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Final report

project

Developing new assessment and policy frameworks for Indonesia's marine fisheries, including the control and management of Illegal, Unregulated and Unreported (IUU) fishing

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2 Executive summary

This project was a collaboration between the Indonesian Research Centre for Fisheries Conservation and Management; Indonesian Directorate General for Capture Fisheries; CSIRO Marine & Atmospheric Research; and, University of Wollongong, with the objectives of:

1. Developing new, innovative fisheries policy and management frameworks.
2. Developing new, fishery-specific stock assessment processes.
3. Developing improved scientific and policy frameworks for sustainable management of Red Snapper stocks within Indonesia waters.

Although a small number of draft fisheries management plans exist, there is currently no clear regulatory basis for enacting specific fisheries management plans in Indonesian waters. This is about to change with new regulations being drafted and national plans being prepared for major fishing regions. As a result, the current ACIAR project was timed to assist in the process of establishing this new assessment and management framework.

This project had three main streams: firstly, in Phase 1, an assessment of fish market landings at 7 fishing ports encompassing several provinces (West, Central & East Java, Lombok and Bali); secondly, in Phase 2, a more detailed analyses of selected fisheries, development of monitoring programs and consideration of possible management strategies (with stakeholder participation); and finally, a review of the Indonesian Red Snapper fisheries. In summary, the following key results were achieved:

- During Phase 1 (2008-2011), an assessment of seven fish landing ports was carried out using a Rapid Assessment Protocol (RAP) to record fish landings, as well as port interviews and collection of existing fisheries statistics held locally. Through interviews with local officials and industry representatives, key issues relating to illegal, unregulated and unreported fishing were identified and analysed. A major output will be a bilingual field guide of economically important Indonesian teleost marine fish.
- As a result of fieldwork carried out in Phase 1, three fisheries were chosen for more detailed assessment of catches and management opportunities: the Bali Strait Lemuru (sardine) fishery, for which there exists useful existing data and a draft management plan; the Southern Java Lobster Fishery of Pacitan and Gunungkidul Regencies, a small valuable fishery for which very little information exists; and, lastly, the Tanjung Luar (East Lombok) Shark Fishery, for which 10 years of data has been collected by CSIRO and RCFMC but for which no formal management strategies apply. For each fishery, new information on the biology of harvested species, landings data and the nature of the fisheries was collected during fieldwork in 2010-11. The information was analysed and summarised at Fishery Data Assessment Workshops during 2011-12.
- Management & stakeholder workshops were carried out for each of the three selected fisheries during 2011-12. The goal of these workshops was to inform the stakeholders about: the life history of the harvested fish; the newly collected data; the assessment of the fishery; and, to discuss the issues and the strategies for fisheries management.
- Workshops were also held to discuss the shared Red Snapper Fishery in Australia and Indonesia. The first workshop dealt with the availability of data within Indonesian waters and the second dealt with management issues. The new information about the fishery indicated that fishers had moved away from the

areas were the stocks were shared, possibly because the populations had been fished out, but this may also be due to high fuel costs restricting distant travel.

- Outputs included major reports on each aspect of the project, as well as identification posters and information brochures distributed to, and displayed at, several fishing regions. A number of capacity building activities were also completed, including training workshops, student research projects and other extension activities.

3 Background

Indonesian fisheries are among the largest and most productive worldwide, and are critical to the nation's economic development and in providing food resources to millions of people. Based on FAO data for 2004, about 4.5 million tonnes of marine fish (value ~ $US3.2 billion) are harvested by millions of people using a range of gears, including hundreds of thousands of fishing boats. This places Indonesian marine capture fisheries among the top five in terms of fisheries production.

Many regency, provincial and national government agencies are involved in administering the Indonesian fisheries and fishing vessels, and the current arrangements have led to a confused situation where "effective management is difficult to achieve" (FAO[1]). For example, the various levels of the Indonesian government issues fishing licences primarily based on the size of the fishing vessels. There are some restrictions on the waters in which different sized vessels can fish, however this is not strictly managed or enforced. In addition, the national government has a series of defined fisheries management zones based on major biogeographic regions, however these do not correspond to the provincial jurisdictions. This creates some confusion in terms of the fishing rights that a licence provides. A further problem is that fishing licences generally do not clearly define the fishing activities, fish species or the fisheries in which fishers can operate, so the system is more or less open access for most fishers. There are also very few, if any, limits on the quantity of the catches or the sizes of the fishes captured.

As a result of the lack of effective management, Illegal, Unreported and Unregulated (IUU) fishing throughout Indonesian waters has become a major issue that confounds attempts to manage fish stocks. Consequently, there is an urgent need to develop effective assessment and policy frameworks to better manage Indonesian fisheries. As a consequence, the national government of Indonesia is actively developing fisheries assessments and fisheries management strategies at a large-scale basis, for the defined fisheries management zones. While this is an important first step, the pathway to an improved fisheries management framework most likely also involves the better definition of individual fisheries activities, followed by an assessment of those fisheries and the development of fisheries-specific management plans. These activities will require the collaboration and agreement between regency, provincial and national government, to resolve issues such as policy development, licence restrictions, research, jurisdiction, funding and many other matters. Currently there are no government regulated fisheries-specific management plans, although a number of draft plans exist, such as the Draft Bali Strait Lemuru Management Plan, developed through the assistance of the FAO.

The University of Wollongong (UoW) and CSIRO Marine and Atmospheric Research have collaborated with agencies within the Ministry for Marine Affairs and Fisheries (MMAF) to develop a research project to better understand the characteristics of the various district and provincial fisheries (e.g., fishing methods, capture species, fished areas, IUU fishing activities, licensing and regulatory framework), and, to investigate new and innovative assessment and management approaches.

The agencies within MMAF involved with the project are: the Directorate General of Capture Fisheries (DGCF); and, the Research Centre for Fisheries Management and Conservation (RCFMC). The Directorate of Marine Fisheries and Human Resources

[1] *Fishery and Aquaculture country profile - Indonesia, FAO website, 2007.*

Development (MFHRD) was originally to be involved in the project, but changes in circumstances led to this agency not taking part.

The objectives, activities and various components of this project were developed through a series of meetings and workshops with district, provincial and national agency staff, and invited specialists, held in Yogyakarta and Jarkarta, during 2007 and 2008. In order to achieve the project's goals, it was considered necessary to undertake the following activities:

- Development of new, innovative fisheries policy and management frameworks.
- Development of new, fishery-specific stock assessment processes.
- Development of improved scientific and policy frameworks for sustainable management of Red Snapper stocks within Indonesia waters.

In Years 1-2, a "fishing port-based" scoping study in seven fishing ports over a region that encompassed several provinces (West, Central & East Java, Lombok and Bali) was completed (Phase 1). This involved meetings and discussions with a range of stakeholders over issues related to local fisheries, catches, management frameworks and IUU fishing. The primary objective of this initial scan of fisheries ports was to identify fisheries that could be used as case studies for detailed investigation in the second stage of the study (Phase 2), carried out during Years 3-4.

In Years 3-4, detailed "fisheries-based" investigations were undertaken to assist in the development of new approaches to fisheries assessment and management, and capacity building, that are relevant to the social, political and environmental realities of Indonesia. Three fisheries were identified and selected as case studies. Field-work by researchers from both Indonesia and Australia was carried out and new fisheries and biological data collected on these case studies. This new information was used to develop preliminary assessments of the fisheries.

Phase 2 also involved holding a series of provincial fisheries management meetings, trainings sessions and stakeholder workshops to communicate the new fisheries assessments and to discuss the need for improved fisheries management, the principles underlying management, and the methods of stock assessment. These activities were designed to raise awareness, develop adoption pathways for the project outcomes and engage with policy makers at the national, provincial and district levels of government.

This Final Report to the ACIAR Project FIS/2006/142 has summarised the basic outcomes and findings, however further detail can be found in the associated reports and books developed as a result of project activities (see Section 10.2).

Photograph: Small-scale artisanal fishing vessel (Jakarta Harbour)

4 Objectives

The project had the primary goal of developing new approaches to fisheries assessment and management in Indonesia, particularly in regard to improving the policy and management frameworks for dealing with the problem of IUU fishing. A series of project development meetings were held in Yogyakarta and Jakarta, with district, provincial and national government agency staff, and other specialists, to assist in the development of this project. In order to address the primary goal, the following specific objectives were developed through this consultative process.

Objective 1: Development of new, innovative fisheries policy and management frameworks.

This objective encompassed a large number of activities related to the management of the project, extension of project-derived information and the establishment of adoption pathways for the project outcomes. A National Project Co-ordination and Steering Committee was formed with membership including the Directors from several departments within the Indonesian Marine Affairs and Fisheries, including those responsible for fisheries management and for fisheries research. Meetings of the Steering Committee were held approximately every six months. In addition, several workshops and field events were carried out to engage the key policy makers and industry stakeholders at district, provincial and national levels of government.

Objective 2: Development of new, fishery-specific stock assessment processes.

This involved two major activities:

- Phase 1: Scanning fishing activities linked to seven fishing ports in 4 provinces in Indonesia and the selection of 2-3 fisheries for the in-depth study. This was achieved through a combination of market sampling using the Rapid Assessment Protocol (RAP) and interviews with fishers, fishing companies and government agencies in order to gather data on catches, fishing methods and gears. Three fisheries case studies were selected after discussion with MMAF and other stakeholders.
- Phase 2: Undertaking detailed fisheries assessment on selected fisheries case studies. This included: attempts to improve the existing fisheries statistics data sets; seasonal market sampling, including collection of data on relevant biology; stock assessment; investigation of current laws, regulations and management; and, identification of IUU fishing problems. During this phase of the projects, more detailed stock assessment studies were carried out on the selected fisheries. This involved both rapid market assessment of catches using the Rapid Assessment Protocol (RAP) and the establishment of market enumerators to provide detailed catch and effort information. Existing policy and legislative frameworks, and the nature and extent of IUU fishing within the region were also investigated. Other methods included interviews and workshops with fishers, fishing companies and government agencies, on-ground short-term assessments of IUU fishing activities, and, a review of national, provincial and regency fishing regulations.

Objective 3: Develop improved scientific and policy frameworks for sustainable management of Red Snapper stocks within Indonesia waters.

This component of the study is specifically designed to investigate the current situation in respect to Red Snapper assessment and management within Indonesian waters, to identify any gaps in knowledge that require further research and to build capacity to adopt and undertake management of the stocks. Two large workshops

were organised to consider the current situation in regard to the assessment and management of Red Snapper stocks within Indonesian and Australian waters. In addition, a number of capacity building and training activities were identified and carried out.

5 Methodology

5.1 Project Timeline

ACIAR Project FIS/2006/142 commenced in June 2008 and was due to finish in December 2011. The project was reviewed in July 2011 and a 6-month extension to June 2012 was granted.

The primary reason for this extension was the significant delays encountered in transferring funds to Indonesia in 2008, due to new Indonesian administrative arrangements that were not fully implemented until mid-2009. This delay in transfer of funds meant that some collaborative activities were undertaken with a limited participation from Indonesian researchers or were postponed until funding became available.

5.2 Study Region

In the Year 1 of the research, a "port-based" scoping study of fishing activities, catches, management and IUU fishing over a region that encompasses several provinces (West, Central & East Java, Lombok and Bali) was completed. Seven (7) locations were identified to be the project sites during this part of the project. They were Pelabuhan Ratu (West Java), Cilacap (Central Java), Sadang (Yogyakarta), Bali (Bali), Banyuwangi (East Java), Tanjung Luar (NTB) and Pacitan (East Java).

The selection of these 7 fishing ports within 4 adjacent provinces was a result of discussions at the workshops held in Indonesia and was based on a number of criteria, including: significant fisheries activity; recognition of probable linkages between adjacent provinces and fishing areas; practicalities and cost in sampling the markets; prioritisation of ports with limited fishing by foreign vessels; and, previous market sampling experience (e.g., ACIAR project FIS/2003/037).

In Years 2-3 of the research, a detailed "fisheries-based" investigation to develop new approaches to fisheries assessment and management, and capacity building, that are relevant to the social, political and environmental realities, was undertaken. These studies investigated three selected fisheries case studies in terms of issues such as: fishing methods, biology of capture species, fished areas, IUU fishing activities, licensing and regulatory framework. On completion of data and information collection phases, fisheries assessment and management workshops were held in relevant districts and provinces.

5.3 Methods

During the project development meetings with Indonesian agency staff, a number of specific tasks were identified. The methods to be adopted for each of these tasks are outlined below.

Objective 1: Development of new, innovative fisheries policy and management frameworks.

Activity 1.1: National Project Co-ordination and Steering Committee.

This committee was established at the start of the project and ran for the life of the research and management activities, from Year1-4. The role of the committee was to provide advice on project operation, receive reports about project progress and help

in providing information to stakeholders within the Ministry of Marine Affairs and Fisheries (MMAF) and other agencies. The Committee was a major pathway for the organization of provincial and stakeholder meetings, development and agreement of relevant fisheries policy and management options, and also the uptake of project outcomes. A major activity under this objective was to identify the fisheries assessment and policy constraints to the adoption of better management practices. These constraints were investigated, documented and solutions sought during the workshops and fisheries management meetings that were held in provincial and district fishing ports. The Committee met twice per year and reviewed all aspects of the project.

In July 2011, a major review of the research project was carried out and the Committee reported progress to the Project Review Team appointed by ACIAR. A Progress Report was developed which summarised all aspects and the project and the Review Team recommended a 6-month extension to ensure all planned aspects were completed.

The Final Project meeting was held in November 2012 and reviewed all major outputs of the project, including draft reports, prior to publication.

Activity 1.2: Provincial Fisheries Management Workshop in 1-2 Provinces.

The function of these initial workshops was to raise the issues of lost fisheries production and of possible impacts on industries and provincial economies, if fisheries continue to be poorly managed; and, to explain management concepts to officials, media, parliament, instructors and lecturers from training colleges, local university. These Management Workshops were designed to highlight the urgent need for fisheries management at the provincial and district levels of government, and to create the climate for adopting new policy and management frameworks. The Directorate General of Capture Fisheries (DGCF) and UoW organised these initial stakeholder workshops in several provincial locations, to discuss issues related to the Shark, Lobster and Lemuru Fisheries and to raise the concept of management planning for specific fisheries.

Activity 1.3: Provincial Training Workshops Years 2, 3, 4.

These workshops were used to train local enumerators in skills needed for implementation of resource assessment and fisheries management, such as: fish and gear identification, data collection and data management for provincial and district staff. Both the Research Centre for Fisheries Management and Conservation (RCFMC) and the Directorate General of Capture Fisheries (DGCF) held several provincial training sessions as part of this project.

Activity 1.4: Fisheries "Stakeholder" Workshops for Selected Fisheries.

The function of these workshops was to explain the purpose of the study, on-going progress, results, and to develop and discuss management options with stakeholders (provincial and district staff, NGOs and local fisheries associations). These stakeholder workshops were primarily developed to provide the role of management advisory committees, specific to the individual case studies that were chosen for detailed investigation. They were one of the key mechanisms for the adoption of the project's outputs, provide input into the policy and management development process, and report back to the Project Steering Committee. DGCF and UoW organised the management and stakeholder meetings. Again, budget allocations to other Indonesian fisheries agencies, UoW and CSIRO were provided to allow active participation of key project staff at meetings.

Activity 1.5: Development of innovative fisheries policy and management frameworks.

The overall objective of the activities listed above is to provide new policy framework and management options to assist in the sustainable management of the selected fisheries. These new policy framework and fisheries management options were developed through the series of provincial meetings, including fisheries assessment workshops (see Activity 2.6 and 2.7, below) and provincial stakeholder workshops (see Activity 1.4, above).

Objective 2. Development of new, fishery-specific stock assessment processes.

Phase 1: Scanning fishing activities linked to seven fishing ports in 4 provinces in Indonesia to select a maximum of three fisheries for in-depth study.

This research design originally involved a short 6-month sampling component (proposed April to October 2008) followed by a reporting of the information through a "market assessment workshop" (proposed for December 2008). Due to the late starting date for the project (August 2008) and the initial project issues in transferring of funds to Indonesia (see above), Phase 1 of the project was extended until June 2009.

The primary goal of this component was to provide improvements to the existing fisheries statistics (using both market-derived statistics and on-ground "rapid" market based sampling) for each of these fishing ports and provide an overview of the fishing activities that are being carried out. The information was used to select individual fisheries for more detailed stock assessments, so that management could be considered (see below).

Information was gathered on the fish and fisheries at seven fish landing ports, namely: Pelabutan Ratu (West Java); Cilacap (Central Java); Sadeng (Yogyakarta); Kedonganan / Jimbaran (Bali); Banyuwangi (East Java); Tanjung Luar (NTB Lombok); and, Pacitan (East Java). The investigations across these 7 fishing ports involved the activities detailed below.

Activity 2.1: Compilation of Fisheries Statistics, IUU Activities and Fishery Description.

The available historical fisheries statistics were collected from the seven fishing ports and entered into a database. This activity was carried out to complement and enhance the existing national fisheries statistics, specifically for these ports and, during Phase 2, for the selected fisheries. As part of the same port visits, descriptions of the fisheries were prepared through interviews with fishers, industry representatives and port authorities. Existing information on IUU fishing in each region was also gathered through access to local fishing records, numbers of boats (including those licensed), current fishing statistics and discussions with local fishers and provincial fishing staff. RCFMC, DGCF, CSIRO and UoW researchers undertook this activity. A brief report was tabled at the Steering Committee meeting (see above) to enable selection of the case studies, and a more detailed report prepared as a project output.

Activity 2.2: Rapid Market Sampling and fishery descriptions.

This activity involves sampling of fish landings at the seven fishing ports (listed above) using the Rapid Assessment Protocol (RAP) developed by CSIRO. The fieldwork was completed by RCFMC and CSIRO. The assessment involved the collection of information on fish species in the markets, basic biological data for selected fish species and estimates of landings on particular days. The results of the RAP sampling of fish markets, which includes a more detailed description of the methodology, have been collated into a report (White et al., 2013a).

Activity 2.3: Market-Scoping Workshop.

Activities 2.1, 2.2 and 2.3 were designed to provide an overview of fishing activities so that individual fisheries could be selected for more detailed assessment.

The outputs of this section of work were brought together at an expanded Steering Committee meeting, with the principal objective of providing a summary of the fishing

activities in the seven fishing ports across southern Indonesia and to select three fisheries that would be suitable for case studies for detailed resource assessment and fisheries management investigations. The workshop was organised by UoW and was held at the fisheries research centre, in Ancol, Jakarta. The three fisheries chosen as case studies were the Bali Strait Lemuru Fishery, the Tanjung Luar Shark Fishery and the Southern Java Lobster Fishery.

Phase 2: Undertaking detailed fisheries assessment on selected fisheries and areas, including: improved fisheries statistics data sets; seasonal market sampling, including relevant biology; stock assessment; investigation of current laws, regulations and management; and, identification of IUU fishing problems.

This part of the research has been referred to as "Phase 2" and involved rapid market sampling of selected fisheries ports, between January 2009 and January 20101. It also included some activities, such as the establishment of enumerators at selected fishing ports, which continued to be funded until the project ended in June 2012. The Project Steering and Co-ordination committee, on advice from the researchers, determined the selection of fisheries for "case studies" (see above). A key factor considered in the selection of the case studies was the need for adopting new management practices, and the probability that developing and adopting new policy and management frameworks might be successful. The three fisheries chosen as case studies were the Bali Strait Lemuru Fishery, the Tanjung Luar Shark Fishery and the Southern Java Lobster Fishery.

The current research was aimed specifically at improving the information available on landings of fish species associated with the three case studies. Key Indonesian personnel responsible for the current national statistics databases were involved in the collection and analyses of these new data. It is widely recognised that the current system is not detailed enough for many management purposes, particularly at the species-specific level, and that the provinces and districts are under-resourced, which results in estimates of catches being used rather than real data. Also data collected at the district level is (always) aggregated over months and markets before being entered into the provincial and national databases, which means that detail is lost. Catch data and licensing data are also not consistently collected and rarely related to each other. The current project aimed to collect the existing historical fisheries landings data at a higher level of detail (e.g., daily or monthly for individual fishing ports and fish species) and also to establish new field staff (or enumerators) and to better resource existing staff, to assist in the collection of improved data for fisheries selected as case studies.

Activity 2.4: Compilation of Fisheries Statistics, IUU Activities and Fishery Description.

This activity included a compilation of fisheries statistics, IUU activities, fishery descriptions and a review of current management practices. DGCF also provided improvements to the existing fisheries landings data for the selected ports and fisheries, by developing new catch forms and logbooks. As part of this study component, additional enumerators were appointed in each of the selected fishing ports, both by DGCF and RCFMC, so that additional landings data for the fish species in the case studies could be collected in more detail, as well as further biological (life history) data. These data have complemented existing national fisheries statistics statistical system.

No new research of IUU fishing activities were proposed, but existing information was compiled and used in describing the fisheries and associated issues. Staff from RCFMC, CSIRO and UoW visited each of the regions and collected landings data

(from fish catch statistics), fishing methods in practice, vessel characteristics, fishing gears being used, fishing areas, and so on. A review of existing management practices in relation to district (Dinas), provincial and national laws and regulations, including gaps in regulations, was also carried out.

Activity 2.5: Rapid, Seasonal Market Sampling.

RCFMC and CSIRO research staff visited each of the selected fish landing sites a number of times over an 18-month period and assessed the catches using the Rapid Assessment Protocol (RAP). New biological information was collected for the key fish species in the selected case studies and a detailed stock assessment report for selected species/fishery was completed. During this period, the rapid market sampling concentrated on providing key life history parameters useful in the assessment of the state of the species and any risks to the sustainability of these selected fisheries.

Activity 2.6: Initial Fishery Stock Assessment Workshop.

A number of initial data assessment meetings were organised by UoW, and attended by RCFMC, DGCF and CSIRO. The aim of these workshops was to identify the field activities to be carried out for each fishery for the collection of additional information and landings data.

Activity 2.7: Fishery Stock Assessment Workshops.

The Fishery Stock and Data Assessment workshops were designed to finalise the research component and were in addition to the planned extension and stakeholder workshops (see Objective 1, above). These workshops focussed on presenting a summary of all of the available information on the fisheries case studies, including an initial stock assessment, based on new market data collected by RCFMC, CSIRO and the enumerators appointed by DGCF. These workshops were a forum to discuss the fisheries landings data, as well as relevant life history parameters of the key species. Where possible, these data were used to prepare preliminary assessments of the stocks and risks to sustainability. Information from these workshops were summarised into a "Data Assessment Report" which was prepared for discussion at the "management and stakeholder" meetings described previously.

3. Development of improved scientific and policy frameworks for sustainable management of Red Snapper stocks within Indonesia waters.

A series of workshops were specifically designed to focus on the constraints to assessment and sustainable management of Red Snapper stocks, and to provide training and capacity building to undertake fishery management. The workshops were specifically targeted towards developing an increased awareness and capacity for action among fishery stakeholders, including industry, and fisheries management authorities.

The Red Snapper activities within this project were designed to: re-assess the stocks; investigate constraints to management within Indonesian waters (to complement the management plan for the shared stocks); and to increase the awareness and capacity to implement improved assessment and management practices.

Activity 3.1: Workshop, Red Snapper stock assessment review and industry status.

The objective of the first workshop was to review existing data and outcomes, identify gaps in knowledge, inform managers and industry, develop a work program to update the stock assessments and provide capacity building to managers.

The "review workshop" was followed up with a stock assessment "research" meeting involving RCFMC, CSIRO and UoW. The aim of this meeting was to provide an

updated assessment of the Shared Red Snapper fisheries, based on any recent research by either Indonesian or Australian fisheries researchers, as well as using new fisheries statistics (landings data) for Red Snapper collected directly from markets, both within and outside Indonesia. This new data set showed that there was currently very little overlap between Indonesian and Australian fishing activities, and that these fisheries, if fleet dynamics remained this way, was less likely to be fishing the same stock.

Activity 3.2: Workshop, Role of governments and industry in the management of Red Snapper.

This workshop is designed to review the role of the national, provincial and district governments in the sustainable management of Red Snapper, and consider possible constraints and issues to a co-ordinated management approach. There are currently major gaps in the management process, and a lack of co-ordination between the various levels of government, in respect to fisheries management. This workshop used Red Snapper as a case study in exploring the role of national, provincial and district governments in fisheries management.

Activity 3.3: Workshop, Development of Management Options for Red Snapper in Indonesian Waters.

Information gathered during the first two Red Snapper Workshops, and smaller data gathering and review meetings, indicated that:

1) The area where there were shared Red Snapper species between Australia and Indonesia were most likely depleted, as the Indonesian fishery operations no longer targeted these shared stocks, and had moved into more northerly locations. Another view expressed was that fuel costs were restricting the amount of travel to remote areas.

2) The only new data available for Red Snapper species within Indonesia were from landings statistics, and these were incomplete and confusing, and had a very high proportion of IUU activities. These landings data were of little use in a re-assessment of the current status of the red snapper as a group, and of no use in assessing individual red snapper species.

3) Unlike the Australian situation, "Red Snapper Fisheries" within Indonesian waters were extremely complex and difficult to resolve because:

- There were a large number of closely related species harvested;
- A multitude of fishing methods were used over a wide spatial area;
- The fisheries involved thousands of fishers, including many subsistence fishers;
- Red Snapper were often a valuable but minor by-catch species in a large number of other fisheries;
- Red Snapper species were often sold locally and not specifically recorded;
- The fishery involved local, provincial and national waters; and, as a result,
- Management would require new regulations across multiple levels of government.

As a result, we considered that management of the Indonesian Red Snapper fisheries as a distinct entity was not a possibility at that stage, and that the shared stocks were no longer a major issue as the fishing activity had moved away.

As a result of these conclusions, the final Red Snapper Workshop was used as a capacity building exercise (see Activity 3.4, below).

Activity 3.4: Management / Assessment Training Sessions.

During the various workshops and meetings, the need for capacity building within various levels of government was investigated and training options identified.

The need for training, particularly in terms of an improved understanding of fisheries management principles, was addressed through a number of training activities, in particular the "Bioeconomics and Risk Assessment Capacity Building Workshop". This was a major capacity building workshop reviewing the current techniques in applying risk assessment methodologies in assessing fisheries and identifying management requirements.

6 Achievements against activities and outputs/milestones

Notes:

1) There were major problems associated with the transfer of funds to Indonesian partner accounts, which resulted in delays to several project activities, particularly those involving the DGCF. The problem has been resolved, but some of the activities have been delayed.

2) The Centre of Fisheries Extension Development was originally a partner in the project but underwent structural changes and is no longer associated. Discussions have been underway on how to provide extension activities through both RCFCM & DGCF.

Objective 1: Development of new, innovative fisheries policy and management frameworks.

no.	activity	outputs/ milestones	completion date	comments
1.1	National Project Co-ordination and Steering Committee established and operational	Six monthly review meetings. (PC / A)	June 2012	The Project Co-ordination and Steering Committee was established in July 2008. Membership has changed a number of times due to staff changes in Indonesia. Meetings were held on: • 26-27 August 2008 • 23 January 2009 • 12 March 2009 • 26-30 January 2010 • 8-10 November 2010 • 4-8 July 2011 (Project Review) • 24-26 June 2012 • 29 October - 2 November 2012 (Final Meeting)
1.2	Provincial Fisheries Management Workshop in 1-2 Provinces	Workshop summary report and media coverage Discussion fishery management issues. (PC / A)	July 2010	Presentations discussing the project and importance of fisheries management were made at the provincial meeting of MMAF: • 28 July 2010. Sun City Hotel, Sidoarjo (Surabaya). Provincial Fisheries Management Meeting. Agenda item included discussion of fisheries management and agreement on revision to the existing Draft Lemuru Management Plan.

1.3	Provincial Extension (3 day) Workshops	Workshops held and extension materials circulated and available (PC / A)	Not carried out.	NOTE: This activity was not carried out due to lack of involvement of CFED. Alternative activities, including additional stakeholder workshops were completed and additional funding directed to DGCF and RCFMC. Identification posters for sharks, rays, lobsters and market fishes have been produced for distribution to fish markets and provincial fisheries officers. A reproduction of the shark poster is included as Appendix 1.
1.4	Fisheries "Stakeholder" Workshops for Selected Fisheries	Stakeholder workshops summary report. Discussion and development of new fisheries policy and management options. (PC / A)	June 2012	• 25-27 January 2011. Mataram. Provincial Fisheries Management Meeting to discuss Shark Management, including the Indonesian NPOA for Sharks. Agreement to proceed to further assessment and consideration of management options. • 22-24 February 2011. Yogyarkarta. Provincial Fisheries Management Meeting to discuss South Java Tropical Lobster management. Agreement reached with stakeholders to proceed to further assessment and consideration of management options. • 8-9 November 2011. Bali. Provincial Stakeholder Workshop on Shark Fishery. Agreement on management strategies. • 21-23 May 2012. Surabaya. Provincial Stakeholder Workshop on Lemuru Fishery. Agreement on management strategies. • 23-25 May 2012. Surabaya. Provincial Stakeholder Workshop on Lobster Fishery. Agreement on management strategies. For further detail of outputs see Section 10.2 of this report.
1.5	Development of innovative fisheries policy and management frameworks.	Final report, workshop summaries, stock assessment reports, management plans. (PC / A)	June 2012	A number of reports have been prepared and made available as supplementary publications to this Final Project Report: • Rapid Market Sampling • IUU Fishing Issues for each Port • Fishery Data Assessment Reports for Sharks, Lemuru and Lobsters • Fishery Stakeholder / Management Workshop Reports For further detail of outputs refer to Section 10.2 of this report.

PC = Partner Country, A = Australia

Objective 2: • Development of new, fishery specific stock assessment processes.

no.	activity	outputs/ milestones	completion date	comments
		PHASE 1		
2.1	Compilation of Fisheries Statistics, IUU Activities and Fishery Description	Fisheries statistics and description report (PC / A)	June 2009	Two fishing port survey trips were done in 2009, and included surveys in Bali, Lombok, and Pacitan and Gunungkidul Regencies (south coast Java). Information from the surveys was presented to the "Market Scoping" Workshop in March 2009. Information on IUU fishing issues, fisheries statistics and existing fishing regulations has also been collected. For further details of outputs refer to Section 10.2 and Appendix 2.
2.2	Rapid Market Sampling and fishery descriptions	Market reports for 7 fishing ports (PC / A)	June 2010	Seven fish landing sites were surveyed three times during the first phase of the project. These sites were located across four provinces in Indonesia, namely: West Java (Pelabuhanratu), Central Java (Cilacap and Sadeng), East Java (Banyuwangi and Pacitan) and West Nusa Tenggara (Kedonganan, Tanjung Luar. For further detail of outputs refer to Section 10.2 of this report.
2.3	Market Scoping Workshop	Workshop Summary Report (PC / A)	June 2009	The "Market Scoping" workshop to identify the selected fisheries for detailed study was held at the Ancol offices of RCFMC in March 09.
		PHASE 2		
2.4	Compilation of Fisheries Statistics, IUU Activities and Fishery Description. To include review of current management practices	Fisheries statistics and description report (PC / A)	June 2012	This activity was delayed (see above) but has now been completed. Field surveys throughout Java, Bali and Lombok were carried out during December 2010 and January 2011 and discussions held with provincial fisheries officers, fishers and fish processors. Local fishing rules and regulations were collected and interviews held to discuss IUU fishing issues and current management practices. Fisheries catch statistics were collected from provincial fisheries offices. For further details of outputs refer to Section 10.2 and Appendix 2.

2.5	Rapid, Seasonal Market Sampling	Market reports for 7 fishing ports (PC / A)	January 2011	Additional seasonal sampling was carried out, such that across the seven sites, a total of 60 daily surveys were completed between July 2008 and January 2011. The Market Sampling has also led to the preparation of a book on the economically important teleost fishes of southern Indonesia, which will clearly illustrate all exploited fish species (>900) in the study area. For further information concerning both the RAP sampling results and the book preparation, refer to Section 10.2.
2.6	Initial Fishery Stock Assessment Workshop	Workshop Summary Report (PC / A)	February 2012	For each fishery, existing data and information were compiled and information gaps identified. For further details of outputs refer to Section 10.2.
2.7	On-going Fishery Stock Assessment Workshops	Workshop Summary Report (PC / A)	February 2012	Data / Stock Assessment Workshop have been held for each of the selected fisheries: Bali Strait Lemuru, East Java Lobsters, Lombok Sharks. For further details of outputs refer to Section 10.2.

PC = Partner Country, A = Australia

Objective 3: Develop improved scientific and policy frameworks for sustainable management of Red Snapper stocks within Indonesia waters.

no.	activity	outputs/ milestones	completion date	comments
3.1	Workshop: Red Snapper stock assessment review and industry status	Workshop report. (PC / A)	December 2008	The first workshop was held in Bogor in August 2008 and the report has been made available to stakeholders. After this first Red Snapper workshop, a meeting of researchers was held to review of available data for Red Snapper in Indonesian waters.
3.2	Workshop: Role of governments and industry in management of Red Snapper	Workshop report. (PC / A)	June 2009	The second Red Snapper Workshop was held in Bogor in February 2009 and the workshop report has been made available to stakeholders.
3.3	Workshop: Development of Management Options for Red Snapper in Indonesian Waters	Workshop report. (PC / A)	December 2010	The third workshop was initially postponed and then cancelled for a number of reasons: (i) The first two workshops identified major problems in implementing the Australian / Indonesian Draft Management Plan for Shared Red Snapper Stocks. In particular, the Indonesian fisheries were extremely complex, involved multiple fishing methods, and red snapper was a relatively minor component of several large fisheries, within provincial and national jurisdiction. There is currently a lack of appropriate policy framework to allow management. (ii) A major FRDC funded Australian project has commenced to review the red snapper data for Australian waters. (iii) Finally, the available data reviewed by the researchers after the first two workshops indicated that there was unlikely to be significant Red Snapper stocks in the fishing grounds between Indonesia and Australia. The proposed final Red Snapper Workshop was used as a large capacity building meeting on the topic of bio-economics, fishing capacity and risk assessment.

3.4	Management / Assessment Training Sessions	Report on training activities carried out. (PC / A)	Dec 09	A major and very successful capacity building workshop was held on 28-30 September 2010, involving over 60 participants and covering the issues of bio-economic modelling and risk assessments in fisheries. The topic for the workshop was developed in consultation with the Australia–Indonesia Working Group on Marine Affairs and Fisheries (WGMAF). Other training activities associated with this project include: (i) University of Wollongong PhD student (Arief Setyanto) is now involved in this project, funded primarily through an Indonesian government scholarship but carrying out fieldwork with project researchers. (ii) Dr Fayakun Satria from RCFCM received a John Dillon Fellowship grant for a capacity building visit to Australian fisheries research and management agencies, which took place in during Feb-March 2011. (iii) Mr Budi Prisantoso from RCFCM received support to finalise his Masters Degree in Maritime Studies at the University of Wollongong.

PC = Partner Country, A = Australia

Photograph: Fisheries bio-economics and risk assessment capacity building workshop.

7 Key results and discussion

7.1 Introduction

ACIAR Project FIS2006/142 was a large-scale research project that produced many significant results across a range of activities focussed on three main goals: the assessment of fisheries activities in major landing sites across Java, Lombok and Bali; the selection and identification of several major fisheries for detailed study; the collation of existing information and collection of new information on these fisheries; the development and discussion of management strategies with fisheries industry and government stakeholders; and, the review of information and management strategies for the red snapper stocks shared between Australia and Indonesia.

Some of the key results will be discussed in this section and further information is available in the reports listed in Section 10.2.

7.2 Red Snapper Workshops and Management

One of the key objectives in the ACIAR Project FIS/2006/142 was: "To develop improved scientific and policy frameworks for sustainable management of Red Snapper stocks within Indonesia waters". This component of the study is specifically designed to investigate the current situation in respect to Red Snapper assessment and management within Indonesian waters, to identify any gaps in knowledge that require further research and to build capacity to adopt and undertake management of the stocks. As part of this objective, the First Red Snapper Workshop was held in Bogor, Indonesia, on 26-27th August 2008. The objectives of this First Red Snapper Workshop were to:

- Review the information and the stock assessment from the previous ACIAR projects on Red Snapper.
- Investigate the changes that had occurred in the Red Snapper Fisheries and the information available for the fisheries, since the end of the last project (i.e., 2003).
- Prepare a plan for compiling any new information for a new stock assessment of the Red Snapper Fisheries.
- Make recommendations for improvements to the on-going "routine" fisheries statistics collection for Red Snapper.

Approximately 30 participants took part in the 2-day workshop and a number of presentations were made outlining the current situation both from an Indonesian and Australian perspective. On the morning of the second day, a plan for compiling and updating information about the Indonesian Red Snapper fisheries was investigated. The type of data required and some of the possible activities was outlined. As a result of the discussions, it was concluded that a data collection exercise would be undertaken and that two smaller stock assessment workshops would be held in Indonesia (19-23 January 2009) and Cleveland, Australia (March 2009).

The Second Red Snapper Workshop was held on 18-19 December 2008 in Jakarta, Indonesia. The workshop reviewed the roles of the national, provincial and district governments in the sustainable management of Red Snapper, and considered the possible constraints and issues to a co-ordinated management approach. The workshop also examined the Indonesian legislative framework with respect to the formulation of fisheries management plans, and looked at examples of existing and potential management regimes in other fisheries such as the sardine and flyingfish fisheries. The workshop was organised by the Research Centre for Capture

Fisheries, Ministry of Marine Affairs and Fisheries (MMAF), Indonesia and the Australian National Centre for Ocean Resources and Security (ANCORS), University of Wollongong. It was participated in by project team members from the University of Wollongong and the RCFMC, officials from the Ministry of Marine Affairs and Fisheries and Marine and Fisheries Services from the Bali and East Java provinces, and representatives from the Australian Fisheries Management Authority (AFMA) and the Australian Embassy in Indonesia. Representatives from the Swedish Board of Fisheries were also invited to present the preliminary results of the stock assessment on small pelagic species in the Java Sea.

Information gathered during the first two Red Snapper Workshops, and smaller data gathering and review meetings, indicated that:

1) The area where there were shared Red Snapper species between Australia and Indonesia were most likely depleted, as the Indonesian fishery operations no longer targeted these shared stocks, and had moved into more northerly locations.

2) The only new data available for Red Snapper species within Indonesia were from landings statistics, and these were incomplete and confusing, and had a very high proportion of IUU activities. These landings data were of little use in a re-assessment of the current status of the red snapper as a group, and of no use in assessing individual red snapper species.

3) Unlike the Australian situation, "Red Snapper Fisheries" within Indonesian waters were extremely complex and difficult to resolve because:

- There were a large number of closely related species harvested;
- A multitude of fishing methods were used over a wide spatial area;
- The fisheries involved thousands of fishers, including many subsistence fishers;
- Red Snapper were often a valuable but minor by-catch species in a large number of other fisheries;
- Red Snapper species were often sold locally and not specifically recorded;
- The fishery involved local, provincial and national waters; and, as a result,
- Management would require new regulations across multiple levels of government.

As a result, we considered that management of the Indonesian Red Snapper fisheries as a distinct entity was not a possibility at that stage, and that the shared stocks were no longer a major issue as the fishing activity had moved away.

As a result of these conclusions, the final Red Snapper Workshop was used as a capacity building exercise (see Activity 3.4, below). This major and very successful capacity building workshop was held on 28-30 September 2010, involved over 60 participants and covered the issues of bio-economic modelling and risk assessments in fisheries. The topic for the workshop was developed in consultation with the Australia–Indonesia Working Group on Marine Affairs and Fisheries (WGMAF).

Other training activities associated with this project include:

(i) University of Wollongong PhD student (Arief Setyanto) is now involved in this project, funded primarily through an Indonesian government scholarship but carrying out fieldwork with project researchers.

(ii) Dr Fayakun Satria from RCFCM received a John Dillon Fellowship grant for a capacity building visit to Australian fisheries research and management agencies, which took place in during Feb-March 2011.

(iii) Mr Budi Prisantoso from RCFCM received support to finalise his Masters Degree in Maritime Studies at the University of Wollongong.

7.3 Rapid Assessment Protocol (RAP)

A major component of this research project was to develop and trial a Rapid Assessment Protocol (RAP) to quickly capture fisheries information and catch data at landing sites throughout Indonesia. The main objectives of this component of this project were to:

- Demonstrate a method for collecting landings information from a variety of landing sites;
- Describe the methodology in detail and identify tools required to allow consistent use by a wider audience;
- Describe issues and limitations of the methodology in relation to the surveys undertaken during this project;
- Detail benefits of this methodology in Indonesia in terms of acquisition of accurate catch composition data at the landing site level.

A Rapid Assessment Protocol (RAP) for obtaining catch composition information was undertaken at 7 landing sites during 9 survey trips between 2008 and 2011. Sixty individual landing site surveys were conducted in the study period. The resulting data was found to be very comprehensive and various analyses illustrated how the resulting data could be investigated. The analyses highlighted that obtaining catch information at a family-level was more accurate than obtaining data at higher taxonomic levels. This methodology can be used across a wide variety of markets and landing sites, regardless of their size and could also be used across different regions and countries to compare the effects of different fishing pressures. The results from this study have produced a strong benchmark against which future change can be assessed. Six new species were identified and issues with taxonomy identified for over 20 species. Further information is available in the published report (White et al., 2013a; see Section 10.2, below).

As a result of the comprehensive analyses of market fish species across Java, Lombok and Bali, a market fish identification book (and guide) is in preparation. The book describes and illustrates about 900 species of marine fishes, in both English and Bahasa Indonesian. The book will be published by ACIAR during 2013 (White et al., 2013b; see Section 10.2, below).

Outputs from this component include (see Table 8.1, 8.2 and 8.3, below):

- Collection of detailed information about fishing gears catches and issues related to the fishing ports in Java, Lombok and Bali.
- Documentation of fish species landed throughout Java, Lombok and Bali.
- Identification of new species and extensions to range of known species.
- A field guide to the bony fishes present at fish markets.

7.4 Illegal, Unregulated and Unreported Fisheries

A number of IUU fishing concerns were highlighted in the provinces of East Java, Central Java, West Java, Bali, Yogyakarta, and West Nusa Tenggara particularly in the ten fishing ports investigated in detail. The most common illegal fishing activities identified by respondents in all provinces include illegal fishing by migrant fishers and to a lesser extent by foreign fishing vessels; fishing without registration and licences, particularly for small fishing vessels; use of fishing gears or methods which are

prohibited in specific fishing zones; non-compliance with port requirements; and landing of fish outside designated landing areas.

Unreported fishing includes non-reporting or misreporting of catch, as well as the lack of recorded fisheries data as a result of landing fish outside home ports. The non-implementation of the logbook system is also a major factor contributing to unreported fishing in the six provinces. Another factor that causes unreported fishing is the incompatibility of data collection systems between the local and national governments. Some data collected in the sub-district, district and provincial ports are inadvertently lost in the process of data aggregation for purposes of national fisheries statistical reporting.

Unregulated fishing also occurs in the project areas in various forms, such as the absence of adequate regulations for small fishing vessels, lack of specific regulations adopted for the lobster fishery, lack of adequate regulations for the management of small scale fishing vessels, lack of adequate implementation of management measures and fisheries regulations, particularly in respect of mesh sizes and fishing in rumpons (fish aggregating devices), and non-application of sanctions to fisheries violations. The absence of strict port arrival and clearance requirements are also considered as examples of unregulated fishing which may further encourage illegal and unreported fishing. As well as this general information about IUU Fishing in relation to the selected fishing ports and regions, detailed information was collected for the three specific fisheries, namely, Bali Strait Lemuru, South Java Lobsters and Tanjung Luar Sharks.

The major output from this component (see Table 8.1, 8.2 and 8.3, below) has been a review and documentation of Illegal, Unregulated and Unreported fishing activities at many of the fishing ports throughout Java, Lombok and Bali, as well as those specifically related to the Bali Strait Lemuru Fishery, Tanjung Luar Shark Fishery and Southern Java Lobster Fishery.

A report summarising the current situation in regard to the National, Provincial and Local Fisheries Legal and Policy Framework and IUU Fishing activities has been prepared and is available both printed and on-line forms (West et al., 2013)

7.5 Fishery Data Assessment and Stock Assessments

7.5.1 Lombok Shark Fishery

New information on shark catches and effort for the Tanjung Luar district were collected and examined in combination with the available historical data. The information came from three separate sources: market surveys conducted as part of this and previous ACIAR projects; official Dinas Perikanan fisheries catch statistics; and, "Local Fisheries" data collected from each market, including catches and effort on particular days recorded by on-site enumerators. These latter data should be the basis of all aggregated provincial level Dinas Perikanan data, and national data, but is not subject to the scaling and aggregation rules incorporated by different agencies. By using comparisons among these sets of data we examined how statistics at different scales are produced, and whether these procedures might be updated to provide better information for fisheries information.

Outputs from this component dealing with Shark Fisheries include (see Table 8.1, 8.2 and 8.3, below):

- Collection of new market landings data for sharks caught around Lombok, including species-specific information about size and maturity of approximately 20 species.

- Major revision of assessment of the Tanjung Luar shark fishery, including collection of new data, revised assessments of approximately 20 species and development of management recommendations, including implementation of the NPOA (Sharks).
- Review of management strategies for Tanjung Luar Shark fishery and, more generally, for Indonesian shark fisheries.
- Stakeholder appreciation of the issue of conservation in shark fisheries, including new identification posters and brochures (See Appendix 1).

A major project report on the Tanjung Luar Shark fishery has been prepared, which contains new assessment information for the fisheries (catch, species composition, fishing effort, etc.), a summary of the outcomes of the final of two stakeholder workshop and recommendations for future work. Further information is available in the published report (White et al., 2012; see Section 10.2).

7.5.2 Bali Strait Lemuru Fishery

The small pelagic fish resources in the Bali Strait have a long history of exploitation, using various traditional fishing gears. However, the fishery developed rapidly only after the introduction of purse-seine gear during the early 1970s, prompted by strong demand for fish as a resource for the developing processing industries. This fishing gear has become the main fishing gear used in the Bali Strait small pelagic fishery. Based on fishery data from Muncar Fishing Port, purse-seine fleets contributed about 85 % of the total catch of the Bali Strait fishery in 2009. The Bali Strait Lemuru Fishery is one of the few fisheries in Indonesia that has a "draft" management plan. The main basis of the management plan is a strategy to reduce effort through a bilateral agreement between the two main provinces involved, namely East Java and Bali. Despite the long history, there are major gaps in knowledge concerning the lemuru fishery and, as part of this ACIAR Project, additional enumeration (market collection of statistics) was carried out by RCFMC. This enumeration was designed to complement an existing project, undertaken in conjunction with a Norwegian funded study to assess juvenile stocks by acoustic methods. As an activity of this ACIAR project, fisheries data were collected from markets in Pengambengan and Kedonganan during January - December 2011. There was also sampling in Muncar, East Java, funded by the Norwegian funded project (INS 2094-06/035 - Capacity Building in Fisheries and Aquaculture), with data collected from August 2010 until December 2011.

The primary objectives of this ACIAR study were to assess the current state of the fishery and issues impacting on the fishery, and identify methods for improved data collection and reporting for the fishery and suggest a framework for improved management. The project also gathered sufficient information to enable a new assessment of population parameters, including, growth, mortality and yield per recruit. These data continued to indicate that the Bali Strait lemuru populations were still overfished in terms of biological targets.

In July 2010, a provincial fisheries meeting was held in Sidoarjo, East Java, at which the Bali Strait Lemuru Fishery was discussed and agreement reached to review existing data and prepare a new Fishery Management Plan. A Lemuru Fishery Data Assessment meeting was held in February 2012 were a number of recommendations were made discussed. The outcome of the workshops was an agreement to:

- Improve the estimates of biomass from the acoustic surveys being carried out by the Research Centre for Fisheries Management and Conservation.
- Improve estimates of the growth rate of lemuru (resolve whether fast or slow). Need to carry out independent ageing of a range of fishes using otoliths as a

check on the length-based methods. (e.g., a key question is whether adult fish are 2 or 4 years age when captured.)

- Investigate the location, distribution, movements and abundance of larvae and juveniles and adults. There is also a need to investigate the impact of fishing on juveniles (bagan lift nets).
- Continue to inform the stakeholders that the lemuru fishery remains heavily fished.
- Inform industry of options methods of management (community-based):
    - Minimum legal sizes for sale
    - Spatial closures (e.g., marine park) to protect juveniles- more research is required on whether this would be useful.
- Inform industry of the impact of climate cycles on the catches of lemuru and the risk to lemuru stocks of heavy fishing effort during and directly after years of low
- Improve catch statistics for lemuru:
    - Improve the identification skills of enumerators in fishing ports and district offices so that lemuru catches are properly separated from other Sardinella in the official statistics
    - Investigate sources of under-reporting of the catch and estimate the various unreported components (e.g., 'take home' proportion of the catch, low catches which are not recorded, small size classes which are not reported, capture by un-reported methods).
    - Investigate whether there are useful industry sources of data (e.g., cannery records).

In summary, major outputs from this component dealing with the Bali Strait Lemuru Fishery include (see Table 8.1, 8.2 and 8.3, below):

- Collection of new market landings data for lemuru in East Java, including length frequency to complement biomass estimates using echo sounder technology.
- Major revision of the stock assessment for Bali Strait lemuru fishery.
- Review of management strategies for Bali Strait Lemuru fishery.
- Better stakeholder appreciation of the issue of oceanography and climate on the lemuru fishery (e.g., El Nina and rainfall).

Further information is available on this research component in Wudianto et al. (2013).

7.5.3 Southern Java Lobster Fishery

The lobster fishery was a focus of Phase 2 of this ACIAR project and concentrated on the fisheries operating on south coast of two provinces: East Java and D.I. Yogyakarta. Lobster fisheries at Cilacap (Central Java) were also included to a lesser degree. Detailed information on the lobster fisheries were collected during 8 field trips during the period May 2010 – February 2012. The first of these trips was focussed on characterising the fisheries and determining the resources required to establish an enumeration program. The field teams included project members from RCFMC, RIMF, CSIRO and University of Wollongong. An additional field trip in January 2011 was devoted to a review of fisheries regulations and the existing fisheries management. The main locations for field research were Pacitan, Tamperan,

Watukarung, Tawang, Sadeng, Gesing, Baron, and Drini and included biological surveys of lobsters. Data (species, length, weight, sex, maturity etc.) were collected on a total of 3188 lobsters landed to TPIs and those held by collectors (*pengumpul*). Information was also gathered during visits to DKP Propinsi Yogyakarta, DKP Kabupaten Gunungkidul, DKP Kota Pacitan, PPP Tamperan and through interviews with local fishing association representatives.

The following is a summary of the main findings of the research component:

- *Panulirus homarus* (Udang pasir) and *P. penicillatus* (Udang batu) are the two most common species. *P. homarus* is the dominant catch of gillnets, and *P. penicillatus* is the dominant catch of krendets. The other species in the fishery are *P. longipes* (Udang batik), *P. versicolor* (Udang bamboo), *P. ornatus* (Udang mutiara), *P. polyphagus* (Udang pakistan) and *Scyllaroides squammosus* (Udang merah).
- Lobsters are caught by gill-nets deployed from boats, and by krendets deployed from boats and from cliffs. The percentage of the total lobster catch taken with krendets varied between surveys, ranging from 53% in March 2011 to 77% in December 2010, with an overall average of 67%. However, these results come from an unusual period characterised by a level of lobster fishing by gill-nets (from boats) that was much lower than normal.
- The main path of distribution and marketing of lobsters is from fisher – to Level 1 collectors (*bahkul*) – to Level 2 collectors (*pengumpul*) – to exporters (in Jakarta, Surabaya etc.). Some fishers sell direct to pengumpul.
- Lobster catch is strongly seasonal with peak season being October to December. Recent seasons have seen unusually low catches. Fishers and collectors state overfishing and impacts of weather as primary reasons for low catches. In particular, the absence of a 'sharp' demarcation between end of dry season and start of wet season is given as the primary cause.
- Lobsters that pass through the TPI are recorded and reported in fisheries statistics. Many lobster catches (perhaps as much as 50 – 70%) do not pass through TPI and are unrecorded, but this varies among locations.
- Fishers lose as much as 60% of their fishing gear on each fishing trip. This gear remains in the lobster habitat and is recognised by fisheries authorities and fishers as a serious environmental issue.
- At the time this project commenced in 2008, illegal fishing of lobsters by fishers using compressor and potassium cyanide was stated as the most serious issue for the fishery. This problem has since declined through community-based management. Some illegal fishing activity continues, with use of diving and chemical methods- fishers exploiting loop-holes in the current fisheries laws.
- Lobster grow-outs (small lobsters grown to larger lobsters) have been attempted by some collectors, in on-shore ponds and in sea cages in various locations on south coast Java, with mixed success. No one has yet achieved a grow-out operation that is sustainable and cost effective. There is considerable interest among fishers and collectors in the lobster aquaculture technology used with success in Vietnam and other countries.

In summary, major outputs from the Southern Lobster Fishery component include (see Table 8.1, 8.2 and 8.3, below):

- First collection of any information on the Southern Java Lobster Fishery, including landings data, biological data and information on fishing gear and methods.
- Identification of key issues impacting on the fishery.
- First stock assessment for Southern Java lobster fishery.
- Review of management strategies for South Java Lobster fishery.

Further information is available on this research component in Milton et al. (2012).

7.6 Fisheries Stakeholder Workshops and Development of Management Strategies

For each of the three fisheries selected for detailed assessment and management, a number of stakeholder workshops were held with local government agencies, the fishing industry and fishers. These workshops were designed to present the research results from the project, discuss their implication and then to raise various options and strategies for management of the fishery. Summaries of the management stratgeies developed for each fishery is available in the relevant reports (see Section 10.2).

7.6.1 Lombok Shark Fishery

The final workshop on Provincial Management for Shark Fisheries was held on 25 – 27 January 2011 at Jayakarta Hotel, Mataram, West Nusa Tenggara. The workshop was part of the collaboration project between the Government of Indonesia and The Government of Australia, which is ACIAR Project No. FIS/2006/142: Developing new assessment and policy framework for Indonesia's marine fisheries, including the control and management of Illegal, Unregulated and Unreported (IUU) Fishing.

The objectives of the final workshop were (1) to share information of shark fisheries in West Java, Central Java, DI Yogyakarta, East Java and West Nusa Tenggara, (2) to identify issues within shark capture in West Java, Central Java, DI Yogyakarta, East Java and West Nusa Tenggara, and (3) to collect some inputs for implementation of The National Plan of Action for Shark (NPOA Shark). The workshops covered a wide range of relevant issues and discussed the management implications that arose from the data collection and analyses. At this stage, there is no opportunity for specific management of the Tanjung Luar shark fishery, however the results from the various market sampling programs were used to help develop and support the Indonesia's National Plan of Action (NPOA) for the Conservation and Management of Sharks.

The workshop recommendations were to:

- Propose a new project for the training on shark species identification for the enumerators dealing with the collection of shark catch statistics.
- Develop NPOA shark guidelines for the stakeholders in the implementation of the NPOA in all over Indonesia.
- Use the standard form in data collection and evaluation of the capture and utilization of shark in the fishery base landing, and fishing port.
- Implement a new fishing Logbook, as specified in Ministerial Regulation No. 18/ 2010.
- To continue to carry out research of shark fisheries in Indonesia.

7.6.2 Bali Strait Lemuru Fishery

The final Stakeholder Workshop for Bali Sardinella Fisheries was held on 21-23 May 2012 at Novotel Surabaya Hotel & Suites, Surabaya. The objectives of the workshop are (1) to inform the result of evaluation of Bali Sardinella data collection and research in Bali (Pengambengan Fishing Port- Jembrana, Kedonganan Fishing Port-Badung) and East Java (Muncar Fishing Port-Banyuwangi), (2) to review Bali Sardinella fisheries issues in Bali (Pengambengan Fishing Port- Jembrana, Kedonganan Fishing Port-Badung) and East Java (Muncar Fishing Port-Banyuwangi), and (3) to collect information for up-dating Bali Sardinella fisheries management plan.

The workshop recommendations can be described as below :

- Improve data collection and species identification of Bali Sardinella and other sardinella species which caught. Data collection coverage consists of catch, species, vessel, fishing gear and fishing ground.
- Conduct data collection of trip (days at sea) and number of setting by implementing fishing logbook.
- Further research on age estimates for the different size classes that are fished, the location of spawning areas, the spatial and vertical distributions of larvae, juveniles and adults of lemuru (including acoustic surveys and oceanographic), the impact of fishing on juveniles - in particular, impacts of bagan (lift net) fishing.
- Determine potential and status estimation of Bali Sardinella by improving the methodology of stock assessment as a basic for management and licensing.
- Improve monitoring on licensing implementation, including 'andon fisher' (exclude purse seine) issues.
- Improve dissemination of the strong influences of global climate features (e.g. SOI index, La Nina and El Nino events) and exploitation on the abundance, or at least 'catchability' of lemuru in Bali Strait to the lemuru fishing industry.
- Develop alternative livelihood for Bali Sardinella fisher during off season.
- Develop plan of action of Bali Sardinella fisheries management plan as attached.
- In order to achieve better Bali Sardinella fisheries management, it is a need to develop a Bali Sardinella Fisheries Management Plan, which is established through Ministerial Decree as stipulated in Fisheries Law No. 31/2004 as amended by No. 45/2009.
- The workshop recommend that collaboration project among Indonesian Government, ACIAR, and other International Funding should be continued.

7.6.3 South Java Lobster Fishery

The project held three "stakeholder" workshops for the lobster fishery: "The Workshop for Provincial Management of the Lobster Fisheries" in Yogyakarta during 7 - 9 March 2011, "Data Assessment Workshop for Lobster Fishery" in Bali during 26 -27 March 2012, and "Stakeholders and Fisheries Management Workshop for Lobster Fishery" during 24 - 25 May 2012 in Surabaya. The key outcomes of these stakeholder workshops can be summarised as:

1. Continue the research surveys on south coast Java lobsters to improve information on the biology of the 6 species. This requires the methods adopted during the project to be documented.
2. Inform industry of options for management (community-based?), such as:
    a. Minimum legal sizes for capture and sale
    b. Releasing berried females
    c. Spatial closures (e.g. protected zones). More research is required to determine whether spatial closures would be effective for lobsters.
3. Undertake a risk assessment on the lobster fishery and associated habitat:
4. Requires more data on the relationship between the different species of lobsters and their habitats.
5. Investigate the effect on the catch rate and size selectivity by different gear types
6. Requires research on the relationship between mesh size and length at first capture.
7. Investigate whether fishing gear can be developed that is more resistant to being lost during fishing operations. This requires collaboration with a gear technologist.
8. Highlight the impact of ghost fishing by lost gill-nets and krendets on the lobster populations and associated habitats.
9. Encourage a community-based (perhaps industry sponsored) program to remove the lost fishing gear.
10. Develop and document methods for estimating the current under-reporting of lobster catches.
11. Improve the information on lobster catches by collecting additional catch information from collectors (*pengumpul*) through the introduction of a logbook system.

7.7 Training and Capacity Building

There were many activities that were undertaken throughout the life of the project that contributed to training and capacity building. Major outputs in terms of training and capacity building were:

- Training of RCFMC staff in the procedures for Rapid Market Sampling was carried out in the first 18 months of the project.
- Training of junior researchers during joint fisheries assessment workshops and data analyses meetings for red snapper, lemuru, shark and lobster fisheries.
- Training workshop and follow-up discussions on the application of bio-economics and risk assessment in fisheries. This highly successful meeting (**Bioeconomics, Fishing Capacity, and Risk Assessment Workshop)** was held in Jakarta in September 2010, with over 50 fisheries managers and scientists participating in this capacity building activity.
- Training of Indonesian postgraduate students:

- Dr Fayakun Satira from RCFCM received a John Dillon Fellowship grant for a capacity building visit to Australian fisheries research and management agencies.
- Mr Budi Prisantoso from RCFCM received support to finalise his Masters Degree in Maritime Studies at the University of Wollongong.
- A University of Wollongong PhD student (Arief Setyanto) is now involved in this project, and funded through an Indonesian government scholarship and carrying out field work with CSIRO and RCFCM research staff.

Photograph: Mixed selection of fishes (Jimbaran Bay, Bali).

8 Impacts

This ACIAR project was finalised in December 2012 and many important scientific, community and economic impacts were already apparent. Some of these will be outlined below.

8.1 Scientific impacts – now and in 5 years

The project has had significant scientific impacts across the range of activities, which will result in fishery assessment and management reports, journal papers, and a significant contribution in the form of an identification book on the economically important teleost fishes of southern Indonesia. Some of the current and future scientific impacts are listed in the Table 8.1 below, against the major project outputs.

Table 8.1: Scientific outputs and impacts – now and in 5 years

Outputs	Impacts (Now and in 5 years)	Comments
Collection of detailed information about fishing gears, catches and issues related to the fishing ports in Java, Lombok and Bali.	Increased management success and more effective research	Identified the key issues for the important marine fisheries at seven ports and the requirements for effective monitoring of those fisheries. These data will be of particular importance for the revised versions of the catch monitoring system being introduced by Indonesia.
Documentation of fish species landed throughout Java, Lombok and Bali.	Improved accuracy for future data collection and species identification	This represents new information about the distribution of fishes in the region, and is essential to the management and assessment of fisheries throughout Indonesia and the region.
Identification of new species and extensions to range of known species.	Improved accuracy for future data collection and species identification	The revision of fish species lists and inclusion of new and/or rare species is an critical step toward a more sustainable approach to fisheries management.

Outputs	Impacts (Now and in 5 years)	Comments
A field guide to the bony fishes present at fish markets	Improved capability for future research and management Improved accuracy for future data collection and species identification	This represents fundamental information about the common bony fish species, which is essential to the management and assessment of fisheries throughout Indonesia and the region. This guide will complement the Guide to Indonesian sharks previously produced by ACIAR.
Collection of new market landings data for lemuru in East Java, including length frequency to complement biomass estimates using echo sounder technology.	These data have enabled a new biomass estimate for lemuru and will contribute to current and future stock assessments for the Bali Strait lemuru fishery.	The Bali Strait lemuru fishery is one of the most valuable in Indonesia and is currently undergoing large fluctuations in landings.
Major revision of the stock assessment for Bali Strait lemuru fishery.	This revision of the Bali Strait lemuru fishery has provided the basis for new management strategies to be developed and will provide direction for future research of the lemuru fishery.	The re-assessment of the lemuru stocks is an important step in ensuring long-term sustainability of the fishery and has important social and economic implications for the region.
Collection of new market landings data for sharks caught around Lombok, including species-specific information about size and maturity of approximately 20 species.	These data have increased our understanding of the biology of over 20 Indonesian shark species and will continue to be the basis for current and future steps towards sustainable fishing and conservation of sharks in Indonesian waters.	

Outputs	Impacts (Now and in 5 years)	Comments
Major revision of assessment of the Tanjung Luar shark fishery, including collection of new data, revised assessments of approximately 20 species and development of management recommendations, including implementation of the NPOA (Sharks).	Development of new management strategies (see below) for shark fisheries throughout Indonesia, and particularly for Lombok. Implementation of new regulations related to Indonesian shark fisheries. Fulfillment of some of Indonesia's key requirements contained in the NPOA and IPOA for sharks (related to improved data collection).	This major revision of the assessment of shark species comprising the largest shark fishery in Indonesian waters has led to the development of new management strategies (see below) and fulfills some of Indonesia's key requirements contained in the NPOA and IPOA for sharks (related to improved data collection). This assessment will be invaluable in the future, as a basis for ongoing research on Indonesian sharks species and to meet the requirements of the NPOA (Sharks).
First collection of any information on the Southern Java Lobster Fishery, including landings data, biological data and information on fishing gear and methods. Identification of key issues impacting on the fishery.	Improved understanding of the currently overexploited lobster stocks in southern Java. Development and future implementation of management options for the Southern Java Lobster Fishery (see below) aimed at providing sustainable fisheries.	These data are the only source of detailed information currently available about lobsters in Indonesian waters and the lobster fishery of South Java, which is currently largely unregulated. The information will help direct future research and contribute to future lobster management plans.
First stock assessment for South Java lobster fishery.	Development and future implementation of management options for the Southern Java Lobster Fishery (see below) aimed at providing sustainable fisheries.	As the first fisheries-based assessment carried out on Indonesian lobsters, this information has been fundamental in developing management options for the fishery and will continue to be used in future research and management related to Indonesian lobsters.

8.2 Capacity impacts – now and in 5 years

A number of capacity building outputs have resulted from the project activities and these will have impacts now and into the future, as outlined in Table 8.2.

Table 8.2: Capacity outputs and impacts – now and in 5 years

Outputs	Impacts (Now and in 5 years)	Comments
Discussions between national and provincial fisheries researchers and managers concerning red snapper, lemuru, sharks and lobsters, as well as more generally the links between science and policy development in fisheries.	Increased collaboration between fisheries researchers and managers at the national, provincial and local levels of government in Indonesia.	These discussions have led to a better understanding between researchers and managers about the issues related to each of the fisheries examined and also the key role of fisheries research in providing the best available information for fisheries management. This has the potential to continue these discussions in respect to these and other specific fisheries.
Training of junior researchers during joint fisheries assessment workshops and data analyses meetings for red snapper, lemuru, shark and lobster fisheries.	Increased capacity in fisheries assessments and in the process of researchers contributing to management strategies.	The experience gained by a number of junior Indonesian fisheries researchers in real case studies will have long-term benefits in building the capacity of RCFMC.
Training workshop and follow--up discussions on the application of bio-economics and risk assessment in fisheries.	Increased capacity for future research and management.	Over 50 researchers and managers participated in various training and capacity building activities. This will have long-term benefits to Indonesia.

Outputs	Impacts (Now and in 5 years)	Comments
Training of Indonesian postgraduate students.	Increased capacity for future research and management.	The training of postgraduate students during the project has led to a greater understanding of the fisheries issues within Indonesia and exposure to a range of international fisheries research and management experiences.

8.3 Community impacts – now and in 5 years

There are likely to be immediate and long-term community impacts from this project, particularly as the scientific and capacity building outputs from the project are adopted and improvements are made to the assessment and management of Indonesia's fisheries resources. Improvements to management will have impacts that are inter-related, and fall across the sub-categories of economic, social and environmental benefits. As a result these combined "community" impacts are considered together in Table 8.3.

Table 8.2: Community-based outputs and impacts – now and in 5 years (combined across the sub-categories of economic, social and environmental impacts.

Outputs	Impacts (Now and in 5 years)	Comments
Review of management strategies for Bali Strait Lemuru fishery.	Changes to the management of lemuru stocks in Indonesian waters, with the objective of improving the long-term sustainability of the fishery. Increased management success.	The adoption of improved management would lead to a more sustainable fishery and therefore have a combination of economic, social and environmental benefits.

Outputs	Impacts (Now and in 5 years)	Comments
Review of management strategies for Tanjung Luar Shark fishery.	Changes to the management of shark stocks in Indonesian waters, with the objective of improving the long-term sustainability of the fishery. Increased management success.	The adoption of improved management would lead to a more sustainable fishery and therefore have a combination of economic, social and environmental benefits.
Review of management strategies for South Java Lobster fishery.	Changes to the management of lobster populations in Indonesian waters, with the objective of improving the long-term sustainability of the fishery. Increased management success.	The adoption of improved management and addressing the habitat degradation issues identified would lead to a more sustainable fishery and therefore have a combination of economic, social and environmental benefits.
Documentation of Illegal, Unregulated and Unreported fishing activities.	Improved understanding of how IUU fishing at the local (provincial level) can impact international and regional market of fish. Provided forum for local fishers to understand the national policies and laws of Indonesia on IUU fishing. Better understanding amongst local fishers of the relationship between addressing illegal activities and applying fisheries management measures.	There is an international requirement for Indonesia to submit a national plan of action to combat IUU fishing. The IUU documentation can significantly contribute to the development of specific measures that can be adopted within the national plan to address the problem. Provided information that will significantly assist in the development and adoption of effective community-based and/or government-based management, and have substantial impacts related to economic, social and environmental benefits.

Outputs	Impacts (Now and in 5 years)	Comments
Better stakeholder appreciation of the some of the key issues affecting specific fisheries, such as: • Oceanography and climate on the lemuru fishery (e.g., El Nina and rainfall). • Conservation in shark fisheries, including new identification posters and brochures. • Recruitment overfishing on the lobster fishery and possible management strategies to address the issue.	Industry and stakeholder co-operation and involvement in developing and adopting improvements to fisheries assessment and management in these specific fisheries.	The adoption of improved management and addressing the habitat degradation issues identified would lead to a more sustainable fisheries and therefore have a combination of economic, social and environmental benefits.
Opportunities for discussions between government fisheries agencies with industry leaders.	Facilitated cooperation between government and fishing industry. Reduced the perceived gap between the needs of local fishers and national fisheries management and policies.	Field interviews and management workshops provided an avenue for the discussion of management issues, as well as 'socialisation' of existing laws. It is expected that such discussions will encourage compliance amongst fishers.

In addition to the above many components of this ACIAR project have contributed to improvements to fisheries data collection and fish landing statistics systems in Indonesia, which will lead to improved information about the fishes being exploited and those that may be at risk of overexploitation.

The good coverage of species and images collected for the teleost book will enable us to determine which of the species being exploited in this area are currently assessed as threatened globally (i.e., listed on IUCN Red List). The Rapid Assessment methodology for market surveys has also produced a strong benchmark for which future change at the sites surveyed can be assessed (White et al. 2013). At this stage, there have been no other environmental impacts of the project, apart from building an awareness of the problems created by fisheries stock collapses.

8.4 Communication and dissemination activities

The Red Snapper workshops involved large numbers of participants, including many from Australia, and provided an excellent forum for the communication of information about these fisheries from both the scientific and management viewpoint. This has had a major impact on the negotiations between Australia and Indonesia on the management of the remaining red snapper stocks.

Fisheries survey teams visiting various fishing markets have included participants from RCFMC, DGCF, CSIRO and UoW. The planning for and implementation of these survey activities has provided another good opportunity for increased communication and collaboration between the primary agencies involved in the project. The many interviews conducted for the survey, with provincial, regency and district level fisheries staff, with port authority staff, and with members throughout all sectors of the fishing industries, provided valuable opportunities for spreading the word about the project's aims and objectives and for emphasising the key message of the benefits that will hopefully flow from development of improved systems of fisheries management.

During the enumeration development trip to east Java in October and November 2009, Craig Proctor was invited to give a seminar at Universitas Untag (Universitas 17 Agustus 1945) in Banyuwangi. Although the subject of the seminar was on tuna fisheries, it provided opportunity to also communicate the objectives and activities of this project to the students and university academic staff.

At the completion of the enumeration development trips for lobster fisheries of south coast Java, a member of the development team, Darren Dennis (CSIRO Cleveland), presented a seminar at RCFMC on Torres Strait lobster fisheries and management and sustainability issues.

Recent management (stakeholder) workshops on sharks and lobsters provided a major communication forum for fishers, managers, researchers and processors and enabled discussion of the issues affecting these fisheries.

Photograph: First Red Snapper Workshop participants (Bogor, 26-27 August 2008).

9 Conclusions and recommendations

9.1 Conclusions

Indonesian fisheries are amongst the largest in the world and are a major contributor to the economic and social well being of the nation. Developments in the policy formulation and assessment related these fisheries will be critical in the long-term survival of the fish stocks and in achieving an ecologically sustainable management framework, supported by information derived from innovative research.

Fisheries research and management within Indonesia is undergoing rapid change to meet the challenges exerted by both internal and external factors, such as:

- Full, and in some case overexploitation, of most of the available fisheries throughout Indonesia.
- Declines in landings for some species and groups.
- In many cases, a lack of a suitable management framework related to specific fisheries.
- Increasing demands to meet national and international agreements and benchmarks n assessment and management practices.
- The lack of capacity, particularly at local and provincial levels of government, to deal with fisheries research, management and compliance of fisheries within their jurisdiction.

This ACIAR project has contributed significantly to initiatives from the Indonesian Government that aim to improve fisheries and fish research, landings and catch monitoring, policy development and fisheries management throughout the nation. The research of major fish landing places throughout Java, Lombok and Bali has contributed greatly to the fundamental information about the fishes and fisheries critical to future assessment and management, while the specific case studies relating to the Bali Strait Lemuru Fishery, Tanjung Luar Shark Fishery and Southern Java Lobster Fishery have provided benchmarks for future fisheries management at the national, provincial and local levels of government. The large number of workshops and meetings organised throughout this project, particularly those meetings involving stakeholders in various fisheries, has provided a forum for discussing research results and management options, and demonstrated the collaborative approach required for successful fisheries management.

Funding agencies, such as ACIAR, have a major role to play in further assisting the progress toward sustainable fisheries management in Indonesia, which has major outcomes in regard to economic, social and capacity building benefits, as well as contributing towards food security.

9.2 Recommendations

A large number of recommendations have been developed through the many meetings, workshops, interviews and discussions with government agencies and fisheries stakeholders carried out during the course of this project. These recommendations relate to specific aspects of the individual components of the project and have been summarised above and in the project reports relating to these project components (see Section 10.2, below).

In addition to these specific recommendations related to individual fisheries, a number of additional and more general recommendations were raised at the Final Project Steering Meeting, held at the University of Wollongong from 29 October to 2 November 2012, and attended by most of the key members of the project team. The recommendations raised at this Final Project Meeting are summarised below:

- Rapid Assessment Protocol
    - Training-workshops on RAP for enumerators and other fisheries officers should be developed and funding sought from ACIAR.
    - The training-workshop could be held initially in Jakarta for 5-7 days focusing on smaller markets with less translocation. A user guide for the identification of families of species may be developed and distributed prior to the workshop to ensure effective uptake of the concept and methodology. The workshop would also provide an opportunity to modify and develop tailored RAP User Guide suitable for Indonesian fisheries.
    - Sustainability scoring index linked in with RAP should be investigated as an option for future research.
    - The RAP approach to market sampling should be applied in other regions for comparison to existing landings data.
- Bali Strait Lemuru Fishery
    - Further research may include feasibility of new measures or options to improve management of the lemuru fishery, such as spatial or temporal closures.
    - Future research on lemuru may include studies on population genetic studies, age structure, spawning ground, as well as impact of oceanographic conditions on the fishery. It is recommended that any future research should involve the expertise of oceanographers in an effort to better forecast catches and provide advice to industry on catch forecasts.
    - Continue socio-economic research into the community and industry participation in stock assessment (e.g., introduction of logbooks) and management.
- Lombok (Tanjung Luar) Shark Fishery
    - Further research may include development and feasibility of management measures or options for the shark fishery, concentrating on certain species, such as *Sphyma lewini*, while taking into account associated species such as tuna and dolphin.
    - Investigate feasibility of developing closed / sanctuary areas for sharks of high conservation status.
    - Development of tablet and smart-phone apps for identification and data recording of sharks.
    - Provide additional information on thresher sharks by compiling the existing information available from previous projects e.g., tuna catch data.
    - Examine tuna by-catch data for sharks.
- South Java Lobster Fishery

- Wild lobster larval distribution may be enhanced by capture-based-aquaculture (CBA) (or fisheries based aquaculture), which is currently being trialed in Lombok.
- Capacity building in Southern Java to inform stakeholders of the problems related to the lobster stocks and the CBA approach to re-establish stocks through a grow-out.
- Establish a reserve area for lobster conservation (requires additional research)

- Fishery Stakeholder (Management) Workshops
  - Follow up Actions for each Stakeholder Workshop.
- General Fisheries Issues
  - A number of small interesting fisheries were identified in need of further research, including those related to Fish Attracting Devices (FADs), bagan (lift net) fisheries, tiger snail fisheries, handline fisheries and others (refer to Appendix 2).
  - Educating fishers and fisheries co-operative in better handling methods in order to achieve better quality fish products.

Photograph: Lemuru fishing vessels (Bali Straits).

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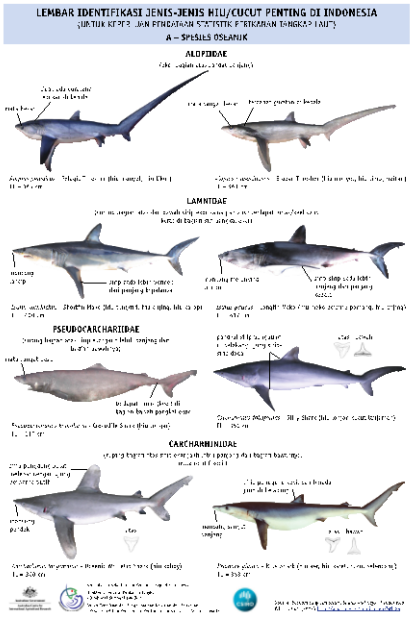
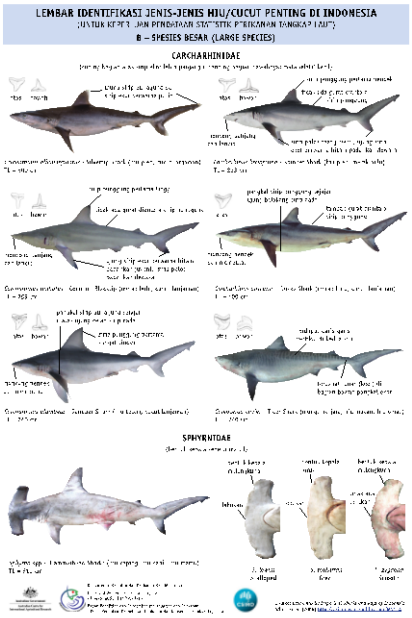
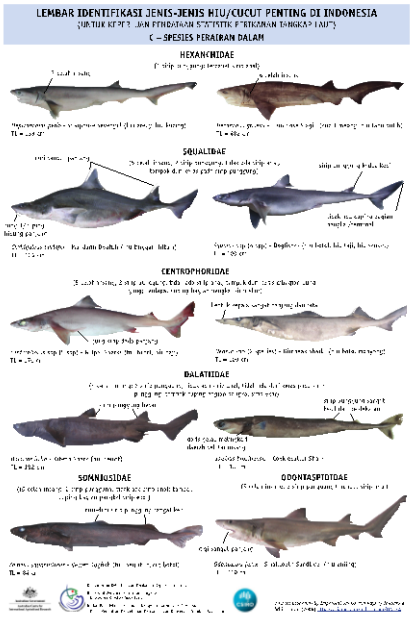
11 Appendixes

Appendix 1: Brochures produced for shark identification.

NOTE: Reduced version of brochures produced for display in markets and use by enumerators, with the aim of improving fisheries statistics on shark catches.







Appendix 2: Initial compilation of fisheries information for fish landing sites

Compiled by: C Proctor[2], R. Andamari[2], H. Umrony[3], and M. Anas[3]

1. Introduction

This report is a preliminary set of notes on the results of a survey of fisheries that was conducted as a Phase 1 activity for ACIAR Project FIS/2006/142: *Developing new assessment and policy frameworks for Indonesia's marine fisheries, including the control and management of Illegal, Unregulated and Unreported (IUU) Fishing*.

The principal report from this survey is not yet finished and in keeping with the request from the Steering Committee for a survey report that is as concise as possible, we have restricted these notes to the information we consider important to the Committee's task of deciding which fisheries are appropriate choices for Phase 2 focus. We gathered a considerable amount of information during the field activities, interviews, and from the reports provided by the various offices visited, but the synthesis of all that information into a short and 'easily digestible' document prior to Phase 2 fisheries selection workshop has proved too great a task in the time available. However, it is certainly our intention to complete the more comprehensive primary survey report, as it will be a useful reference document for Phase 2.

2. Survey objectives and methodology

The terms of reference for the survey, as understood by the survey team, were to gather as much information as possible (to complement that obtained through the rapid market sampling program) on key marine fisheries operating from, or based around, the 7 fishing ports that had been chosen as focus for Phase 1 of the project. The information was to enable a characterisation of the fisheries, including:

- Numbers and types of vessels, the types of fishing gears, numbers of fishers, areas of operation, fishing behaviours, and vessel ownership
- Estimates of catch (both current and past) for the key fisheries, and hopefully some measures of catch effort, degrees of seasonality, and catch trends across years
- As complete as possible understanding of factors underlying significant shifts in catch effort and/or average catch for key fisheries
- Identification of any significant IUU issues
- Descriptions of the ways catch is distributed from the ports; the various marketing routes, and the proportion of catch sold locally as compared to that exported to other regions within Indonesia or to international destinations
- Descriptions of fishing industries linked to the ports, and, where possible, measures of production - for large-scale processing companies, fish

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[3] *Directorate General of Capture Fisheries, Jakarta*

collection/distribution companies plants, and relevant smaller-scale processing plants
- A characterisation of the ports themselves, in terms of facilities, and including past, present, and planned developments
- An understanding of the roles of the various Government fisheries agencies and offices (national, provincial, regency, and district level offices, and port authorities) in past and current monitoring of the fisheries
- An understanding of the scale and activities of the various fishermens' associations and cooperatives active at each port
- An assessment of availability and extent of existing fisheries statistics for each region

The seven ports of primary focus were, from east to west, Tanjung Luar (southeast Lombok), Kedonganan (south Bali), Banyuwangi/Muncar (northeast Java), Pacitan (south coast, East Java). Sadeng (south coast, DI Yogyakarta Province), Cilacap (south coast, Central Java), and Palabuhanratu[3] (southwest coast, West Java).

The field component of the survey was conducted over two trips – Banyuwangi/Muncar, Cilacap, and Palabuhanratu were surveyed during 7 – 19 July 2008, and Kedonganan, Tanjung Luar, Pacitan and Sadeng were surveyed during 20 – 29 January 2009. During the course of the field investigations and interviews, it became clear that several additional ports and landing places needed to be surveyed to provide a more complete picture for some of the fisheries. The specific reasons for including these other places are covered below in the Sections on each region, but in general, their inclusion was because of obvious strong connections between fleets in neighbouring landing places, and/or strong linkages in the flow of catch between landing places. The information presented in these preliminary notes was largely obtained through:

- Observations made during investigation visits to the various ports and smaller landing places.
- Interviews with staff at the various levels of Government fisheries offices (national, provincial, regency, district), offices responsible for the management of the ports and landing places (port authorities), and offices of Inspection and Quality Control (*Laboratorium Pembinaan dan Pengujian Mutu Hasil Perikanan*)
- Fisheries statistics reports (monthly, quarterly, annual, miscellaneous) published by and/or provided by the aforementioned offices, and from other historical literature (including web-sourced information)
- Interviews with all levels of fisheries and industry – fishers (skippers and crew), vessel owners, vessel agents, and staff of fishing companies, large and small processing companies/plants, distribution plants, local fishermen's associations and cooperatives
- Accessing the existing knowledge of staff at Research Centre for Marine Fisheries, Research Institute of Marine Fisheries, Directorate General of Capture Fisheries, universities and other institutions and agencies

3. Information by port

Extensive information concerning the fisheries in each landing place was gathered during the field surveys and discussions and this is available in the form of trip report notes. Below, a brief summary of the data and information is presented in a tabulated format.

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[3] "Palabuhanratu" is the spelling used for this report, as this is the spelling used by the various fisheries offices and as it most commonly appears on signage in the city and around the port. Other forms encountered include "Pelabuhanratu", "Palabuhan Ratu", and "Pelabuhan Ratu".

Summary of some of the key fisheries surveyed at ports of focus (in order from East to West). Ports of primary focus highlighted in yellow. The other landing places were surveyed after it became obvious they had significant importance to fisheries at the primary ports. Prepared by Craig Proctor, CSIRO.

Province: Regency/ **Landing Place**	Fishery	Vessels (n)	Gears used	Catches/ Production	Products/ Markets/ Distribution	Catch trends/current stock status	Considerations with respect to choice as fishery for Phase 2 focus
Nusa Tenggara Barat:							
Kab. Lombok Timur/ **PPI Tanjung Luar**	Sharks and rays	97 (> 7 GT) 155 (5 GT)	drift longline (*rawai apung*) bottom longline (*rawai dasar*)	945 tonnes (year 2007 prod.data, not gear specific). Data for whole of Kab. Lombok Timur, Year 2006: 538 tonnes (not gear specific)	Shark oil, fins, cartilage products, teeth, skin, dried gills etc. Some produced by fishers then sold. Other produced by companies (Lombok based, but also outside ?) for international markets/buyers.	Many of the species are considered highly vulnerable to over-exploitation and there is strong evidence of very significant catch rate declines in some Indonesian waters during the past 3 decades (Blaber et al. 2009). Same true for waters fished by T. Luar fishers ? Historical catch data for T. Luar highly aggregated as "sharks" and "rays" and likely to be of little use in making an assessment for any species.	• Although monitoring and enumeration of catch at T.Luar is complicated because fish are brought in from outside areas, this is not an issue for the elasmobranchs, as all are caught by local vessels • Reasonably well defined fishery in terms of vessels and gears • Already a good body of data on species and size composition from earlier ACIAR projects • The project has project members with high level of expertise in elasmobranch IDs, hence well situated for training of enumerators • Current management of the fishery considered ineffectual by the Provincial Govt, hence very supportive of any move towards improvements. • IUU issues: The fishery is largely unregulated.
Kab. Lombok Timur/ **PPI Tanjung Luar**	Squid	239 (2 – 3 GT)	Encircling net using light as lure (Payang - *Jala oras*) + bycatch	264 - 461 tonnes (year 2007 prod.data, not gear specific, and some inconsistency between	80% consumed fresh, 20% processed at *pindangan* (boiled & salted). Some to local markets but also places outside of East Lombok e.g. Mataram.	During 1970s – 80s landings in excess of 1000 tonnes/yr. MSY estimated at 830 – 960 tonnes/ yr (Ghofar 1989). General consensus is that the stocks (multi-species) crashed from overfishing.	• Only a small vessel, primarily artisanal fishery, but previously a very important one for the East Lombok Regency • Apart from *Jala oras* there are several other net types and handlines used by T.Luar fishers, but as yet, it is unclear how much squid is caught by these 'others'. Aside from that, the fishery appears reasonably well defined • A good body of data and existing

			from other nets ?	provincial and regency data).			knowledge on the Alas Strait squid fishery e.g. Ghofar's PhD thesis (1989). Dr Ghofar has expressed his willingness to be involved in any future focus on this fishery • Provincial and Regency Fisheries have expressed a lot of interest in rejuvenating the squid fishery. • Complicated by there being at least 6 important squid species within the fishery. • IUU issues: The fishery is largely unregulated.
Kab. Lombok Timur/ **PPP** **Labuhan Lombok** (approx 75km from Mataram, and 40 km from Selong. Approx km to the north of Tanjung Luar).	Tuna	190 (5 – 10 GT)	Troll-line, handline (deepwater and surface). FAD based fishery. FADs southeast of Lombok, and others to north near Pulau Medang.	978 tonnes yellowfin. 1,176 tonnes skipjack (data prod. PPP Lab.lombok 2007) Max catch 3 – 4 tonnes/vessel, 7 – 13 day trips.	Two tuna processing companies close to the port: UD. Vercase (loin, sashimi, steak), export to USA, Europe, Jakarta. and UD Baura (fish processing prior to canning in Surabaya and Bali). Some of the tuna catch and bycatch to local markets.	Catch subject to many influences, including weather and fuel-price. (2008 landings 20% down on those of 2007 for these reasons). This is a developing fishery so difficult to make conclusions on catch trends. Unfortunately time did not allow visits to the two companies.	• Although well to the north of Tanjung Luar, this port was surveyed following comments from Provincial Fisheries office that this fishery was an important one for Lombok, and that facilities at the port were substantial (including ice factory and cold-storages). • A reasonably well defined fishery, but complicated by most of the vessels being from Sulawesi and just using Labuhan Lombok as a fishing base. • According to port staff, since 2008 there have been conflicts between the troll-line/handline vessels and purse-seine vessels fishing on the FADs, including cutting of nets and cutting of FAD lines. • At present a largely unregulated fishery • PPP Lab Lombok staff conduct daily enumeration of landings, with good separation of pelagic species (i.e. minimal aggregation).
Bali:							
Kab. Badung/ **Kedonganan**	Lemuru	330 *jukung*, 2 – 3 GT (for Kab. Badung	Drift gill-net	As yet unable to determine total landings for	Catch mostly distributed from Kedonganan to processing: *pindang* (boiled-	General consensus from all literature and from comments provided during interviews that Bali Strait lemuru fishery is over-fished.	• If the Bali Strait sardine (*Sardinella lemuru*) is chosen for Phase 2 focus, Kedonganan should be considered for inclusion as a monitoring site, because: - although the small jukung vessels (drift-

		2006) > 100 *slerek* from East Java during peak season	Purse-seine	Kedonganan only. 14,000 tonne listed for 2007 Bali Strait fishery landings in Bali. .	salted), fishmeal, frozen (for longline bait), canned. There are 6 canneries that are currently active (located in Jembrana Regency). International export and distribution to domestic markets.		net) fish in shallower waters, closer to shore, than the *slerek* from East Java, their cumulative catches from the shared stock are still substantial. - significant numbers of *slerek* from East Java land catches at Kedonganan during the peak season (east monsoon) • From all that was seen and heard at Kedonganan, current monitoring/recording practices of both Regency Fisheries Office and the KUD are not capturing the full extent of the landings. Many landings are bypassing the KUD catch weighing stations and go unrecorded. • Rapid market sampling may not have captured the full extent of the fishery here, as much of the lemuru activity happens late afternoon and evening (except during peak season when it can be all day). • Enumeration will need to be well planned to accommodate both vessel types and the highly seasonal characters of the fishery. • Strong support expressed by all those interviewed in Bali for improved management of the lemuru fishery, and considered by most a high priority.
Kab. Jembrana/ **Pengembangan**	Lemuru	143 vessels total: 50 *Slerek* from East Java, 15 - 20 GT	Purse-seine	13,096 tonnes (2007 prod data, PPP Peng.) Max. landings 300 tonne/day from 15 – 20 vessels.	As above	As above	• Further to first point above for Kedonganan, similarly, PPP Pengambengan should be considered for inclusion in monitoring for the Bali Strait lemuru fishery. • The landings are very substantial and a large proportion come from the East Java *slerek* vessels that land at this port. • From data obtained from the port authority office at Pengembangan, it appears they already have a good system of enumeration, providing daily records of catch by species (lemuru, layang, tongkol, and tembang) for each vessel. Therefore additional enumeration may not be necessary.

		and the rest are smaller 5 – 10 GT local vessels (info PPP Peng. and from interviews)					• The District of Negara (Regency of Jembrana) appears to be 'centre of canning' (6 active canneries) and fish meal plants for Bali, so this places even more importance on including this region if the lemuru fishery is chosen.
Kab. Badung/ **Kedonganan** And Kab. Badung/ **Jimbaran mangrove site**	Tuna	164 active vessels, 5 – 10 GT (info Bu Joice, staff DKP Kab. Badung at Kedonganan)	Troll-line/ handline. Fish on FADs southeast of Lombok.	No estimate yet possible for total landings/year Max. catch 3 tonne/trip. 40-50% YFT, remainder SKJ and bycatch	Smallest fish < 20kg to Kedonganan markets, and also to fish collection/distribution plants (*pengumpul*). Larger tunas (primarily YFT (av. 30 – 40 kg, but max 70 – 100kg) to processing companies in Benoa.	Comments from fishers interviewed suggest catch rate of smaller tunas (<20kg) has declined by as much as 50% during past 2 yrs. This they attribute to impact of purse-seine vessels around the FADs. All evidence suggests escalating catches of the large tuna caught by deepwater and surface handline. This is a fast growing fishery in Indonesia (see also below for Palabuhanratu).	• This fishery is included as an important one as it represents a fast growing area of tuna fisheries in Indonesia – the expansion of troll-line/handline fishing around FADs. This style of fishery originates from Sulawesi and many of the vessels involved are Sulawesi vessels that have based their operations in other areas (including Bali, Lombok, south coast Java, and Palabuhanratu). • The 'Jimbaran mangrove' landing site is not far from Kedonganan but on the east-facing side of the peninsula. The troll-line/handline vessels unload there during west monsoon season because the winds are too strong off Kedonganan. • The increasing amount of large tunas (primarily YFT) caught by handline around FADs is of concern to IOTC and WCPFC. At present these tunas are not covered by the monitoring at Benoa as they are not from longline vessels. • The conflicts between purse-seine vessels and the troll-line handline vessels on FADs appear to be a fast growing problem area. And the scale of purse-seine catches on the FADs is recognised as perhaps the biggest threat to tuna stocks. Choosing this fishery

							would hopefully enable a better understanding of both fisheries, and indirectly assist in addressing the 'purse-seine around FADs' issues.
Kab. Badung/ **Kedonganan**	Demersal reef species	?	Handline, gillnet	Many species. Rapid market sampling will provide good coverage of species comp. and amounts that pass through Kedonganan.	Majority are imports from other areas in Bali but also from far off (including Lombok, Madura, Kalimantan, Flores). Higher prices available, catering to the Bali tourist trade.	?	• Too many unknowns surrounding this 'fishery' to be considered as a choice for Phase 2 focus • Majority of demersal reef species are not landed by local fishers, but are 'imports' from other areas.
Jawa Timur (East Java):							
Kab. Banyuwangi/ **Muncar**	Lemuru	185 *slerek* (20 – 30 GT), 44 *payang* (10 – 15GT) 255 *jaring* (10 GT)	Purse-seine Payang net	~ 54,000 tonnes (data prod. PPP Muncar 2007)	Catch mostly distributed from PPP Muncar to processing: *pindang* (boiled-salted), fishmeal, frozen (for longline bait), canned. In Muncar District: 8 canneries, 30 fish meal plants, and 22 *pindangan* (boiled-salted fish) plants that are active.	As mentioned above for Kedonganan, the general consensus from all literature and from comments provided during interviews is that Bali Strait lemuru fishery is over-fished.	• Current enumeration/monitoring of the lemuru fishery in Muncar rests largely with one staff from office of PPP Muncar. He does daily recordings of catches through direct observations of unloadings, data obtained from TPI (fish auction place), and records made on trucks leaving the port precinct. It is unlikely this level of resources is providing adequate coverage of what is a large fishery. • It is likely the TPI data grossly under-represent the true level of landings (for example, iformation provided suggests all baskets are classed as 80kg, even though they contain 100 – 120kg of fish, i.e. special arrangement with fishers to limit *retribusi* payment)

			Gill-net		(info from PPP Muncar).		• A very large amount of literature has been written on this fishery. Perhaps the most studied fishery in Indonesian waters? A PhD thesis in prep by Ms Eny Buchary (currently based at Uni.British Columbia) is likely to be the most valuable recent resource of information for the project if lemuru fishery is chosen for Phase 2. Her study includes IUU and ineffective management aspects. Bu Eny has expressed an interest to be involved if there is future focus to improve management of the fishery. • The cooperative management agreement that exists between East Java and Bali provinces appears good in principle for placing limits on the size of respective fleets, but observations through this survey suggest the agreement is not being enforced by either province. • Strong support expressed by all those interviewed in Muncar and Banyuwangi for improved management of the lemuru fishery, and considered by most a high priority.
Kab. Banyuwangi/ **Pancer** (approx 80km southwest from Banyuwangi in Kec. Pesanggaran)	Lemuru	6 51 3 80 (data PPI Pancer 2007)	Purse-seine Gill-net Payang Drift gillnet	2,572 tonnes (data prod. Kab. Banyuwangi 2007 for Kec. Pesanggaran	Catch mostly distributed from PPI Pancer by truck to Muncar for processing: *pindang* (boiled-salted), fishmeal, frozen (for longline bait), canned.	As above	• Pancer is worthy of mention because from the scale of landings that we saw during our visit there suggest it is more important for the lemuru fishery than the available production data suggest • It is likely that in addition to local vessels, *slerek* based at Muncar also use Pancer for unloadings, when Pancer is closer to their current fishing grounds and/or when tide is very low in Muncar port. The vessels we observed unloading were some of the larger *slerek* from Muncar • If lemuru fishery is chosen for Phase 2 focus, some level of monitoring at Pancer may be advisable, at least for the first year.

Kab. Pacitan/ **Pacitan (PPP Tampernan)**	Lobster	109 "units" 3.260 "units" and 1500 fishers (totals for Kab. Pacitan 2006) 32 jukung vessels (that catch lobsters but other demersal spp also)	Gill-net Krendet (lobster ring-net) Nets (PPP Tampernan	45.09 tonnes in 2007 28.02 tonnes in 2008 Drop in catches from 2007 to 2008 attributed to lower effort in 2008 – less favourable weather/sea conditions during peak season (Oct and Nov)	Almost all catch sold to live to fish & lobster collection/distribution plants (pengumpul) in the village districts where lobsters are fished. Then live shipments from these plants to Surabaya and Jakarta and onto other places (including international – Hong Kong, Singapore).	Back in 1980's when lobster numbers were high were high, fishers could land 4 quintal (4 x 100kg) after 3 days fishing. Nowadays catches are much lower. General consensus among all interviewed that lobster populations have been overfished. Also consensus among fishers and fisheries staff alike that fishers from "outside" of Kab. Pacitan who use compressors and potassium cyanide have greatly contributed to the low lobster numbers. There have been incidences of compressor/potassium boats being burnt by irate net fishers. Existing regulations to prevent compressor/potassium fishing have proved ineffectual due to inadequate wording of the act. Too difficult to gain conviction as it does specifically mention compressors & potassium. DKP Kab. Pacitan are in process of preparing new regulations that can be enforced. Information on the scale of the compressor/potassium component of the fishery is scant, and in particular	• Although a largely artisanal catch fishery, the subsequent sale and distribution of the high value catch makes it a significant commercial fishery. • This fishery has some features that will make it a logistical challenge if chosen for Phase 2 focus: - In Kab. Pacitan lobsters are fished both from sea by boat (fibreglass jukung – gillnets and krendet) and by shore from the rocky cliffs (krendet fishers) to the east of Pacitan city. There are lobster fishers in all the village districts of Kecamatan Pringkuku, Sudimoro, Ngadirojo, Kebonagung, Tulakan and Pacitan. Hence adequate monitoring of the fishery probably will involve enumeration at these other village districts, in addition to the main landing port PPP Tampernan. It is not yet clear how easy it is to get to these villages, but if lobsters are being trucked out, it must be possible. Perhaps local enumerators can be recruited for each place. - Most lobster catch pass through TPIs (fish auction places), but some areas do not have TPI. In those cases they are sold direct to the *pengumpul* and most likely there is some proportion of the fishery not covered by current production estimations of DKP Kab. Pacitan. - The fishery includes six species of lobster – *Panulirus peniculatus, P. longipes, P. versicolor, P. polyphagus, P.homarus, and P. ornatus.* No information yet found or obtained on the proportion of each species in the fishery, either now or previously. The collector/distribution plants are the obvious, likely best source of such data. But perhaps there have been other studies ?

						information on where the compressor/potassium vessels are based.	• The day after our visit to office of DKP Kab. Pacitan there was a meeting in Yogyakarta between stakeholder groups (fishers, Govt agencies) from Kab. Pacitan and from Kab Gunungkidul to discuss the fishery and in particular the compressor/potassium issues. Improved management of this fishery is considered a very high priority by all. • No current size limits or closed season on egg-carrying lobsters
D.I. Yogyakarta:							
Kab. Gunungkidul/ **Sadeng**	Lobster	~ 100 *jukung*	Jaring lobster (gill-net) and jaring krendet (ring-net)	Total of 9.5 tonnes landed at 8 Districts of Gunungkidul) in 2008. Of that, 2.9 tonnes was landed at PPP Sadeng in 2008 (data provided by staff of DKP DI Yogyakarta)	As with lobsters in Pacitan, almost all catch sold to live to fish & lobster collection/distribution plants (*pengumpul*) in the village districts where lobsters are fished. Then live shipments from these plants to Surabaya and Jakarta and onto other places (including international – Hong Kong, Singapore). There are 2 *pengumpul* lobster in Sadeng. One is owned by Susie "Air" who is famous for establishing a lobster collection and export business for south coast Java. She is based in Pangandaran (west of Cilacap) but has	According to Pak Marjoko, staff at PPP Sadeng, back in the "early days" ~ 1997, lobster fishers were landing 0.5 tonne per day. Much less now. Most lobsters seen during the survey were small.	• Similar issues to those described above for lobster fishery in Pacitan. • Given the common elements of both Sadeng and Pacitan lobster fisheries and the relative close proximity of the two areas, it appears to make sense to include both in any Phase 2 focus. • This would be a good choice from point of view of developing inter-Provincial systems of co-management.

					collection/distribution plants in several other places including Sadeng.		
Jawa Tengah (Central Java):							
Kab. Cilacap/ **PPS Cilacap**	Tuna & Skipjack	-	Longline Drift gill-net	-	-	-	• Tunas and skipjack were initially included in this summary of fisheries because the scale of their landings (75.5% of total fish landings by volume at PPS Cilacap in 2007) makes them perhaps the most important fishery for the port and Regency. However, given that the tuna fisheries here are already largely (although not entirely) well covered by the IOTC monitoring program established in 2002, it is unlikely there is a pressing need for these fisheries to be chosen for Phase 2 focus.
Kab. Cilacap/ **PPS Cilacap**	Sharks & Rays	156 (10 -150 GT) 184 (10 – 100 GT) 15 (10 – 30 GT)	Longline Drift Gillnet Bottom gill-net	~ 14 different species of shark and 3 species of ray among catches of these gears at Cilacap. Volume of production for each is possible from data of PPS Cilacap but not yet calculated.	Much of the elasmobranch catch is processed locally in processing plants in Menganti district (2 processing plants, 4 *pengumpul* for elasmobranchs in total) - plants that process and deal in fins, skins, cartilage products, teeth, dried gills, liver oil, and meat (even the offal goes to catfish farms as feed). Products trucked to Jakarta for further distribution – domestic and international markets. Some of the	No comments provided in interviews that suggest any dramatic decline in the elasmobranch landings at Cilacap, but good species specific data of PPS Cilacap for past 8 years at least could provide clearer picture (not yet analysed by this survey). Indications of catch trends from earlier shark studies at Cilacap ? Note: Catches of sharks at Palabuhanratu dropped 50% from 2006 to 2007 and then another 50% 2007 to 2008 (info from PPN Palabuhanratu) –	• In common with tunas/skipjack fisheries (multi-fishery because of multi-gears), elasmobranchs are an important set of fisheries at Cilacap. • Current enumeration of the elasmobranchs (and other marine species) by PPS Cilacap staff is of high standard, with catch/landing records for individual species (no aggregation). This can be largely attributed to the high level of ID skills of primary enumerator Mr Joko Rianto. • No size data currently available from PPS Cilacap daily monitoring. • Based on the experiences of IOTC & RCCF during the tuna fisheries monitoring program of past 7 years at Cilacap it is likely the enumerator staff at PPS Cilacap would very amenable to an increased level of sampling of the elasmobranch landings, and there may be only need for recruiting one additional enumerator, if any, and further training on IDs to ensure corect

					elasmobranchs are sold for local consumption and includes smoked meat product.	attributed to "overfishing".	identifications.
Kab. Cilacap/ **PPS Cilacap** and Kab. Cilacap/ **Various beach landing sites**	Prawns/ shrimps	1035 (2 -3 GT) 270 (10 – 25GT) 150 (number of units for PPS Cilacap only, 2007)	Trammel-net (*jaring tiga lapis*) Shrimp gill-net *(jaring klitik)* Demersal danish seine (*arad*)	6 main species of prawn/shrimp landed at PPSC : *Metapenaeus dopsoni*, *M. endeavouri*, *Penaeus merguiensis* , *P. indicus*, *P. monodon*, *P. semisulcatus*. But many others landed at the other sites, including the small *rebon* shrimps (Hippolytidae and Palaemonidae). Species are grouped under	There are 6 landing places important for prawns/shrimp fishery in Kab. Cilacap: PPPS Cilacap (main port) + 5 beach landing sites, each with their own TPI (fish auction places) – Sidakaya, Rawajarit, Lengkong, Kemiran and Tegalkatilayu. Prawn auction occurs in the TPI at PPS Cilacap every afternoon (~1600 – 1900hrs). Auctions occur in the other places at various times depending on times of boats returning to shore. Many of the best quality prawns are purchased by company PT. Toxindo Prima (close to PPSC) for frozen export to Japan. 467 tonnes of	This survey has not had time as yet to do a trend analysis on the fishery nor conduct a literature review, but information provided in interviews does suggest stocks are at significantly lower level than previously. Much discussion and conjecture about whether the lower catches and fluctuations in catch are the result of environmental factors (e.g. degradation of mangroves in the Segara Anakan area) or from fishing pressures (or from both). Reports obtained from Segara Anakan Conservation and Development Project, authored by consultant Richard Dudley (2001 & 2003) give good coverage of this and suggests management options.	• This fishery is included because, although the prawn/shrimp fisheries combined only account for a small % of overall marine production in Kab. Cilacap, it is a high value fishery and one that involves a large number of vessels and large number of fishers in the Regency • A large proportion of the fishery is at an artisanal, small scale level, but the component of the catch of sufficient quality is of significant commercial importance. • Monitoring of this fishery would probably require enumeration at all the landing sites, but the distances from PPS Cilacap are not great. Current monitoring both inside and outside of PPSC relies on the records of auction at the various TPIs, but involves some aggregation of species and provides no size data. • If the project was interested in choosing a fishery, with strong links to environmental influences as a key management issue, this would probably be a good choice • It is not a well-defined fishery in that all the vessels that catch prawns/shrimps also carry other gears and fish opportunistically i.e. prawns and shrimps are not always the primary target. • On the negative side, Cilacap is not the easiest place to get to, and in recent times has carried some significant safety/security concerns for non-Indonesian project members.

				several local names: *Udang jerbung, U.dogol, U. tiger, U. barat, U. krosok, and U. rebon* Data available from DKP Kac. Cilacap for all landing sites and each grouping, but not yet analysed. Total prod. For 2007, all species = 1298 tonnes	frozen prawn export in 2007. Some prawns to Jakarta and other domestic markets. There are also processing plants for dried shrimp and much is used for terasi (*dried shrimp paste*).		
Jawa Barat (West Java):							
Kab. Sukabumi/ **PPN Palabuhanratu**	Tuna & Skipjack	33 active vessels (info from skipper/ owner)	Troll-line/ handline	Catch/trip 2 - 4 tonnes 912 tonnes SKJ, and 1,043	All fish are landed fresh (i.e. unfrozen). Most fish are auctioned at TPI. Grade A & B fish are sent to Jakarta. Grade C fish to local *pindangan* (boiled – salted).	A relatively new fishery (began in 2005) with many vessels from Sulawesi. Many of these vessels in current fleet are from there but more and more troll line/handline vessels are under construction in PPN Palabuhanratu – most wood but	• This fishery is similar to those described above for Labuhan Lombok and Kedonganan; FAD-based and involves combination of troll-line fishing for small tunas (YFT, BET, SKJ) and handline fishing (deep-water and surface/shallow) for large tunas (YFT >20kg) • Similar issues: - Minimal regulation of number of private

				tonnes YFT & BET landed in 2007 (data prod PPNP)	Some vessels do sell direct to buyers on the wharf. Some catch sold in local markets including those at PPNP.	some fibreglass. Difficult to get accurate number of FADs, but info from skipper/owners suggests 5 FADs currently used by fishers from Palabuhanratu (2 given through Govt assistance program and 3 privately owned). Their location ~ 8 – 9 deg S, 60 – 70nm from PPNP.	FADs installed - Provincial and Regency Govts providing assistance with some FADs donated to fishers, but little follow-up with management/regulation of FAD use - Conflicts with purse seine vessels from outside areas (inc. from as far away as Lampung and Sibolga, West Sumatra) using the FADs and taking very big catches (up to 70 tonnes/trip) - Conflicts with drift gill-net vessels whose nets become fouled on the FADs • Provincial and Regency Govts see this FAD fishery (which commenced ~2005) as a good one to promote as it is potentially high value and a more sustainable fishery (compared with purse-seine and gill-net) - higher quality fish, and potential for establishing filleting plants for the larger fish (with export to international and domestic markets), as is occurring elsewhere, particularly in eastern Indonesia. • Currently good enumeration of this fishery through team of 4 enumerators (+ team manager) at PPN Palabuhanratu (initiative of DGCF). However, no size measurements as yet. • Most tunas from this fishery are sold through auction at the TPI at PPN Palabuhanratu and most (but not all) landings occur at same time every day (morning, ~ 0800 - 0900hrs to 1200hrs). In theory it would be a relatively easy fishery to monitor to high level of detail. • Any system of management developed for this fishery should be readily transferable to the other similar FAD-based troll-line/handline fisheries elsewhere in Indonesia.

Kab. Sukabumi/ **PPN Palabuhanratu** and Kab. Sukabumi/ **Cisolok** (~13 km NE of Palabuhanratu)	Layur (hairtail, *Trichiurus sp.*)	> 350 vessels (perahu/ jukung) (< 5GT)	Handline (*pancing ulur*)	Layur are caught by many gears, but majority by handline – handline (240.9 tonnes), pelagic danish seine (1.9 tones), bagan (3.4 tonnes). PPN Data prod. 2007 – but just fish landed at PPNP.	A large proportion of layur landed at PPN Palabuhanratu (and at other landing sites such as Cisolok) goes to company PT. AGB, located in the port precinct. This company deals in frozen fish and layur is their main product. Export to Korea and China after trucked to Jakarta. 150 tonne/month (5 – 12 tonne processed/day). Began operations in 2005. Layur fishery highly seasonal. No fish landed during May – July. The company does not own vessels but uses system of *mitra kolaborasi* with local fishers.	Production statistics from PPN Palabuhanratu show a lot of fluctuation across years 1993 – 2007. Range 9.6 – 304.0 tonnes. 247 tonnes in 2007 is similar to levels of late 1990s, with some low prod. years in between 2000 – 2003. Interestingly, no major escalation in landings after 2005 with establishment of company PT. AGB.	• A reasonably well defined fishery dominated by one gear type • Highly seasonal • Not yet sure of level of knowledge of the *Trichiurus* sp. Biology. Earlier studies / • No person interviewed appeared to have strong ideas on what causes the major fluctuations in catch across years (although last 3 yrs fairly stable based on prod. statistics). No opportunity as yet to examine levels of effort. • A significant amount of layur is landed at Cisolok (~13km from Palabuhanratu) most of which goes to company PT. AGB. 7 tonnes were sent from Cisolok to the company the day prior to our visit. • The marketing manager of PT AGB, Mr Agus, was very approachable and provided good information and a tour of their factory. We sensed that if this fishery was chosen for Phase 2 focus, the level of cooperation for enumeration at this company (if required) would be high. • We were told of strong outside interest for establishment of more such companies in Palabuhanratu.
Kab. Sukabumi/ **PPN Palabuhanratu**	Bagan lift-net fishery. Mixed species	246 bagans (2007 data PPNP) but not clear how many of each type, and what the	Lift-net. Two types 1. *Bagan apung* – a 'fixed' bagan that is supported by floats (plastic drums) and 2. *bagan*	Mixed catch of mainly small pelagics. Species ?? anchovies, scads, sardines. Total of 1150 tonnes	One collector/carrier vessel can service up to 20 bagans. Catch unloaded direct to wharves at PPNP, and some sold fresh in the fish markets in the port precinct. In Cibangbang, bagan	No bagan fishery in Palabuhanratu prior to 1992. Yet to obtain time series data for bagan catches from either PPNP reports or from DKP Kab. Sukabumi. In hindsight, we should have asked more Qs about this fishery in interviews.	• This is one fishery that our survey did not cover as well as should have • It is included here, primarily because staff at PPNP told us that attempts had been made by Govt to close down the bagan fishery, over concerns of overfishing of juvenile fish stocks. However, we have yet to find out the extent of the regulations/laws and the strategy for their enforcement. The fishery appears to be alive and well, with hundreds of bagans in the Palabuhanratu region but also many in other areas such as Cibangbang further along the coast from Cisolok.

		boundaries of the bagan fishing area are. 21 collector/carrier vessels that service the bagans.	*perahu* – the type constructed around a vessel .i.e. non-anchored	landed at PPNP from bagans in 2007 (data PPNP)	catches are boiled in salted water then dried on racks in the sun.		