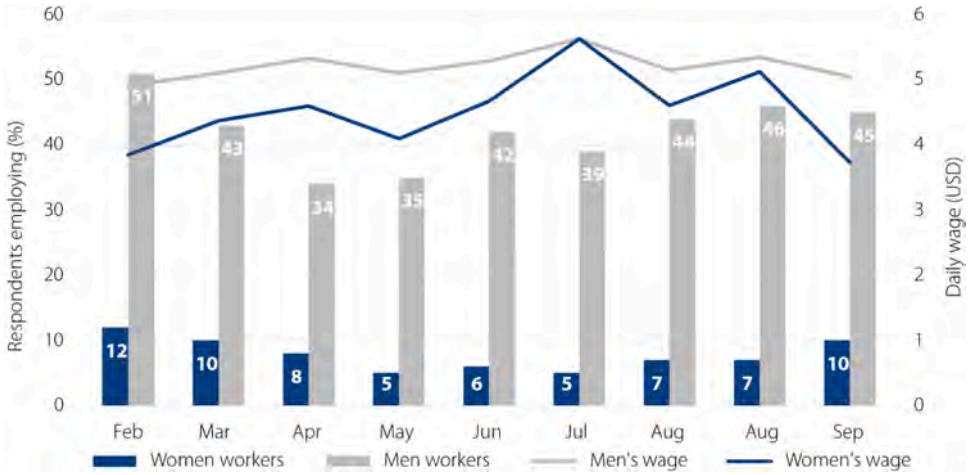

Fig. 4. Respondents hiring male and female casual workers (%) and average daily wage paid (USD), February-September 2020. N = 768.

value in subsequent months can be interpreted as percentage changes relative to the value in the base month.

In keeping with our value chain approach we first analyze, by country, prices and sales volumes of farmed fish in three value chain segments: upstream (farms); midstream (traders); and downstream (retailers),. We focus on farmed fish because it accounted for the bulk of fish produced and traded by respondents in the sample, making cross-country comparisons possible. We then analyze aggregate trends in the quantity, value, and price of selected inputs and products procured, produced, or sold by value chain actors including fishers, fish processors, hatcheries, feed mills, and farms.

4.2.1. *Fish prices*

Retail farmed fish prices peaked during the initial lockdown, but subsequently slumped due to low demand. Prices received by farms and traders have been depressed since the onset of the COVID-19 crisis. The following observations stand out.

First, in most countries, prices received by fish farmers and traders in most months were lower than before the onset of the COVID-19 crisis (Fig. 5A,B). Minor exceptions are Bangladesh and India, where farmgate prices exceeded those in February in 4 and 3 months, respectively, but by less than 20% in all but one case. In Nigeria and Myanmar, prices that traders received exceeded those in February by a small margin in 3 and 2 months, respectively. For all other countries and months, farms received between 5% and 35% less for fish sold than they had done in February. Across all countries and months, farmgate prices averaged 10% less than in February, with prices in India and Myanmar affected most strongly. A similar pattern is apparent for fish traders. Indian trader prices were affected particularly severely, averaging about half of February levels in most months. Across all countries, traders' sales prices averaged around 15% less than in February. This pattern is likely an effect of the slow demand evident in Fig. 3D, transmitted upstream from consumers, through marketing intermediaries, to producers.

Second, retail prices spiked during the first months of the pandemic but fell from June onwards (Fig. 5C). Retail prices rose by around 15% in most countries, and as much as 45% in Nigeria during the peak lockdown months from March to May. Divergence between producer and retailer prices during these months likely reflects increasing transport costs, paralleling difficulties in accessing transport (shown in Fig. 3C), as well as restrictions on wet market operations and consumers' tendency to stay home, heightening the chance of fish remaining unsold and becoming spoiled [1]. These costs and risks were likely passed on to consumers, some of whom may have been more willing accept them due to the reduced set of retail options available. However, in most months from June onwards, in most countries except Bangladesh, retail prices fell below February levels. This indicates that demand remained depressed after restrictions on transport and business operations eased, which is consistent with Fig. 3D. Egypt is a partial exception, with retail prices in June, July and August unchanged relative to February.

4.2.2. *Fish sales*

The quantity of fish sold by farms followed a seasonal trend but was lower than in a typical year. Fish sales by traders and retailers were depressed from March onward in most countries. We observe the following specific patterns: First, the trend in volumes of sales that fish farms made reflects the interplay of seasonality with the impacts of COVID-19 and related containment policies. The seasonal effect is most evident in Egypt, where only 8% of farms sold any fish in the 'base' month of February, before the onset of the COVID-19 crisis. Subsequent large increases in the farm sales index for Egypt reflect this low base, the ramping up of production and sales as temperatures rise in March, as well as the relatively moderate human health impacts of the pandemic the country during this period. In Myanmar, fish sales by farms followed a similar, though less pronounced, pattern of high sales relative to February, but contracted in August and September with the emergence of a 'second wave' of COVID-19 infections. Relative to February, volumes of fish sold by farms in India and Nigeria contracted in March-May. This likely reflects the severity of lockdown measures such as restricted interstate movement and market closures in both countries during those months. In most subsequent months however, sales volumes exceeded February levels, especially in Nigeria (Fig. 5D).

Second, the trader and retailer sales index for farmed fish fell in most countries and months, supporting the inference that consumer demand remained sluggish. In all countries except Myanmar, trader and retailer sales in March and April were lower than in February. This finding likely reflects the stringency of lockdown measures and incidence of COVID-19 infections, which were higher in Bangladesh, India, Egypt, and Nigeria during these months than in Myanmar (Figs. 1 and 2). The trader and retailer sales indexes remained above February levels in Myanmar in most subsequent months. In Nigeria, the trader sales index increased up to 10 times between May and September, compared to February. But for all other countries in most months, trader and retailer sales remained below or close to February levels. India's trader and retailer sales were particularly heavily impacted. On average, Indian traders reported selling about 75% less farmed fish in each month than in February, while retailers sold 45% less, suggesting that a dramatic reduction in fish consumption took place.

4.3. *Production, procurement, and prices*

Fig. 6A–C further illustrates the relationships between seasonality of supply and demand and COVID-19 impacts for fishers, processors,

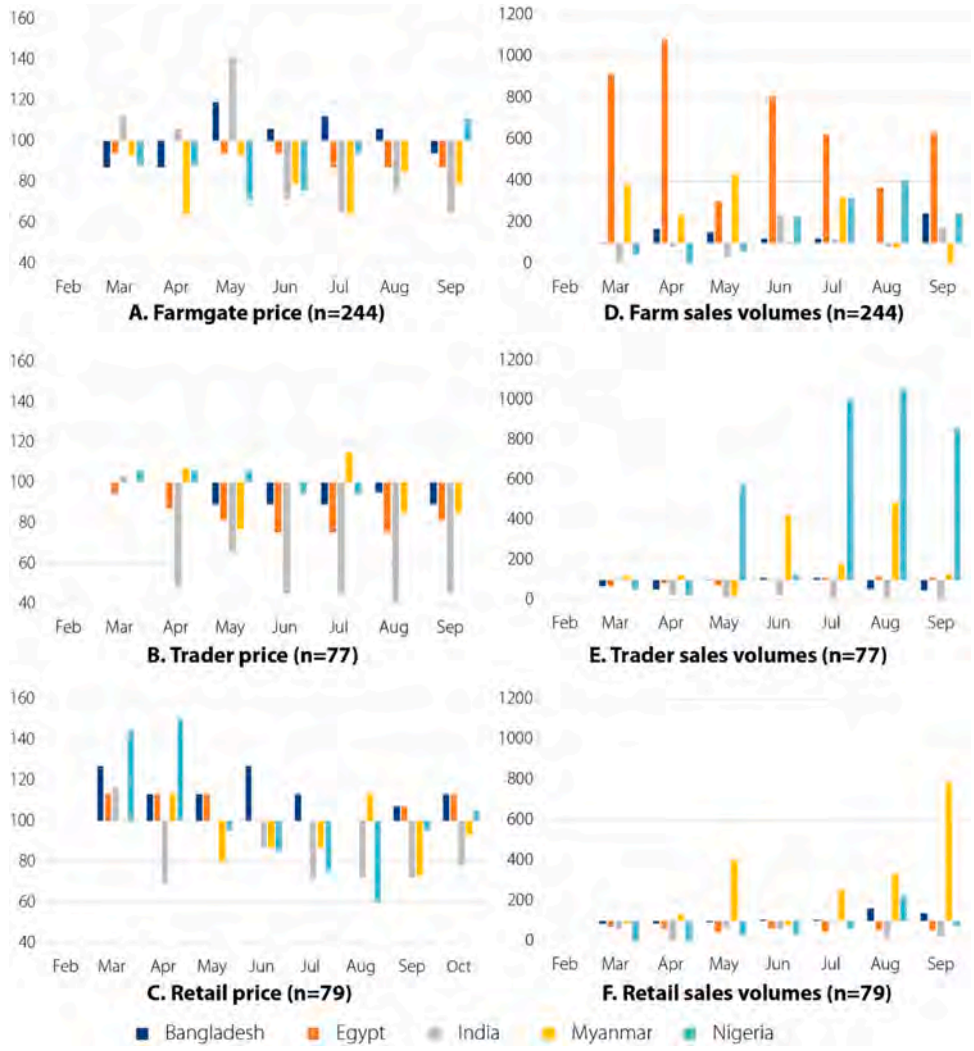

Fig. 5. Monthly farmed fish price indexes and monthly farmed fish sales indexes, February–September 2020 (Note: author's calculations using own survey data. The base month for all indexes is February, with a base value of 100).

hatcheries, and farms. Fig. 6D–F presents price trends for key feed mill and farm inputs.

4.3.1. Production and procurement

Capture fisheries landings are highly seasonal. Stormy weather during the monsoon season often precludes fishing in small-scale marine fisheries. Myanmar, Bangladesh, and states on the east coast of India enact fishing bans during April-June[8] to protect spawning fish stocks. In these locations, "peak" fishing season runs from approximately October to April. Fish processing (meaning fish drying in the case of most survey respondents) is highly dependent on supplies of fish from capture fisheries, requires dry weather, and follows a similar temporal pattern.

The low value of the index for capture fish landings and quantity of fish processed from May to July reflect seasonal tendencies, but the low values in March and April (usually months of high activity) are mainly attributable to COVID-19 impacts (Fig. 6A). Respondents from both types of businesses cited temporary business closures due to COVID-19, restrictions on travel, and difficulties hiring transport among the major reasons for pausing operations in March and April. This is in contrast to the closure of the fishing season and bad weather as the reasons commonly reported from May to August.

Hatchery seed sales undergo two seasonal peaks, especially for hatcheries specializing in carp seed production; in March and April when hatchlings (newly hatched fish) are sold to nurseries, and in July, when fingerlings (larger juvenile fish) are sold to farms. The timing of these peaks in activity is related to the timing of annual production cycles that are linked to seasonal variations in rainfall and temperature. Although these peaks in activity occurred at the usual time, reports from the field in Bangladesh and India indicated that they were low compared to previous years, causing some hatcheries to destroy large quantities of seed that they were unable to sell due to transport restrictions [28,29]. The hatchery sales index remained close to February levels during subsequent months, indicating low levels of business activity as February is low season for hatcheries most countries surveyed (Fig. 6B).

Feed procurement by farms reflects as similar mix of seasonal and COVID-19 effects. Low temperatures reduce fish metabolism, making February a quiet month for feed procurement in Egypt, India, and Bangladesh. The feed procurement index remained at relatively low levels during the peak lockdown months of March and April, even as temperatures rose. The procurement index for non-pelleted feeds, such as rice bran and oilcake, reached its highest level during April and May. This might indicate that they were substituted for more expensive pelleted feeds to reduce costs, an adaptation that farmers reported in our qualitative study in Bangladesh. The overall feed purchase index was about four times higher in May to July than in other months (Fig. 6C).

[8] Exact timings vary by country.

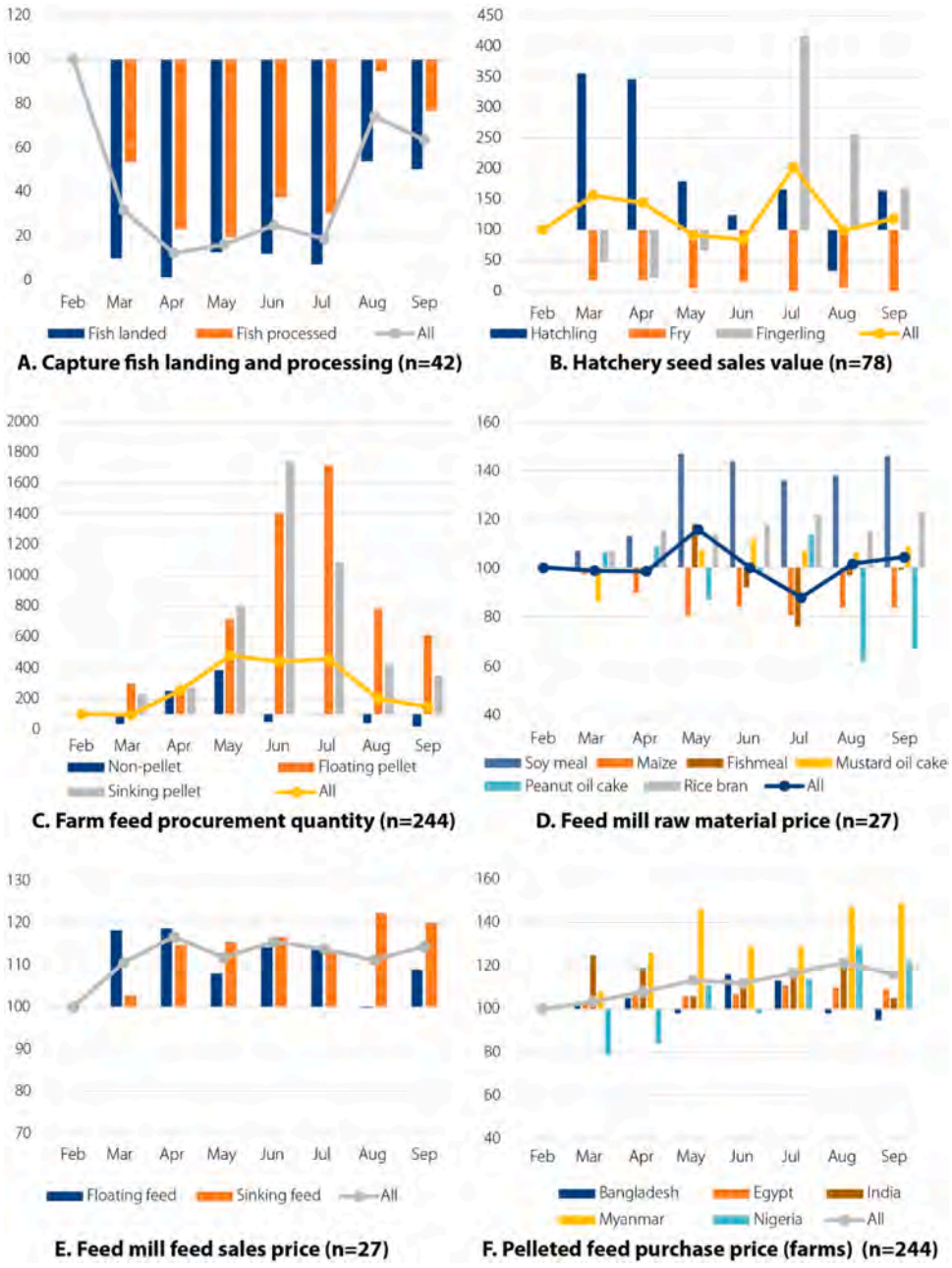

Fig. 6. Monthly all-country indexes, February–September 2020. (Note: author's calculations using own survey data. The base month for all indexes is February, with a base value of 100).

Peaks in the purchase of feed at this time are associated with the peak monsoon farmed fish production season in Asia and Nigeria, when nearly all ponds are stocked with growing fish. High levels of feed purchases during these months may also reflect farms making bulk purchases after transport restrictions eased – a strategy reported by respondents to our Bangladesh qualitative survey.

4.3.2. Input prices

Feed mills use a variety of raw materials for manufacturing pelleted feeds. Raw material prices remained relatively stable throughout the survey period. The price index did not deviate by much more than 20% above or below February levels, for all raw materials except soy. The price index for maize and peanut oil cake trended downward in most months after February. Soy, rice bran and mustard oilcake prices exceeded February levels in most months. The fishmeal price index fluctuated (Fig. 6D). Raw materials are procured from domestic or international markets or both, depending on local availability, price, and quality, meaning that prices are influenced by both international and local conditions. The relative overall stability of raw material prices during this period reflects, in part, the lack of emergency restrictions on international trade during the crisis, which has helped to minimize price volatility for key staple crops such as rice, maize and wheat [30].

Despite relatively stable prices for most raw materials, the mean price of feed that mills sold between April and September was 10–15% higher than in February (Fig. 6E). Farms also reported increases in the price of pelleted feed. The average farm procurement price index for pelleted feed rose about 20% from February to August. Price increases could reflect increased operating costs, including higher wage rates and transport costs. This inference was supported by respondents to our qualitative survey in Bangladesh, who noted that transport costs jumped 30% during lockdown, and remained 10% higher than in 2019 following the relaxation of movement restrictions. Increasing prices of feed may

also reflect high rates of inflation in surveyed countries during 2020 (Fig. 6F).[9]

4.4. Impacts and adaptations

In this section, we review the impacts of the trends outlined above, with respect to incomes and employment, food and nutrition security, assistance (i.e. receipt of financial or other material support), and adaptive behaviors.

4.4.1. Incomes and employment

Higher input prices coupled with falling farmgate prices, as noted above, suggest that farm earnings would have become increasingly squeezed over the course of 2020. Reductions in farming and fishing activity also reduced demand for harvesting labor, transport, and other services, with significant negative outcomes for the many workers who depend on these activities. Qualitative interviews in Bangladesh show working hours declined 30–40% and incomes decreased nearly 70% during the lockdown period for drivers employed in transporting fish and production inputs, due to lower fish and shrimp harvests and landings.

Income levels reported by farmers, fishers, businesses, and workers in aquatic food value chains in Bangladesh, typically improved post-lockdown but fell short of 2019 levels. For example, fish harvesting workers worked an average of 25–28 days and earned approximately USD 145–180 per month in May-August 2019. This plummeted to 8–12 days and USD 60 per month in March-April 2020, before recovering partially to 15–20 days and USD 90–95 per month in May-August 2020. Transport workers carrying fish, shrimp, crab, and fish seed reported similar trends.

Many respondents in Bangladesh reported seeking supplemental work to cope. For example, an itinerant fish seed trader (*patilwala*) reported taking up day laboring to support his family due to the negative impact of COVID-19 on demand for fish seed, while a female collector of wild shrimp post-larvae (PL) began working as a laborer on a crab farm to supplement reduced income from PL sales. Other respondents used savings or borrowed to meet their food consumption needs. Poorer respondents, in particular, expressed feelings of anxiety and helplessness in the face of uncertainty, inability to find work, and pressures around paying back loans. This strongly suggests that non-material dimensions of their well-being were also compromised.

4.4.2. Food and nutrition security

COVID-19′s impacts on food and nutrition security varied widely by country. From May onward, we asked respondents whether the quantity of food their family purchased during the past month was the same as, higher, or lower, than under 'usual' circumstances. By this simple measure, food and nutrition insecurity was lowest in Egypt (where no respondent reported purchasing less than usual from July onward), and highest in Nigeria, where 55–85% of respondents gave this answer in each month (Fig. 7). Impacts were significant in Bangladesh and Myanmar, where between approximately one-quarter and half of respondents, respectively, purchased less food than usual each month. Myanmar is notable because this share trended up over time, reflecting the late onset of widespread COVID-19 infections and a second round of containment measures there. These figures suggest that the reduced financial viability of businesses in the aquatic food value chain has been linked to persistent negative impacts on food and nutrition security for many operators.

Qualitative interviews from Bangladesh provide additional insight into food and nutrition security during the pandemic. Effects on consumer behavior differed among lower- and higher-income consumers.

Actors in lower-income groups, including small-scale farmers and fishers, *patilwala*, drivers, and laborers, described decreased dietary diversity and increased food and nutrition insecurity, due largely to loss of work and income. Commonly reported coping strategies included skipping meals, eating less per meal, purchasing fewer food items, consuming fewer animal-source foods and/or eating greater quantities of more affordable staple foods. For example, a fish farmer described how her family had not eaten meat in a single meal in a month during the COVID-19 pandemic, a decline from their usual four times per month prior to this time. One fishing laborer explained that his school-aged children had to start working at the fish landing center to supplement declining household income and cope with increasing food and nutrition insecurity. However, some lower-income respondents reported being able to maintain normal levels of food consumption by producing part of their own food. For example, a dried fish retailer explained that her household was able to continue consuming fresh and dried fish from fishing, as well as vegetables grown on a small area of her own land.

In contrast, respondents with higher incomes, including operators of large hatcheries and feed mills and employees of seafood export companies, reported being able to switch to mobile applications for grocery shopping and delivery. They also described eating more nutritious foods such as fruits rich in vitamin C with the intent of boosting their immune systems. Better-off respondents also reported following food safety and hygiene practices such as soaking vegetables and fruits in saltwater before consumption, which they believed would reduce the risk of COVID-19 infection. No low-income participants reported carrying out these practices, likely reflecting limited access to utilities such as running water, and indicating their heightened vulnerability during the pandemic relative to groups with more resources.

4.4.3. Assistance

Beginning in May, respondents were asked whether they had received any form of assistance, like cash transfers or emergency food rations, from institutions such as government, NGOs, religious institutions or business associations. The share of respondents receiving assistance was very low in Bangladesh, Egypt, and Nigeria. In Myanmar, rates of assistance were low from May–July, but jumped to 32% in August and 39% in September as the government implemented a cash transfer scheme during the country's second lockdown [32]. India had the most consistent rates of delivery, with 12–24% of respondents receiving assistance each month (Fig. 8). Government was the main source of assistance, but trade associations also played a significant role in India, accounting for 15–35% of assistance in all but 1 month. Our online survey of actors in African aquaculture value chains produced similar findings, with only 4% of respondents reported having received any assistance by mid-July.

Most of the assistance received appears to have been in the form of social protection transfers to households or individuals, rather than support targeted at businesses. A Bangladesh qualitative survey respondent opined that in the past, public funds had often been distributed inequitably, stating, "bank loans and benefits have always been for the musclemen of society, with less chance to reach to the real entrepreneurs". Other respondents felt that such funds might be difficult to obtain, or that informal businesses and enterprises without bank accounts could be ineligible to receive them. Low levels of information about and access to government loan programs for businesses are also reported by operators of integrated poultry-fish farms in Myanmar [33].

Many qualitative survey respondents from Bangladesh used informal support mechanisms to sustain their families, leveraging social capital with friends, relatives, and/or wealthier actors in aquatic food value chains to cope with lost income or livelihood activities. For example, a driver explained that a local shopkeeper had allowed him to delay payment for his groceries. Fishing laborers and fish harvesters often took loans from fishers and farmers on condition of working for them in the following year, effectively selling their labor in advance, likely at discounted rates. Some operators of larger businesses reported providing

[9] Nigeria (12.9%), Myanmar (6.1%), Egypt (5.7%), Bangladesh (5.6%), and India (4.9%) [31].

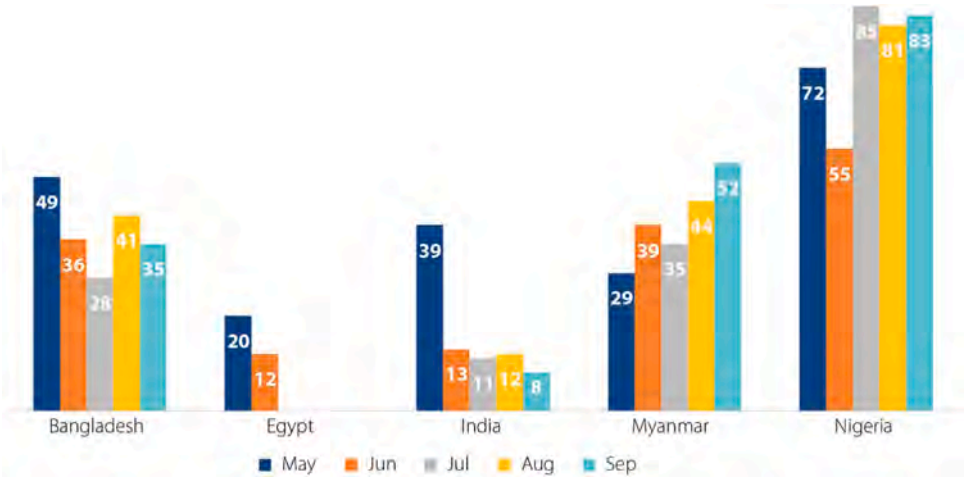

Fig. 7. Respondents consuming less purchased food than usual, by month (%). N = 768.

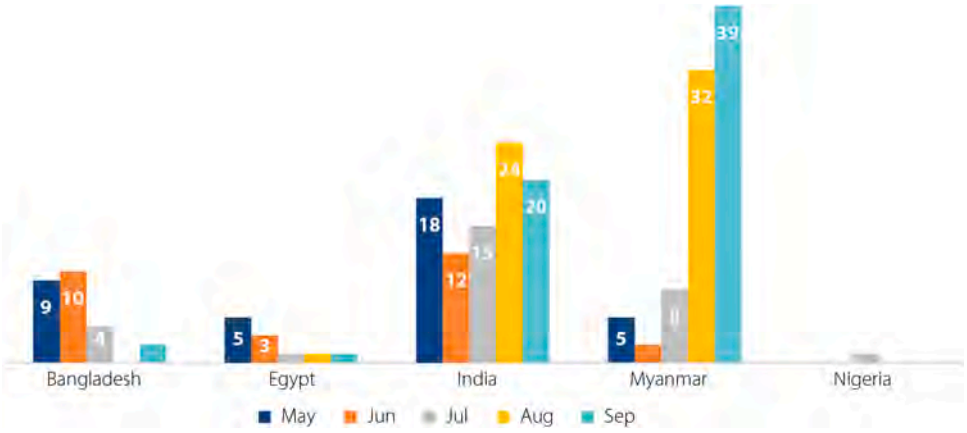

Fig. 8. Respondents reporting receiving any assistance, by month and country (%). N = 768.

food, financial assistance or loans to workers, neighbors, and smaller enterprises, during the lockdown period. These observations hint at the operation of local moral economies, with somewhat ambiguous implications. While they are capable of providing a degree of social protection in the absence of state support, there is potential for exploitative consequences.

4.4.4. *Adaptive behaviors*

Qualitative interviews from Bangladesh and our online survey in Africa revealed that aquatic food value chain actors took a variety of adaptive measures to facilitate businesses operations. These can be categorized broadly as reactive or proactive.

Reactive adaptations focus on variable cost reduction or input substitution, as a response to low demand for products and/or constrained supply of inputs. The most common reactive adaptations reported by respondents in Africa and Bangladesh include the following: (1) Temporarily pausing or reducing the duration of operations; (2) Minimizing operating costs (e.g. by laying off or hiring fewer workers, paying lower wages, reducing input procurement, reducing harvesting and/or stocking rates, delaying the beginning or end of a production cycle, or using cheaper production inputs); (4) Sourcing alternatives to unavailable inputs; (5) Bulk buying and hoarding inputs; (6) Selling products at discounted rates; (7) Borrowing working capital; (8) Paying bribes to facilitate continued operations.

Reactive adaptations are common, particularly for smaller enterprises with limited resources. Although often necessary for reducing losses, minimizing risks, or overcoming constraints, these strategies tend to lower productivity and incomes. For example, hatcheries in Bangladesh used synthetic hormones after the price of imported carp pituitary gland from India rose several times, resulting in lower ovulation and higher rates of hatchling mortality. Also, feed mills and farms in Africa and Bangladesh used locally sourced raw materials or feeds of inferior quality and/or higher price when imported products were unavailable. In another example, farmers in Bangladesh stocked hatchery produced shrimp PL, perceived to be of inferior quality to wild caught seed. Many actors in Bangladesh, including dried fish processors, hatcheries, *patilwala*, and feed retailers reported offering discounts or selling products at reduced rates to clear stock or generate sales.

During the lockdown in Bangladesh, confusion around the enforcement of movement restrictions, which vehicles transporting fish and shrimp were officially exempted from, often resulted in drivers having to pay bribes, raising transport costs. Similar findings are reported in Nigeria [1]. Selling assets was a drastic but relatively uncommon coping strategy, reported in one instance in Bangladesh where a small feed retailer sold land to cover business losses.

Proactive adaptations are innovations that fundamentally alter business operations, value chain structure, or relations between value chains actors, creating new opportunities or potential to improve performance. Adaptations of this type were most common among, though not exclusive to, larger businesses. Respondents in Africa and Bangladesh cited the following examples: (1) using digital platforms for marketing or procurement; (2) operational diversification, such as farms selling products direct to customers, offering delivery services, or setting up retail operations; (3) institutional innovations, including

coordination among shrimp hatcheries in Bangladesh to set a minimum price for PL; (4) providing expanded trade credit to customers to maintain demand.

Other minor proactive adaptations include conducting business activities remotely (meeting online instead of face-to-face), placing orders by phone, and following safety precautions such as social distancing and providing personal protective equipment and hand sanitizers to safeguard the health of workers and customers.

5. Discussion and conclusions

Here we synthesize findings from our multi-country panel survey of aquatic food value chain actors and contextual interviews from Bangladesh and Africa. Six results stand out.

First, consistent with other reports [1,3,11,14,17], COVID-19 and associated containment measures severely disrupted aquatic food value chains across the countries surveyed, particularly via impacts on transport and logistics. Importantly, most effects on the availability and accessibility of aquatic foods and production inputs were relatively short-lived, leading to a "V shaped" recovery in aquatic food and production input supply after the most stringent lockdown measures were eased.

Second, also consistent findings from many Global South countries, lagged effects of lockdown measures and the ongoing COVID-19 health crisis have resulted in persistent reductions in consumer demand [6,7,9,32]. Demand for aquatic foods has yet to recover to pre-pandemic levels in the countries surveyed. As a result, derived demand for production inputs and services, such as seed, feed, transport, and labor also remains low. This resulted in substantially lower incomes for businesses and workers throughout the value chain in 2020, as compared to 2019.

Third, except for a brief spike in retail prices during the lockdown period, aquatic food prices in all segments of the value chain trended downward over the course of the pandemic in the countries surveyed, reflecting depressed demand. Prices of most raw materials used for feed production remained relatively stable, in line with international agricultural commodity prices [7,30], but prices of manufactured feeds rose, reflecting increased costs of doing business and inflation. These trends may result in a deepening "squeeze" on the financial viability of producers and supporting value chain actors if demand does not recover. Based on trends observed in the countries surveyed, it seems likely that global aquatic food production contracted significantly in 2020, for the first time after decades of near continuous growth, as also reported elsewhere [34,35].

Fourth, aquatic food value chain actors reacted to these challenges in multiple ways. These included reducing production costs, using alternative inputs, leveraging social capital through informal networks, borrowing, seeking alternative employment, and reducing food consumption. While born of necessity and essential for enabling businesses and households to survive in the short to medium term, some of these coping strategies seem likely to undermine well-being and longer-term resilience [36]. It remains to be seen to what extent flexible strategies such as lowering input costs, subsistence food production, self-exploitation (e.g. practicing farming or fishing with very low returns) [37], and survival-driven livelihood diversification [38], will enable smaller producers and others to persist in the short run, prior to their ultimate recovery. Larger businesses appear to have greater capacity to adapt proactively. These advantages may deepen as the COVID-19 crisis continues, leading to concentration in some value chain segments [3].

Fifth, there is a high degree of commonality in the impacts and adaptations observed across countries, but with local conditions tempering outcomes. The stringency and timing of COVID-19 containment policy responses and the progress of the pandemic are critical factors, and these interact with seasonality in ways that may heighten or dampen impacts. The underlying robustness of the economy in which containment measures are implemented also appears to play an important role. Actors in Egypt and India seem to have recovered more quickly and fully than in Myanmar and Nigeria, while Bangladesh occupies an intermediate position. As widely observed elsewhere [39,40], findings from Bangladesh show that COVID-19 has exacerbated pre-existing social and economic inequalities. Asset-poor respondents and those in precarious occupations are most vulnerable to financial, food and nutrition insecurity and health risks, with consequences that are highly gendered [41].

Finally, the global COVID-19 pandemic has already reversed years of progress on key human development indicators, including poverty and food and nutrition security, with sub-Saharan Africa and South Asia affected most severely [10]. Aquatic foods play a unique role in diets in countries in both regions, as a leading source of relatively affordable and accessible nutrient-rich animal-source food [42]. Aquatic food value chains also support livelihoods and generate employment and income for millions of women and men across the Global South, offering routes out of poverty for some [25]. Prior to the COVID-19 pandemic, the dynamism of aquatic food value chains and their potential to drive progress toward development goals made them attractive sites for investment and intervention by governments and development agencies. This potential makes renewed investments in aquatic food value chains and the livelihoods they support of even greater importance in the context of post-COVID-19 recovery efforts.

6. Policy recommendations

In this section, drawing on the results presented above, we outline policy recommendations to mitigate and support recovery from the on-going shock of COVID-19. These are divided into supply side and demand side recommendations, and recommendations that are immediate (aimed at mitigating the on-going shock) and longer term (aimed at resilient recovery).

6.1. Immediate, supply side

Immediate supply side recommendations fall into two groups: (1) ensuring the smooth functioning of aquatic food value chains; (2) providing emergency financial support to actors in them.

The first set of recommendations includes the following points:

- Ensure that logistics (transport, storage), physical marketplaces, and "lateral" value chains delivering inputs, are designated essential. They must also be exempt from movement restrictions, and kept open and operating, with social distancing and sanitation provisions such as water and soap for handwashing, and providing personal protective equipment (PPE) to protect public health. This is the most fundamental condition for avoiding supply-side shocks [1,43].
- Designate workers throughout aquatic food value chains as essential workers. Special consideration should be given to mitigating the effects of containment policies on migrant workers, who make up a significant part of the workforce in many aquatic food value chains and can be particularly vulnerable to both lockdown measures and health risks [12].
- Ensure that rules governing containment policies are clearly formulated and publicized widely to maximize compliance and minimize rent seeking opportunities.
- Establish regular processes of consultation between government, fisheries professionals, and relevant business associations at national and sub-national levels to quickly identify emerging problems in aquatic food value chains and agree on and implement remedies.
- Avoid border closures and restrictions on imports or exports to help prices remain stable.

The second set of recommendations is prefaced by the observation that emergency financial support to actors in aquatic food value chains has been very limited to date in the countries surveyed. Where such schemes are implemented, they should take into account the following:

- Accord value chain actors such as traders, transporters, input suppliers, and processors the same priority as producers when allocating resources.
- Focus on small and medium enterprises, farms, and fishers, as these are more labor- intensive (employing many more people) than large enterprises, and they account for the majority of aquatic food produced and traded [3].
- Bailout programs that prioritize allocation of scarce resources to industry could exacerbate inequities rather than reduce them [44]. To maximize impact, aid packages can be scaled progressively. For example, when providing financial aid, payments can be made on a sliding scale weighted in favor of smaller boats or farms, rather than allocating a flat fee per unit of size or area.
- Financial support packages for business should be well-advertised. They must have transparent and simple application criteria and be designed in recognition that most aquatic food value chain enterprises are informal and often unbanked, making it necessary to devise inclusive application and distribution mechanisms.
- Loan timing and duration should account for seasonality, such as by scheduling disbursement around peak stocking season for farms, and repayment dates after final harvest.

6.2. Immediate, demand side

In most of the countries studied, the reach of formal social safety nets appears to have been limited or patchy to date. Keeping value chains working is thus of paramount importance. Nevertheless, where implemented adequately, safety nets play important roles in mitigating the impacts of shocks on the poor and vulnerable [45]. We observe the following:

- Unconditional cash transfers targeted particularly to vulnerable and poor groups, including women of reproductive age, can increase consumption of nutritious aquatic foods and stimulate demand for their production. Disbursement can be timed to coincide with the implementation of any forthcoming waves of lockdown measures, or other periods of particularly acute stress, including cyclones and drought, or fishing ban periods.
- Aquatic foods such as dried fish can be included in food aid packages as nutritious, culturally appropriate, convenient and low-cost foods, and used as an alternative to nutritional supplements that also stimulate demand for production.

6.3. Long term, supply side

Recommendations for the long term are aimed at revitalizing aquatic food value chains, to protect livelihoods and human nutrition, contribute to post-pandemic recovery and promote resilience to other future shocks. These include the following:

- The physiology of widely consumed aquatic organisms means that there is little chance of transferring viral zoonoses to humans [46]. This is strong grounds for promoting aquatic foods as preferred animal-source foods, given the associations between livestock rearing and bushmeat consumption and the emergence of new infectious diseases [47].
- Construct or upgrade critical infrastructure such as roads, electricity, and marketplaces.
- Establish systems for real time monitoring of the quantities and prices of aquatic foods and inputs produced and traded to track changes and support speedy interventions where necessary.
- Provide practical digital literacy training to actors throughout aquatic food value chains to support digitalization in aquaculture and fisheries to facilitate ease of advertising, marketing, input procurement, and delivery of technical advice and payments.
- Invest in human capacity and skills through training programs to support sectoral development in fisheries and aquaculture. This may include promoting production of nutrient-rich aquatic foods for household consumption to reduce food and nutrition insecurity in the face of shocks.
- Capture fisheries can play an important safety valve function during shocks such as COVID-19 but are vulnerable to particularly heavy exploitation during such events [15,48]. Fisheries should be accorded higher priority in development planning processes because of their importance for livelihoods and food and nutrition security.

6.4. Long term, demand side

On the demand side, revitalizing aquatic food value chains through the types of intervention described above will boost employment and income. This will contribute to demand for aquatic foods and other goods and services through production, consumption, and employment linkages [49]. The COVID-19 pandemic has widened existing inequalities and underlined the weakness of existing forms of social protection in many countries [50]. Over the long term, better developed and more comprehensive systems of social protection and public health care will be key to pre-empting rapid, large-scale slides into extreme poverty and food and nutrition insecurity when shocks occur [51].

CRediT authorship contribution statement

Ben Belton: Conceptualization, Formal analysis, Methodology, Supervision, Roles/Writing - original draft. **Leah Rosen**: Data curation, Formal analysis, Roles/Writing - original draft. **Lucinda Middleton**: Data curation, Formal analysis. **Saadiah Ghazali**: Data curation, Formal analysis. **Abdullah-Al Mamun**: Data curation, Formal analysis, Investigation, Supervision, Roles/Writing - original draft. **Jacqueline Shieh**: Data curation, Formal analysis, Roles/Writing - original draft. **Hamia S. Noronha**: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Roles/Writing - original draft. **Goutam Dhar**: Data curation, Formal analysis. **Mohammod Ilyas**: Investigation. **Christopher Price**: Supervision. **Ahmed Nasr-Allah**: Supervision. **Ibrahim Elsira**: Investigation. **Bikram K. Baliarsingh**: Investigation, Supervision. **Arun Padiyar**: Supervision. **Suresh Rajendran**: Supervision. **A.B.C Mohan**: Supervision. **Ravi Babu**: Supervision. **Michael Joseph Akester**: Supervision. **Ei Ei Phyo**: Investigation, Supervision. **Khin Maung Soe**: Investigation, Supervision. **Ajibola Olaniyi**: Investigation. **Sunil N. Siriwardena**: Supervision. **John Bostock**: Methodology, Supervision, Writing - review & editing. **David C. Little**: Methodology, Supervision, Writing - review & editing. **Michael Phillips**: Funding acquisition, Writing - review & editing. **Shakuntala H. Thilsted**: Conceptualization, Writing - review & editing.

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Fisheries co-management in hilsa shad sanctuaries of Bangladesh: Early experiences and implementation challenges

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Abstract:

Community-based fisheries management has long been practiced in the management of the inland fisheries of Bangladesh. However, formal coastal co-management has only been implemented recently in hilsa shad (*Tenualosa ilisha*) sanctuaries. The study analysed the pre-implementation processes, institutional arrangements, implementation activities, as well as challenges for fisheries co-management that are currently being implemented in the Padma-Meghna riverine-estuarine system. As a first step in establishing a co-management system in hilsa shad sanctuaries, communities (both fishing villages and fish landing centres) were selected for interventions. Co-management communities were formed from the community-village to district level with the defined tasks of developing plans and programs, implementing management rules and regulations, monitoring compliance, and creating awareness in a cost-effective manner among various stakeholders. Still, the operationalization of co-management in this large riverine-estuarine system is a challenging task. To overcome these challenges, several issues had to be considered through lessons learned from previously implemented community-based fisheries management projects in Bangladesh. To ensure that fisheries co-management is functional, the institutional framework needs to be flexible with support from local government institutions and NGOs. The boundary of the management unit needs to be clearly defined and community-based organization also needs a clear legal status. To make co-management sustainable, a relationship of trust and respect among co-management partners needs to be developed and maintained. The effective implementation of fisheries co-management will require an inclusive compensation scheme that will motivate stakeholders to comply and maintain fisheries management efforts through collective action.

Keywords: Hilsa sanctuaries; Co-management; Small-scale fisheries; Implementation challenges

1. Introduction:

Since the late 1980s, co-management has been widely proposed and implemented when other management approaches like top-down centralized management approaches have failed or have been found less effective in addressing management challenges (e.g. over-exploitation; governance failures)[1–3]. Co-management arrangements take shape in a collaborative partnership in which local resource-users or community groups and government agencies share some level of responsibility or authority to develop a management plan and enforce decisions[4–6]. Such arrangements also often involve collaboration among a range of stakeholders such as different government agencies, nongovernmental organizations, research institutions, private enterprises, and civil society organizations[7]. Arguably, co-management is widely touted as a participatory management

solution that enables the sustainability of fisheries and marine ecosystems in biological and socio-economic terms[2,3,8–11]. For both terrestrial and marine protected areas, co-management has been shown to bring significant benefits for local communities. It can lead to increased and more equitable sharing of economic benefits by enhancing tenure rights and decision-making processes[12]. Many studies have documented the involvement of dependent communities in conservation initiatives, particularly in protected areas (PAs), indicating that co-managed PAs are more likely to deliver better social and economic benefits than other types of governance[12]. A meta-analysis [13] suggested that fisheries co-management provides benefits to communities through progress in different key outcome indicators such as household income and well-being, wellness of resources, fish yield, and community access to resources. Co-management also helps reduce overcapitalization and improves monitoring, control, and surveillance by fishers, thus reducing the cost of enforcement, promoting economic development, ensuring more equitable processes in decision-making, and enhancing trust and reducing conflict among stakeholders. Co-management has been shown to result in more legitimate norms that are better-suited to local settings[2,3,9,14–17]. However, these outcomes vary, particularly with institutional and contextual conditions[12,16]. Co-management is not a "one-size-fits-all" tool and thus is not a solution to all problems of fisheries management; co-management has mixed outcomes, as its context, role, efficacy, and success varies widely[12,18,19]. For example, such practices may have some undesirable social and ecological outcomes such as the risk of elite capture and dominance by the powerful, creating incentives for over-exploitation that may increase social inequality and create other conflicts[10,18,20,21].

Critical assessment of the elements that contribute to such difficulties imply that an ill-planned pre-implementation process is an important factor. There are pre-implementation and implementation phases in the process of developing fisheries co-management. The pre-implementation period, or 'step-zero', refers to the process that takes place before the actual decision is made to initiate a co-management system, encompassing the things that need to be examined and controlled before co-management starts[18]. Implementation takes different shapes and forms depending on cultural context and institutional settings[22]. Thus, context is a determining factor for the success or failure of co-management. Identifying contextual factors will lead to a better understanding of factors that lead to the implementation of co-management and its resulting consequences[18]. Most co-management studies focus on how the co-management approach should be implemented, how such approaches operate in practice, the results that are obtained, and the problems and challenges that are faced[18]. This step-zero analysis of co-management has received less attention[1,18]. Though understudied, the pre-implementation phase is as important as the implementation phase. Learning about pre-implementation stages would help practitioners decide whether to proceed with implementation and if so, how to succeed. It should be noted that taking appropriate actions in the initial stage does not ensure final success, as problems may occur at a later stage. However, initial mistakes in co-management arrangement can lead to long-term undesirable outcomes in ecological health and management capacity of the fishery systems

and can curb practitioners' capacity of optimizations of planning processes [1,18]. Therefore, the initial steps of co-management play a crucial role in building the foundation for adaptive learning and allow partners to transform resources management policies and strategies, and even decision-making rules [15,18]. Fisheries co-management requires the formulation of a new structure to bring stakeholders together for decision-making and effective implementation. A country's regulations can inform the creation of the co-management structure, which may even be created using pre-existing committees and arrangements. These committees may be formed at landing centres, fishing villages, or at the beach, subject to the size and type of the fishery[23].

Concurrent with global efforts, community-based fisheries management (as a prototype for co-management systems) has long been practiced in managing inland fisheries resources in Bangladesh[24], but few studies have been published on the management of estuarine or coastal fisheries in the country[25].The Bangladeshi government's policies are moving towards participatory governance, which is reflected in the National Conservation Strategy 2016 that stressed the need for developing a regulatory framework that would enable and recognize the systems of community-based co-management in fisheries systems[26]. Thus, recent policy trends include the decentralization of power and authority to local government administration at the village level, encouraging the greater participation of different stakeholders. This provided the entry point for the development of the co-management system in the hilsa shad fishery of Bangladesh.

The article has the following two objectives:

a. To identify institutional arrangements, factors that enable success, and the limitations of previous management practices in the implementation of co-management in hilsa shad sanctuaries.
b. To understand pre-implementation processes, implementation activities, and challenges in the implementation of fisheries co-management in hilsa shad sanctuaries in the Padma-Meghna-River systems.

2. Overview of the hilsa shad (*Tenualosa ilisha*) fishery

The hilsa shad, *Tenualosa ilisha* (Hamilton, 1822), is an anadromous, commercially important fish species in the Indo-Pacific region. It has a wide distribution area in the region and occurs in marine, estuarine, and riverine environments[27]. Hilsa shad species generate billions of dollars in the Bangladeshi economy and are the single most important fishery in Bangladesh[28]. To protect the fishery from the overexploitation of juveniles and brood fish, the government of Bangladesh established six sections in the rivers of Padma, Meghna, Tetulia, and Andharmanik as hilsa sanctuaries (Fig. 1). In the sanctuaries, a temporary fishing ban is imposed on catching *jatka* (juvenile hilsa with a size <25 cm) from November 1 to June 30 each year. In

addition, a 22-day country-wide closure on fishing brood hilsa is implemented during the full moon in autumn (October and November months) to ensure safe breeding of hilsa[28]. To compensate fishers for the lack of income from fishing during the *jatka* fishing ban period, the government provides 40 kg of rice each month to about 0.25 million households for four months, as well as modest support for alternative income-generating activities[29]. So far, the establishment of these sanctuaries has proved successful in terms of biological gains, which are reflected in increased hilsa production over the last consecutive years since 2007-2008. However, these apparent successes have been masked by several challenges in the hilsa fishery management, such as top-down management approaches, non-compliance with sanctuaries rules by the fishers and traders, and conflicts among stakeholders that often question the efficacy of the management approach. In this context, the establishment of adaptive co-management by involving fishers, various stakeholders in the value chain, and the government in the sharing of responsibilities was considered in the search for better management options to protect biodiversity in the sanctuaries in a sustainable manner[30].

3. Methods

This study employed a mixed methods approach that includes(a) the analysis of documents (scientific articles, project reports, government documents, etc.) from different projects involving community-based fisheries management that have been undertaken in Bangladesh, (b) participant observations, and (c) interviews with fishers and other stakeholders. The second and third authors attended meetings, discussions, seminars, and training conducted on the arrangement of co-management. The minutes and proceedings of these events held both home and abroad were critically analysed. In addition, sixty in-depth semi-structured interviews were conducted in December 2018 and February 2019 with two communities (30 at each site) located in Haimchar *upzila* (sub-district) of the Chandpur district and Kalapara *upzila* of the Patuakhali district. In interviews averaging one hour, participants were asked to reflect on co-management processes. They were asked who initiated the discussions (formal or informal) about the co-management approach in hilsa sanctuaries, who were the participants in the initial discussions, what was the response towards this new approach, and how many meetings were conducted before an agreement about co-management was reached. The total time in days that the whole process required was calculated and the types of preparations undertaken before the co-management was initiated were listed. For example, participants discussed the number of workshops that were held; whether experts and local stakeholders were consulted and if so, how many; whether capacity assessment or feasibility studies were conducted; and whether the constraints and potentials of the co-management approach in the respective hilsa sanctuaries were discussed. The respondents included fishermen, fisherwomen, value chain actors and higher-level fishery entrepreneurs (businessmen, money lenders), as well as fishery officials and NGOs personnel. The data were analysed using a thematic approach.

4. Results

4.1.Early experiences of community-based fisheries management in Bangladesh

Starting in the mid 1980s, the Bangladeshi government initiated different pilot-scale projects and expanded "community-based fisheries co-management" through various donor- and government-supported projects, spreading community-based management to different inland water bodies such as *baor* (ox-bow lakes), *haor* (bowl- or saucer-shaped shallow natural depressions), floodplains, *beels* (lake-like wetlands with static water) and tributaries and small rivers. These projects included Oxbow Lakes Project I & II (OLP- I & II), Community-Based Fisheries Management Phase 1 and 2 (CBFM I & II), Management of Aquatic Ecosystems through Community Husbandry (MACH), Fourth Fisheries Project (FFP), Coastal and Wetland Biodiversity Management Project (CWBMP), Wetland Biodiversity Rehabilitation Project (WBRP), The Community-Based Fisheries Management in South Southeast Asia Project (CFBM-SSEA), and Community-Based Sustainable Management of Tanguar *Haor* Program (CBSMTP). These projects had varied rates of success, driven by different factors (Table 1). The majority of the projects that were carried out in closed waterbodies were found to demonstrate successful outcomes.

In these community-based fisheries management projects, the access and use of waterbodies (locally known as *jalmahals*) were given to fishing communities' organizations through standardized Memoranda of Agreement (MoA) between the Ministry of Land and Ministry of Fisheries and Livestock, as the wetlands belong to the Ministry of Land[24]. The institutional arrangement was usually three- or four-tiered, from the village level to the national or sub-national level. For example, in the Oxbow Lake Program (OLP-II), at the grassroots level, two groups of Fishing Teams (FT) and *Baor* Pond Teams (BPT) were formed for capture fishery harvest and fish culture in the *baor*. This participatory management played a key role in the successful implementation of culture-based fisheries management in the oxbow lakes[31]. In the Community-based Fisheries Management- Phase 2 (CBFM 2), 130 Community Based Organizations (CBOs) were established and developed as clear legal entities. The central committee was registered officially with the government. The CBFM-2 provides a successful mechanism for the implementation of sustainable fisheries management measures such as closed seasons during spawning season, gear restrictions, and habitat restoration[32].

For financial sustainability, the Sunamganj Community-Based Resource Management Project (SCBRMP) facilitated the formation of community-based credit organizations for savings and credit activities. The Community-Based Fisheries Management in South Southeast Asia (CFBM-SSEA) project linked their CBOs with national and regional CBO networks to share knowledge on fisheries management and other livelihood options. The Community-Based Sustainable Management of Tanguar *Hoar* Program (CBSMTHP) project was successful in engaging communities to develop a participatory co-management structure, promoting local

leadership and organizing and supporting livelihood activities within the co-management structure[33].The Management of Aquatic Ecosystems Through Community Husbandry (MACH) project developed and demonstrated a combination of institutional arrangement that has proved very effective towards achieving these goals[34].However, in many cases, stakeholders' participation was limited to the implementation process, with limited or no involvement in the pre-implementation stages(op.cit.).Several constraints such as conflicts between user groups, the limited capacity of local organizations, elite capture, access rights and tenure, and government bureaucracy have been identified as the main problems in developing and enforcing community-based fisheries management arrangements (Table 1).

[Table 1 here]

4.2.Introduction of adaptive co-management in hilsa shad sanctuaries

4.2.1. Pre-implementation process: Conditions and drivers of the adaptive co-management process

Before the actual implementation of co-management in hilsa shad sanctuaries, a number of policies, plans, strategies, or projects were undertaken related to for hilsa fisheries management that laid the ground for the implementation of co-management for such sanctuaries (Table 2). The New Fisheries Management Policy (1986), the National Fisheries Policy (1998), the Hilsa Fisheries Management Action Plan (2003), the establishment of hilsa sanctuaries (2005), gear restrictions, seasonal closures, the *jatka* task force committee, and the adoption of a compensation scheme (2007) exemplify the government's policies for better management of the hilsa shad fishery, which culminated in the implementation of the USAID-funded Enhanced Coastal Fisheries in Bangladesh (ECOFISH-BD) project that has been implementing adaptive co-management through a partnership between Department of Fisheries, WorldFish, and other national and international partners. Different projects have aimed at improving the management of inland capture fisheries since the late1980s, with the majority occurring in the late1990s to mid2000s[25]. As the review suggests, none of these projects focused exclusively on the management of riverine, estuarine, or coastal fisheries, or the hilsa shad fishery. The necessity of implementing hilsa shad fishery management was felt at all levels when the annual catch of hilsa declined to as low as <200, 000 tonnes during 2002-2003. Through an insightful, in-depth study on the biology, distribution, and breeding periods of hilsa shad, the government developed a unique document, the Hilsa Fisheries Management Action Plan (HFMAP), in 2003. This plan became effective in 2004.Various pre-implementation policies, plans, and projects undertaken for hilsa fishery management at different times are presented in Table 2.

[Table 2 here]

Table 2 shows that hilsa management started after the establishment of the sanctuaries in 2005 and that of the *Jatka* Conservation Task Force in 2008. The efforts taken evinced improvement in hilsa catches at a slow growth rate of 5% per year until 2014-2015. In 2015, science-based decision making was employed in hilsa management started covering all aspects of science, adaptive co-management, livelihood support, and policy support for the government of Bangladesh through the DoF. Initially, discussions for better management of hilsa sanctuaries were made mainly with important fishing communities along the Padma-Meghna-Tentulia and Andharmanik Rivers. Later, other major hilsa fishery stakeholders including *aradar* (fishery entrepreneurs),*mohazon* (informal money lenders and boat/gear owners), and *majhi* (skippers and veteran fishers) were also engaged in discussions. A number of issues related to sanctuary management were raised and discussed in a series of meetings with fishing communities and other relevant stakeholders. Fishers were particularly concerned about overfishing and illegal fishing in the sanctuaries during the ban periods. The fishers were able to express the nature and extent of their suffering due to income loss during the ban periods. The GoB introduced a compensation program for about 50% of the fishers, but the quantity was poor and not all fishing households were covered. Thus, to maintain their livelihood, fishers took out loans from microcredit organizations as well as informal loans (known as *dadon*) from middlemen including informal moneylender (known as *dadondar*), *mohazon*, *aratdar*, and boat and net ownersThus, the fishers mostly remain indebted. Some of the fishers are forced by the middlemen to continue illegal fishing during the ban periods to repay their loan instalments. The participant fishers complained about harassment by police during the fishing ban period. Some fishers alleged that powerful *aratdar* conduct illegal fishing during ban periods, bypassing law-enforcing agencies. The use of monofilament gill net (locally known as *current jal*), which is widely blamed for destructive fishing, was among the thorniest issues during the discussions. The government provides compensation upto 40 kg of rice per household for four months during the *jatka* ban period and started to provide food support (20 kg per household)from 2016-17 onwards during the brood catch ban period. However, besides the rice grain supports, fishers still needed money to buy other essentials.

It should be noted that the majority of fishers use illegal gear like *current jal, behundi jal* (estuarine set bag nets, ESBN), and *char ghera jal* (beach seine), which are highly efficient in catching small juvenile hilsa as well as undersized fishes of all kinds. Fishers demanded a complete ban on the production and manufacture of these gears. Some fishers alleged corruption and a lack of transparency in the distribution of compensation benefits. They also suggested that the timing of the ban periods was not appropriate. Further, participants emphasized the need for awareness building among the fishers for better enforcement of sanctuary rules. In this context, the majority of fishery stakeholders opined that in the vast areas of riverine ecosystems, the Department of Fisheries alone is not capable of enforcing Monitoring Control and Surveillance (MCS) activities during the ban period. The majority of stakeholders supported involving fishers in the management process and in sanctuary development for two primary reasons. First, they opined that the government

association alone is not able to carry out the management of sanctuaries. Second, they stated that as these are resources with open access, they should be managed by the resource users. Considering the intentions of the fishers and identifying the weakness of the present governance system, ECOFISH-BD started mobilizing the fishers in communities and landing centres, which are the center of fisheries activities (e.g. fish landing, auctions, processing and marketing). Therefore, the project began organizing stakeholders to create a platform of collaborative/participatory management. Before implementation, the project organized several consultation meetings with various stakeholders to build an appropriate riverine co-management structure.

Initially, a rapid assessment was conducted with the help of the local office of the Department of Fisheries around the Meghna River system to determine where co-management should first be introduced. Following the rapid assessment and other secondary information, 136 villages and 63 landing centres in 10 coastal districts along the Padma-Meghna River ecosystems were selected. These villages were located along the riverside of 6 hilsa sanctuaries. The sanctuaries vary from 20 km to 100 km with a total length of432 km covering about 285,800 ha water area. As a first step in establishing the co-management system, representative and strategic fishing communities and fish landing centres were carefully selected with the objective of achieving positive impacts after ECOFISH-BD interventions. After selection, community profiling and gender analysis were conducted in each of the selected villages in order to assess and prioritize the intervention needs and opportunities of targeted villages as well as to identify the stakeholders, training needs, vulnerabilities, livelihood strategies, and alternative income generation options involving both fishermen and women. The objective of gender analysis was to understand existing gender norms, roles, and practices in the host fishing community. A variety of participatory tools were employed to gather information on socio-demographic characteristics, ecosystem characteristics, the harvesting of local ecological knowledge (LEK), basic household and community facilities, gender relations, and social capital. Overall, community profiling was employed as a tool for stakeholder engagement and it helped to form community-based co-management institutions. Community profiling also identified the major actors in hilsa fisheries management (Table 3) through stakeholder mapping. The project team opened up a dialogue among stakeholders from the inception of the project by convening a series of workshops, meetings, and training for the major actors. At the grassroots level, two different co-management models –*Ghat* based and Union *Parishad* based co-management– were introduced in 13 *upazila*s(the second tier of the three tiered local government administration) of Patuakhali, Bhola, Laxmipur, Chandpur, Shariatpur, and Barishal districts (Fig. 1). The fish landing centres locally called "*ghat"* are formal and informal parking places in which fishing boats unload the catches, where different actors in the value chain are involved in post-harvest preservation and fish trading. The Union *Parishad* is the last tier of the local government administration, where an elected chairman is in charge of the government administration and community well-being.

[Figure 1 here]

The models were formulated with consideration for the socio-political context, the influence of the stakeholders, geographical location, fishing activities, and the number and types of stakeholders. Co-management sites were selected by considering the importance of their fisheries, strategic location, the number of fishers, and the fishing intensity.

[Table 3 here]

4.2.2. Co-management committee structures and representatives

Overall, the hilsa sanctuaries co-management structure consists of four layers of local-level decision making with representatives from all stakeholders including the Department of Fisheries and other administrative entities (Fig. 2) with the stated aims of conserving fish biodiversity in the sanctuaries, increasing hilsa and other fisheries production, building awareness on compliance with government rules and fishery regulations, and generating supplementary/alternative income. At the apex, the district level co-management committee (DCC) is headed by District Commissioner (DC-District Chief Executive appointed by the government), with the District Fisheries Officer (DFO) acting as member secretary. Other members include representatives from the *Upazila* Co-management Committee, DoF, Bangladesh Coast Guard, Bangladesh River Police, Chairman of *Upazila* Council, and elites. The next layer of decision-making authority in the *Upazila* Co-management Committee (UzCC) is headed by *Upazila Nirbahi* Officer (UNO-Sub-district Chief Executive appointed by the government) and the relevant *Upazila* Fisheries Officer serves as the member secretary of the committee. Representatives of the *Ghat*/Union Co-Management Committee, Chairman of the *Upazila* Council Bangladesh Coast Guard, Bangladesh River Police, and elites are also members of the committee.

The third level of authority for decision making is either the Union Co-management Committee (UnCC) or the Hilsa *Ghat* Co-management Committee (HGCC). In the UnCC, the Chairman of the Union *Parishad* is the president, and the Assistant Fisheries Officer (AFO) or Field Assistant (FA) from the DoF is the member secretary. In the ghat-based committee, *aratdar/mohazon* is the president and the fishing community leader is the member secretary of HGCC; government and community representatives are the members of the committee. The main function of both committees is to take part in the planning process for resource conservation and motivate stakeholders to implement the plan. In addition, the committee plays a role in recruiting Community Fish Guards (CFG), conducting boat and net census, helping the government to provide boat licenses, assisting the government authority to provide government IDs, distributing rice, and resolving conflicts. The lowest tier of decision making is at the village level in the Fisheries Management Committee (FMC). FMC represents the fishers' community groups such as HCGs (Hilsa Conservation Group), CSG (Community Savings Group), HGG (Hilsa *Ghat* Group), and other local stakeholders who play vital roles in fisheries management. The main function of the committee is to motivate fishers and community members to comply with government rules and policies related to fisheries management, create linkages between

community members and governmental or non-governmental bodies, and make decisions related to sanctuary management at the local level.

[Figure 2 here]

4.2.3. Building of community-based organizations

Community-based organizations were formed through participatory approaches. The Hilsa Conservation Group (HCG) was the fisher-led village-level group and is the primary platform for the establishment of co-management systems. A total of 575 HCGs have been formed involving around 19,534 fishers (of which 30% are women). HCG groups are primarily composed of 30-40 members with three office-bearer positions – President, Secretary, and Treasurer. HCG members meet once a month to complete 24 learning sessions following training modules. The major discussion points are government compliance with seasonal bans, climate change adaptation, alternative income generation activities, biodiversity conservation, and the implementation of HCG annual plans. The responsibilities of HCG include raising awareness on hilsa conservation in the fishing community, conducting regular meetings, discussing the importance of hilsa conservation, assisting the DoF to identify illegal fishing gear, developing fishers' capacity to reduce dependency on hilsa fishing and help each other in alternative income-generating activities, and strengthening Community Savings Groups (CSGs). Hilsa *Ghat* Groups (HGGs) are stakeholder-led groups based in landing centres that plays an important role in influencing the overall fisheries co-management process. Sixty-three Hilsa *Ghat* Groups (HGGs) were formed in landing centres. The main objective of forming HGG is to engage fish landing centre-based stakeholders (*aratdar*, *mohazon*, boat owners, fishers, and laborers) in resource conservation and to introduce fair-trade practices in the hilsa value chain. Capacity building of HGG was the main focus of the intervention. The HGG's responsibilities include conducting regular meetings, developing the capacity of members regarding the existing fisheries rules and regulations, increasing awareness about biodiversity conservation, motivating the members to develop a friendly relationship with fishers, encouraging *aratdars* to provide support for hilsa fishers, mobilizing the Community Fish Guard (CFGs), and preparing and implementing the annual plan. CFGs are selected by the CSGs to ensure that young, dedicated, and committed members safeguard natural resources. An important building block of co-management was the Community Savings Group (CSGs), which is a women-led group that was formed in each village (Fig. 3). The objective of the community savings scheme is to enhance the access of women and other marginalized social groups to technologies and resources, along with ensuring access to easy and low-interest soft loans to reduce dependency on high-interest loans from external credit providers. Gender mainstreaming was conducted by engaging 148 fisherwomen in 136 villages. CSGs were established with the support of a matching fund from the project of an amount of BDT 25,000 (USD 300) once the CSGs saved BDT 25,000 (USD 300). This brought relief to the fishing communities, allowing fishers to gradually remove the burden of loans from

micro-credit and *dadondar*. Women-empowered families and communities have been observed to comply with the HFMAP rules and regulations and have been very helpful in the adoption of co-management in the sanctuaries.

[Figure 3 here]

After thoroughly developing the various building blocks and increasing their capacities through various meetings over three years, an apex CBO body, the Fisheries Management Committee (FMC), was formed in every village involving HCGs, HGGs, CSGs, CFGs, and representatives from the rest of the community who are not fishers but who directly or indirectly depend on the river ecosystems for their livelihoods. The capacities of FMC were again strengthened by organizing training, meetings, and awareness building campaigns. Thus, the project has been working in different tiers at the village level, the *ghat* level, and the administrative level (Table 4) to ensure that representatives of all stakeholders are involved in the establishment of a co-management system. It took two to three years to build the co-management committees at the *upazila* levels and around four years to form the district level co-management committees. The co-management activities started with the formation of building blocks at the fishing communities and landing centres, taking about a year to cover all six sanctuaries.

[Table 4 here]

4.3.Stakeholders' perceptions regarding implementation challenges

While the stakeholders of the hilsa sanctuaries mostly held positive views on the potential roles of co-management, interview participants also raised concerns. Some fishers expressed the frustration that they have little power to resist illegal fishing in their areas. Fishers who remained outside of co-management arrangements often dissuaded participating fishers, claiming that it compromises their freedom. Some fishers were not convinced about the inclusion of non-fishers in the co-management committees. A minor group of participating fishers were still concerned about the future of the introduced system and were prone to becoming involved in illegal fishing. Some fisher respondents perceived that some *aratdar* (fishery entrepreneurs) are against co-management in their areas, as they are afraid of losing control of their client fishers if they later become economically solvent. Some key informants suggested that further awareness building and counselling are necessary to ensure fishers are more compliant. Fishing communities in the sanctuaries had insufficient access to education, health, and physical infrastructure. A key informant opined that poverty was the main driver that forces fishers to continue illegal fishing, even if they are aware of the positive role of sanctuaries and co-management approaches. Thus, this interviewee suggested that creating economic opportunities for fishers is important to ensure that co-management is functional and sustainable. Some fishers suggested that to make co-management a success, it is important to ensure that the beneficiaries

of the compensation scheme are limited to genuine fishers. Some fishers complained about the undue influence of rural elites and local government administrations in Union *Parishad.* They asked for greater empowerment through the co-management committee by giving them responsibility to enlist fishers and distribute compensation, and some of them expressed reservations about the transparency of the distribution of rice and alternative income generation support through the Union *Parishad.* They also felt that the formal recognition of community fish guards is necessary to give them power to monitor resources, at least during the ban period, and embedding them within local government institutions or under the control of the *Upazila* Fisheries Office.

5. Discussion

Chuenpagdee and Jentoft [18] hold the opinion that co-management does not evolve in a vacuum; it is introduced in a political, social, institutional, or cultural context. As such, co-management often arises as a solution to a problem or while an opportunity is seized. Like many global examples, co-management in the hilsa shad sanctuaries evolved to solve fisheries crises that have arisen from illegal fishing, and catch of juvenile and brood species [18,35]. Co-management tools are considered 'realistic solutions'[9] that can help sustain the revived stock of hilsa fishery that was achieved through the establishment of sanctuaries in riverine and estuarine waters[30]. In the present case, preparation was made well before implementation took place. To ensure that the process was feasible and sustainable, some practical preparatory activities were conducted as prescribed by Chuenpagdee and Jentoft[18]. These activities included visiting the communities; conducting several dialogues, seminars, workshops, and consultation meetings; sharing information and communicating with the communities; consulting with experts; conducting baseline studies; and selecting potential partners. Conducting a feasibility study in pre-implementation process provided an understanding of the power dynamics and helped identify potential stakeholders, pre-existing conflicts or common ground to start with, access rights, and the needs of local institutions[18]. However, beyond this pilot-scale implementation, as implementation theory suggests, the process of co-management establishment should not be expected to be straight forward. The process can be difficult, time consuming, ambiguous, and challenging[13,35].

Operationalization of co-management in a large riverine-estuarine system is a challenging task for several reasons. Hilsa shad is a migratory species whose life cycle straddles river, estuarine, and marine ecosystems in multispecies fisheries. Thus, a mismatch exists between the scales of distribution and the mobility of fishery stocks[9,25]. The Padma-Meghna River ecosystem is an open-access common pool resource covering a vast area without clearly defined property rights and diverse access rights, and where resource appropriation is not subject to taxation. The stakeholders are also heterogeneous with competing interests and conflicts that make open-water systems complex, particularly for co-management[32]. Thus, it is difficult to motivate the fishers to invest in their resources, comply with the closure of fisheries, and accept the monitoring, controlling, and surveillance necessary of fisheries co-management, as the accruing benefits are spilled over to the whole river

system[25,30,32]. Consequently, the process of designing a co-management structure and building an institution for co-management tends to be complex and time-consuming and requires the participation of all stakeholders[28,32]. Previous community-based fisheries management projects in Bangladesh can provide some important lessons for overcoming these challenges.

Past attempts at implementing community-based fisheries management suggest that a number of factors need to be considered in such projects. Major impediments to the successful implementation of co-management occur when rural elites capture the benefits of increased harvest, incentives, or power that lead to conflicts and mismanagement[30,32,36]. Co-management arrangements should employ both persuasion and legitimate force in order to resolve conflicts that arise from elite capture. This was done successfully by the Fourth Fisheries Project[37]. Further, the institutional framework should be flexible so that it can adapt with changing circumstances, experiment with new management tools to replace unsuccessful ones, or improve its capacity to avoid conflicts to increase the resilience of the fishery[11,38]. For example, the CBFM project followed an inclusive institutional structure to include all communities and the local government institutions together with direct beneficiary fishers[32]. A clear legal status for community-based organizations is similarly important[39].

It is important to clearly define groups who have the right to fish and those who do not have within clearly defined boundaries [38,39]. In the OLP II project, membership in the Community-Based Organization (CBO),the Lake Fisheries Team(LFT), was clearly defined to facilitate the inclusion of genuine fishers who lived around the lake area and to ensure the equal voting rights of all members in decision-making[31]. The establishment of the CBO was a time-consuming and arduous task. Experiences from the Fourth Fisheries project suggest that building a new institution on the pre-existing structure of another project could save time and resources, as participants are already acquainted with the different activities of CBOs, such as the formation of small groups of fishers, funds management, and compliance with the ban period[37]. In the case of expanding co-management in all sanctuary areas, CBOs can be built on pre-existing *jatka* conservation task forces to save time and other resources.

Ensuring that management units in clearly defined boundaries are created at an appropriate scale could contribute to the success of co-management[9,39].The number of members in the co-management group should be representative of the community, but smaller groups are more easily manageable than larger groups[39]. Clearly defined boundaries are required to confine the number of fishers, to provide fishers an accurate knowledge of their working areas, to restrict the dynamics of fishing efforts to a size that fits their available harvest technology, and to reduce the costs of information gathering, monitoring, and enforcement [9,39]. Further, setting management and administrative boundaries is similarly crucial for co-management in a large river system[25]. Defining the boundaries of a co-management area using the boundaries of political and

administrative units may be most suitable, at least in post-colonial states in the Indian sub-continent like Bangladesh, where administrative boundaries have been developed over hundreds of years. Arbitration and conflict resolution over co-management and institutional arrangements is another pressing issue[16,39]. The involvement of resource users in rule formulation and enforcement and the enforcement of sanctions on rule violators lead to better conflict management[39]. If non-compliance goes unattended, particularly non-compliance by rural elites, other fishers may also become non-compliant. As a remedy, Ostrom[38] suggested that people violating the rules should be disciplined by CBOs, with penalties imposed in accordance with the seriousness and context of the offence. Mutual trust and respect are further requirements for the survival of co-management arrangements. Trust-building activities can be started in the initial stages of the co-management process and strengthened over time. The OLP II set a good example of a trust-building process in southwest Bangladesh. In the project, upholding the rules helped develop trust among fishers. When individuals consistently broke the rules, they were dismissed from the fisher organization and lost their rights to benefits[31].

For better co-management governance, contributions, commitments, and collaboration from diverse actors(e.g. communities, civil society organizations, and government agencies) can lead to more positive outcomes, such as enhanced compliance with the agreed rules[11,18]. The New Fisheries Management Policy provided roles for donors and NGOs in open-water fisheries management. The policy stated that the government intends to "work in partnership with NGOs and fishing communities in order to increase the participation of local fishers in the management of the fisheries; utilize NGO resources for providing support to fishers in place of agents; and mobilize NGOs' experience in human development training and organization building to create alternative or supplementary income opportunities for fishers and thereby reduce pressure on the fisheries"[43:33]. Overall, NGOs have been partners in a number of community-based management projects[20].

In order to gain positive outcomes from fisheries co-management, an equitable distribution of power is necessary[16]. Co-management arrangements through which communities are empowered to become involved indecision-making are more likely to meet both socio-economic and biological goals [12].To empower communities, implementing partners (NGOs) must assist communities in capacity-building through training, awareness building, and developing management plans. However, NGOs should only be temporarily involved in the process; after completing their assigned activities, their involvement should be phased out[39]. Further, if the local political structure opposes the co-management arrangement in any way, it is unlikely that the arrangement will be sustained[36,39].Wilson *et al.*[20]highlighted that the local government, empowered by appropriate national legislation, could use its authority for structuring and balancing interactions between NGOs and government agencies. This would increase responsiveness to the changing challenges of aquatic resource management, such as conflict resolution[41].

Strong leadership may be the most important condition for co-management success and leadership development [9,39]. However, leadership qualities are not inheritable, so capacity-building through training and education should attempt to build and develop leadership skills in individuals from the partnering communities. This will ensure that the co-management system does not become dependent on any particular person [39]. In the hilsa fishery co-management arrangement, the peer-selected Hilsa Guard plays a role in monitoring illegal fishing, including during ban periods. This arrangement maybe an effective alternative to reliance on government forces alone, which do not have the full capacity to monitor or prevent illegal fishing activities[30,42]. However, the Hilsa Guard should have the power to bar others from using their fishing areas [19] with adequate enforcement capacity, e.g., petrol boats or other systems[16]. A penalty scheme (e.g., financial fines, suspension of fishing rights) supported by the legal power of the state needs to be developed by and agreed to by the partnering communities[42]. However, such a scheme should be gradually developed to avoid inserting unnecessary complexity in the co-management system. Further, the development of fisherwomen-led community savings groups was found to be effective in enhancing livelihoods and household nutrition, community mobilization, women's empowerment, and motivating the fishing communities to ensure compliance.

Sufficient financial resources are required to operate activities and facilities related to management planning and implementation, monitoring, and enforcement in the co-management process. The lack of such resources may inhibit this process [18,35]. Community members should be prepared to invest their own financial resources in the process, as a high dependence on external funding may compromise the sustainability of the arrangements[43].The implementation of fisheries co-management will require an inclusive incentive structure that motivates stakeholders to implement and maintain fisheries management through collective action[32]. The compensation scheme for hilsa sanctuaries is considered a successful conservation strategy for coastal open waters[30]. The key players in the hilsa value chain (eg. middlemen) are not included in the compensation scheme. These players always claim that they invest money on the hilsa business and taking all risks but no business is taking place due to the fishing ban. However, these traders should be brought under co-management system so that they can contribute to the fisheries management and get increased benefits from this open accessed fishery. Otherwise, they can compel the fisher to violate the fishing ban on catching during the ban period[44]. Therefore, the inclusion of middlemen and fishery entrepreneurs in the ghat-based co-management committee is a proper step forward.

The Fourth Fisheries project found that fishers' dependence on resources was lowered when a wide range of livelihoods were available to pursue and there were alternative water bodies to fish. In such situations, fishers also became more compliant with conservation measures[37]. Thus, it is important to facilitate alternative occupations or income generating activities for fishers, particularly during ban periods. In this regard, livelihood-based approaches and strategies for poverty reduction and improved market governance through

specific marketing tactics such as improved product quality through value addition, shorter value chains, market peak timing coordination, and eco-labelling certification must be developed[9,16]. These marketing tactics are likely to provide greater benefits to dependent communities, minimize the risk of overexploitation, and enhance earning by increasing income per unit of effort[9]. To solve the "free-rider" concern related to spill over in fisheries, participating communities should be convinced by the implementing agencies through a demonstration of the positive results of interventions that can be achieved through investing public resources in fisheries management[32]. A mechanism should be developed to make stakeholders feel that their obligations to manage and maintain the resource are fair in comparison to the benefits they receive from such obligations[38].

6. Conclusion

The evolution of co-management in Bangladesh has a thirty-year history, encompassing different interventions through trial-and-error before the introduction of adaptive co-management under ECOFISH-BD in 2015. The establishment of hilsa sanctuaries became a successful strategy to revitalize the once-degraded stock of hilsa shad in Padma-Meghna riverine-coastal habitats. However, fishers have expressed concerns about the socio-economic hardships that communities must face due to fishery closures. As the single most important fishery of Bangladesh, all stakeholders place a huge amount of importance on the catching of hilsa, post-harvest marketing, and value additions. The introduction of hilsa sanctuaries and their gradual stringent management do not only implicate stakeholders' livelihoods but also affect their traditional culture and heritage. Therefore, it is essential to take the path of gradual adoption of several management measures of co-management so that fishing communities and other direct beneficiaries can gradually adjust to the new systems. This could minimize the risk of conflicts and sustain the existing biological gains of hilsa sanctuaries. Global evidence suggests that co-management can be an effective tool to redistribute power; increasing the legitimacy of conservation efforts increases compliance with fishery regulations. This ultimately ensures the sustainability of the fishery conservation efforts for the sanctuaries. However, the establishment of co-management is not an easy process, particularly in a large riverine-estuarine ecosystem like that of the Padma-Meghna River systems. To ensure the success of co-management arrangements, the institutional framework needs to be flexible with a legal status of community-based organizations supported by local government institutions. Adequate time and financial resources are required. Thus, necessary commitments and funding must be put in place for long-term benefits to community organizations and institutions. Importantly, efforts should be made so that co-management arrangements are based on strong relationships of trust and mutual respect among all stakeholders. Thus, the practice of fairness, transparency, good governance, and justice should be maintained at all levels during the implementation of co-management in hilsa shad sanctuaries. If all these points are given sufficient attention, the success of hilsa sanctuaries co-management thus far in six large sections of riverine

waters in Bangladesh and its concomitant benefit of the revival of a declined hilsa fishery and increase in overall biodiversity can be lessons for other countries with similar fishery species, rivers, and coastal waterscapes.

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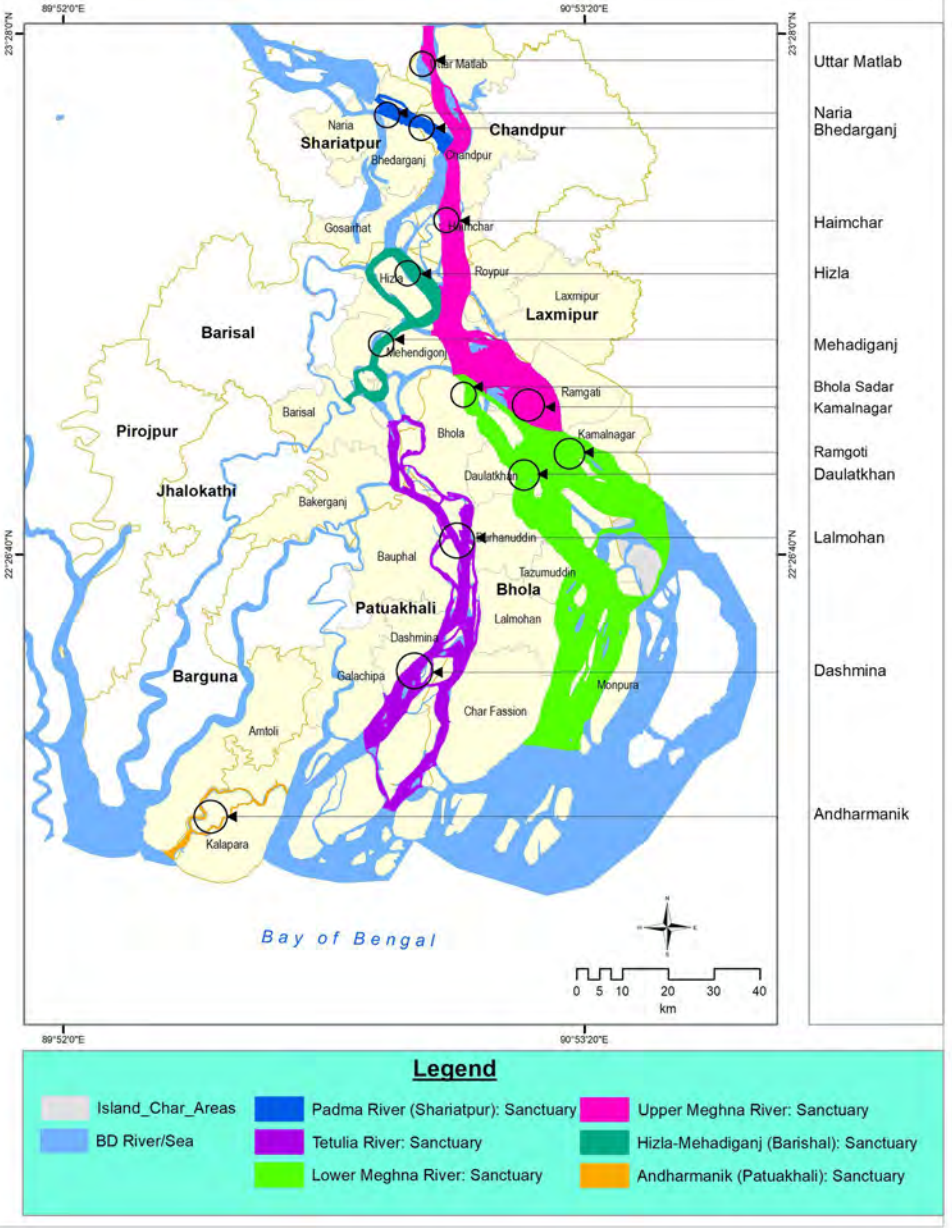
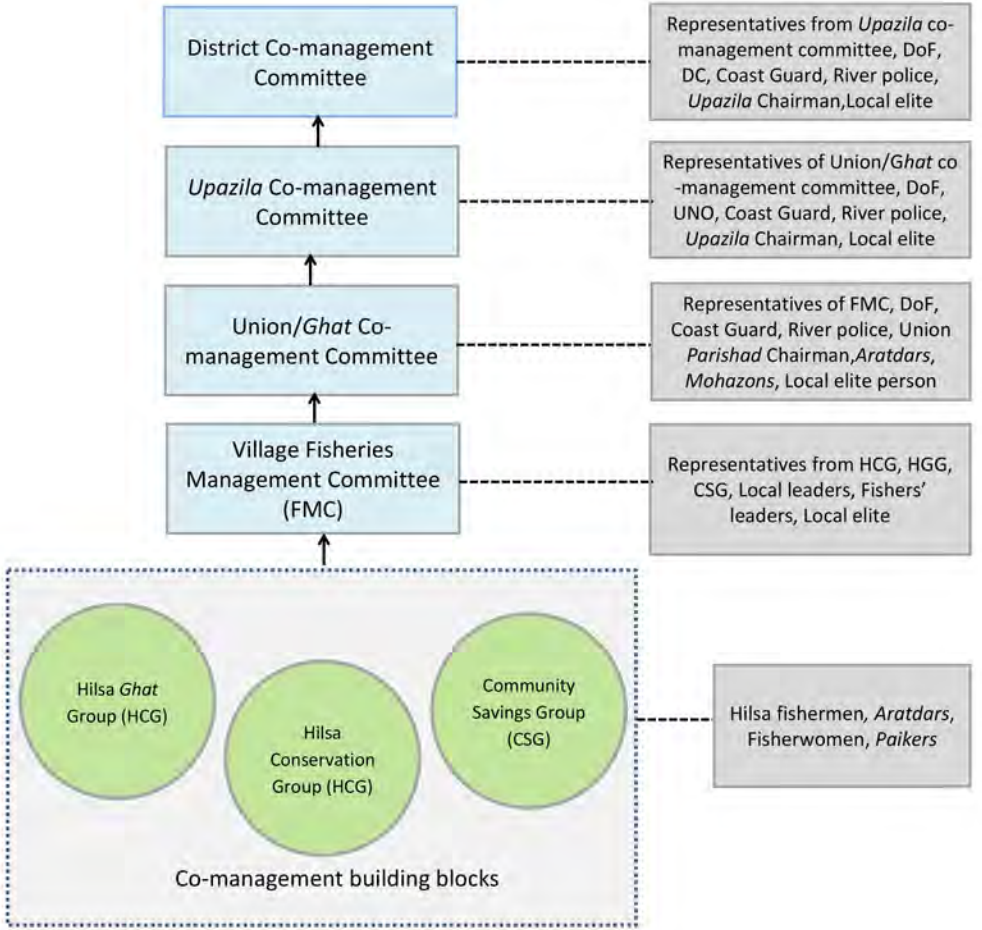


Legend

- Island_Char_Areas
- BD River/Sea
- Padma River (Shariatpur): Sanctuary
- Tetulia River: Sanctuary
- Lower Meghna River: Sanctuary
- Upper Meghna River: Sanctuary
- Hizla-Mehadiganj (Barishal): Sanctuary
- Andharmanik (Patuakhali): Sanctuary


District Co-management Committee
Representatives from *Upazila* co-management committee, DoF, DC, Coast Guard, River police, *Upazila* Chairman,Local elite
Upazila Co-management Committee
Representatives of Union/*Ghat* co-management committee, DoF, UNO, Coast Guard, River police, *Upazila* Chairman, Local elite
Union/*Ghat* Co-management Committee
Representatives of FMC, DoF, Coast Guard, River police, Union *Parishad* Chairman,*Aratdars*, *Mohazons*, Local elite person
Village Fisheries Management Committee (FMC)
Representatives from HCG, HGG, CSG, Local leaders, Fishers' leaders, Local elite
Hilsa *Ghat* Group (HCG)
Hilsa Conservation Group (HCG)
Community Savings Group (CSG)
Hilsa fishermen, *Aratdars*, Fisherwomen, *Paikers*
Co-management building blocks

136 FMCs in every intervened fishing villages

63 HGGs with value chain actors in fish landing center (*ghat*)

575 HCGs with 19,500 members (30% women)

148 CSGs with 5000 women who saved US$ 125k

Fisheries Management Committee (FMC)

Hilsa *Ghat* Group (HGG)

Hilsa Conservation Group (HCG)

Community Savings Group (CSG)

Table 1:Summary of community-based management fisheries management projects in Bangladesh[25,33,34,35,36,37]

Project	Time frame	Ecosystem type	Scope and objectives of the project	Success and achievements	Enabling conditions	Challenges
Oxbow Lake Project (OLP2)	1991-97	Oxbow Lake	Increase productivity of waterbodies, nutritional benefits for people, increase income and social status of poorest fishers	Delegate responsibilities to fishers, enhanced lake productivity	Participation of all stakeholders in the management process	Identification of genuine fishers, group formation
Community-Based Fisheries Management Phase 2(CBFM2)	2001-2006	Open water (river) and closed water (*beel*)	Betterment of poor fishers, sustainable exploitation of water bodies	Better management through sanctuary establishment	Solid GO-NGO partnership, legal status for the CBOs	Elite capture of benefits, conflicts, financial insecurity, limited staff capacity
The Sunamganj Community-Based Resource Management (SCBRMP)		Closed water bodies *(beel*)	Mobilization and unlocking potential of the poor to build a self-help society with prosperity and aspirations to secure the future	Access rights to the water bodies, increased fisheries productivity, capacity building	Adopting a people-centric approach	Benefits captured by the vested group
The Community-Based Fisheries Management in South Southeast Asia (CFBM-SSEA)	2001-2007	Deeply flooded areas	Improvement of inland fisheries management policies for more sustainable, equitable, and participatory management of resources towards improved livelihoods of fishers	Increase in livelihood capital, natural productivity, income, health, and sanitation	Linking Local CBOs with the national forum, GO-NGO partnerships	High lease value, conflicts with previous leaseholders, enforcement and boundary demarcation
Community-Based Sustainable Management of Tanguar *Haor* program/project (CBSMTP)	2001-2007	*Haor*	Prevention and reversion of the wetland degradation, sustainable use of wetland resources to ensure people's participation for formulation and implementation of sustainable management plans, to improve the quality of life, especially for women	Developing the co-management structure, advancing local leadership, vulnerable species revived through interventions, catch per unit effort increased	Legal endorsement by the government	Capacity-building among stakeholders, poaching, poor infrastructure, and flash flooding
Fourth Fisheries Project	1999-2004	Inland waterbodies	Improvement of inland open-water fisheries management through the development of sustainable, community-based institutions and supporting fishers for adaptive fisheries management	Fisheries productivity increased	Cost and benefit sharing between the government and fishers	Elite capture of the benefits, fishers marginalized due to the poor performance of NGOs
Management of Aquatic Ecosystem through Community Husbandry (MACH)	1998-2006	*Beel*, seasonal wetlands, rivers, and streams	To develop new approaches for conservation and management of floodplain and wetland resources to ensure the sustainable productivity of all wetland resources	Develop successful strategies for wetland management and restoration and livelihood improvement. The approach is adopted at the policy level	Institutional arrangement involving all local stakeholders to identify problems and possible solutions	Policy conflicts between ministries, illegal fishing, soil erosion, difficulties in proper site selection

Table 2:Pre-implementation policy, plans, and projects for hilsa shad sanctuaries co-management in Bangladesh

Year	Policy, plans, and projects	Major provision related to hilsa fishery conservation
1986	The New Fisheries Management Policy	• The first policy that addressed the over-exploitation of fisheries resources and inequality of fishing rights • The policy did not specify hilsa shad species, but its objectives were set to divert the greatest benefits of the fishery to genuine fishers instead of non-fisher elites • To adopt conservation measures to ensure that resources are sustained
1998	The National Fisheries Policy	• To develop fisheries resources, enhance fisheries production, alleviate poverty through generating self-employment opportunities, and improve the socio-economic condition of fishers • The strategy recognized the importance of fishers' participation in fisheries management
2003	The Hilsa Fisheries Management Action Plan(HFMAP)	• To support a sustainable hilsa fishery, protect key habitats, and build the capacity of fisheries actors • To ensure compliance with the conservation rules, regulations, and strategies related to the hilsa fishery • To offer alternative livelihoods for *jatka* fishers based on the compensation scheme
2005	Establishment of hilsa sanctuaries	• Following the HFMAP, the government declared four areas in the Meghna, Tetulia, and Andharmanik Rivers and some estuarine waters as hilsa sanctuaries in 2005 and a fifth one in the Padma River in 2011. The sixth sanctuary at the confluence of the Meghna, Arial Kha, Kala Bador, and Kirton Khola Rivers was declared in 2018 • In the sanctuaries, two seasonal bans are imposed on catching *jatka* for 8 months in November to June and brood hilsa ban for 22 days in October-November
2006	The National Fisheries Strategy	• Emphasizes collaboration, linkages, and partnerships for marine fisheries • Advocates a move towards fostering the participation of fishers, stakeholders in the fisheries value chain, local communities, the private sector, NGOs, along with the government through the DoF
2008	'*Jatka* conservation task force and alternative income generation for *jatka* fishers and research'	• Provision of food compensation to hilsa fisher households • Building awareness about conservation, supporting alternative income generation activities • Enforcing regulations to prevent *jatka* and brood hilsa fishing during the ban period
2014-2019	Enhanced Coastal Fisheries in Bangladesh (ECOFISH-BD) project	• Strengthening science-based decision-making in the Hilsa fishery and its aquatic ecosystem • Piloting adaptive co-management in the sanctuaries • Improving the socio-ecological and economic resilience of fishing households and communities • Improving policy, power, and incentives for the betterment of poor fishers

Table 3 Roles of stakeholders involved in hilsa fisheries and building fisheries co-management

Stakeholders	Definition	Major activities	Modality of involvement
Fishers	Involved in direct hilsa fishing	Fishing	HCG, Co-management
Mohazon (boat owner)	Own nets and boats and are leaders in fishing	Net and boat owners involved in the *Vagi* fishers (shareholder fishers)	HCG, Co-management
Aratdar (fish trader)	Owner of fish trading businesses	Provide non-formal loans (*dadon*) to the fishers and buy hilsa from fishers	Co-management
Paikar (petty trader)	Buy hilsa from the *aratdar* and sell them to the retailers (works as middlemen)	Buy hilsa from *aratdar* and sell to retailers	Co-management
DoF	Government body responsible for hilsa conservation and enforcement	Regulate and enforce the laws and regulations for hilsa conservation	All tiers of co-management
Law enforcers	Coast Guard, Navy, Police, and River Police	Enforce compliance with government rules and regulations	Adaptive co-management
Local Govt. Institutions	Elected Union *Parishad* Chairman, *Upazila* Chairman, Member of Parliament	May exert influence on *jatka* and hilsa conservation	Help with the implementation of co-management

Table 4: Building blocks in the co-management process

1st Year	2nd Year	3rd and 4th Year
• Hilsa Conservation Group (HCG)	• Hilsa *Ghat* Group (HGG)	• *Upazila* Co-management Committee
• Community Savings Group (CSG)	• *Ghat* co-management committee	• District Co-management Committee
• Community Fish Guard (CFG)		
• Fisheries Management Committee (FMC)	• Union Co-management Committee	
• Hilsa Conservation Group (HCG)		