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Improving sustainability and profitability of village sea cucumber fisheries in Solomon Islands

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Contents

1 Acknowledgments

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2 Executive summary

More than 75% of the population of Solomon Islands derive most of their basic needs from subsistence fishing and agriculture. As threats to the viability of small-scale fisheries increase, implementation of reactive resource management that can respond to changing resource status and community needs becomes critical. The bêche-de-mer fishery is potentially a multi-million dollar industry in Solomon Islands, however persistent overfishing has put the fishery in real danger of collapse. Initially the objectives of this project were to work with coastal communities in Solomon Islands to assist them to (1) manage their sea cucumber resources sustainably while (2) gaining better returns for their bêche-de-mer product. Six months after the project began a national ban on the collection and export of bêche-de-mer was implemented by the Solomon Islands government. It was therefore necessary to re-cast the project in consultation with stakeholders to increase the emphasis on (1) rather than (2) and on working with the community to assist them to deal with the sudden inability to utilise this important resource.

From 2005 to 2008 WorldFish worked with communities in Kia District (Santa Isabel Island, Isabel Province) and Jorio (Vella Lavella Island, Western Province) to establish community-based management plans for sea cucumber. At the request of the community, the plans were broadened to cover all marine resources. At the community level the project included a participatory process of household interviews and focal group discussions to facilitate the development of a management plan. Beginning in Kia community, the project expanded in 2007 to include all of Kia district and led to the establishment of a marine managed area covering approximately 450 km^2. The management plan was officially launched in Kia on 23 May 2008 setting a time-mark from when lessons will be learned from monitoring and compliance with the management plan, and applied with adaptive management. The suite of indicators is now open to testing through the implementation of the plan and the durability and outcomes from the plan over the coming years will be the ultimate test of the effectiveness of the process taken to get to this stage. Through a similar participatory process a management plan for an area of 170 km^2 of the Jorio region was implemented from September 2008. Responsibilities for administration, enforcement and penalties now rest with the communities through their own governance structures. Community technical teams have been trained in simple techniques for reef surveys of benthic invertebrates. While the methodology has purposely been kept as low-cost as possible, and the technical component of surveying can be conducted by the teams independently, the distance of some monitoring sites requires a boat with an outboard motor and therefore fuel. WorldFish continues to assist the teams with data interpretation and in seeking funds to sustain monitoring activities into the future.

In mid 2008 representatives from both Kia and Jorio (along with representatives from related projects in other parts of the country) attended the first community workshop for coastal fisheries held by the Solomon Islands Ministry of Fisheries and Marine Resources. This watershed workshop had the goal of 'netting community knowledge' to better ensure coastal community participation in Solomon Islands inshore and coastal fisheries management. It was an important start to recognising and ultimately implementing the work of communities such as Kia and Jorio, in fisheries legislation and policy.

This project was a critical case-study in a much broader reanalysis of approaches to small-scale fishery management in the developing world. Many of the concepts needed for practical management of such data-sparse fisheries, and ways of communicating them to participants in the fishery, were developed and tested within the project and are now being further refined through a new ACIAR-funded project that has developed from the experiences gained. Consistent with the WorldFish Center strategy and Medium Term Plan ACIAR project FIS/2007/116 '*Improving resilience and adaptive capacity of fisheries-dependent communities in Solomon Islands'* addresses broader resilience questions for small-scale fisheries.

3 Background

Sea cucumber fisheries are, in many parts of Solomon Islands and elsewhere in the Pacific, an important source of income to coastal communities. At the time this project was conceived in 2003, the bêche-de-mer fishery was a multi-million dollar industry in Solomon Islands, and in terms of marine resources in the late 1990s, it followed tuna, trochus and other gastropods as the most significant commercial export (Sulu et al., 2000).

At the province level in Solomon Islands the dependence on marine resources (including sea cucumbers) is substantial; for example, in the island of Santa Isabel, 76% of all households take fish for subsistence, and 59% take shellfish. Thirty-one percent of household's trade in fish, 7% in shellfish, and in the absence of export bans, 17% market bêche-de-mer (Solomon Islands Government Census, 1999). The bêche-de-mer fishery in Solomon Islands has a direct impact on the sociological and economic well-being of communities by providing income where alternatives are limited. The diffuse, village-level nature of the bêche-de-mer fishery means that the financial benefits are widely distributed amongst coastal villages and provide immediate and direct benefit (Kinch, 2004).

In stark contrast to other commodities upon which rural, coastal communities rely for income (e.g. trochus, copra), in recent years the export price of sea cucumbers from Solomon Islands has continued to increase. For example, in 2004, top grade white teatfish (*Holothuria nobilis*) was being exported from Solomon Islands to China for AU$50 per kg of dried product, far higher that its value of AU$6 per kg in 1991 (Kinch, 2004). Increasing affluence in China largely drove strengthened demanded for bêche-de-mer. Although aquaculture production and sea ranching of the temperate species *Apostichopus japonicus* has boomed in China over the past decade, demand for tropical sea cucumbers has also continued as consumers in southern China prefer the tropical species.

These economic circumstances had prevailed since the late 1980s, leading to greatly increased sea cucumber harvesting. Annual exports of sea cucumber in Solomon Islands peaked in the early 1990s to exceed 600 tonnes (dried weight) and were valued at SBD $7-$10 million dollars annually (Vannuccini, 2003; Kinch, 2006). Since that time exports have generally been less than 400 tonnes (Kinch, 2006) but at times of economic downturn, sea cucumber fishing has remained a vital source of income when other sources failed (Ramofafia, 2004). The economic and social problems caused by a collapse in marine resources, particularly sea cucumber stocks, had been predicted to be considerable (Kinch 2004). Although not of high value in comparison with the country's offshore tuna fishery, the industry remains largely in the hands of villagers, and the potential social benefits to numerous low-income coastal communities are many.

The status of coastal land and in-shore marine tenure in Solomon Islands is central to sustainable resource management because ownership largely determines where authority for resource management resides. Legally and constitutionally natural resources are vested in the people of the Solomon Islands and their government (IWP, 2003) and the Solomon Islands' Constitution recognises the traditional system that operates alongside modern administrative arrangements, stating that "local clan groups led by chiefs hold land and sea areas under customary tenure and are able to control rights of access, use and development of resources" (Hunnam et al., 2001).

Civil strife in Solomon Islands from 1998 to 2000, and the resulting economic hardship in the country, left small-scale fishery (SSF) resources extremely vulnerable to unsustainable and destructive exploitation. A marked weakness in the government's capacity to formulate and implement the necessary polices to protect resources suggested that customary marine tenure (CMT) was likely to be a better tool for managing resources such as sea cucumber (Ramofafia et al., 2004). In order to work within CMT institutions it is important to recognise that different forms of CMT exist in Solomon Islands, and that growth in population and consumption affects CMT institutions in

different ways (Aswani, 1997, 2002; Hviding, 1989). Traditional management has in the past ranged from bans on the collection of certain species to closed areas or seasons, and gear restrictions. Management decisions are usually dependent on the resource owners' judgment, rather than on any quantitative information (Kinch, 2004) and are not always well adapted to the high levels of pressure now being exerted on some commodities (Foale, 1998). Although local ecological knowledge about marine fauna is often extensive, there are subject areas where knowledge appears to be lacking, and these typically include parameters related to yield and recruitment, such as growth, natural mortality, lifespan and reproductive ecology (Foale, 1998). Accordingly the relationship between dwindling stock densities and recruitment failure is often not recognised by fishers and leaders.

By early in the new millennium it was becoming clear that many Solomon Island communities had over-fished their sea cucumbers, effectively removing one of their few opportunities to earn cash. Evidence came from several sources. First, there was an increasing trend throughout the country to fish for low-value species, which were previously not harvested; the proportion of lesser-value species in the annual harvests increased greatly between 1991 and 2004 (Adams et al., 1992; Holland, 1994; Ramofafia, 2004). Second, total catches had declined considerably since the peak catches of 1992 (Sulu et al., 2000; Ramofafia, 2004). Third, there was ample anecdotal evidence from both fishers and buyers (Kinch, 2004) that catch rates had declined in many areas. Fourth, the number of bêche-de-mer export licences issued declined from 23 in 2003 to 17 in 2004, and the principal reason cited was that export volumes were declining (Ramofafia, 2004).

The genesis of this project was an invitation in late 2003 by ACIAR to the WorldFish Center to prepare a research proposal for a project that would provide benefits to coastal communities in Solomon Islands in the immediate to short-term. By 2004, it was clear that there was an urgent need for effective management of the sea cucumber fishery in Solomon Islands, but there were no national regulations or guidelines in place to safeguard the fishery. An earlier ban on fishing for sandfish (*Holothuria scabra*) was repealed in 2000. Within eight months of this project beginning (1 December 2005) concerns for the fishery led to a national ban on the collection and export of sea cucumber being imposed by the Solomon Islands government. Subsequently the ban was temporarily lifted following the April 2007 earthquake and tsunami that struck Western Province, Solomon Islands to assist affected people in obtaining much needed cash. On 1 April 2008 the ban was reinstated. That situation remains as of March 2009, although in early 2009 some confusion around the legal status of the ban meant that there was, for a period, some fishing and trading occurring in some places. Accordingly the context that was driving the initiation of this project changed considerably after the project started.

This project began in April 2005 and ran through to 31 May 2008. The initial broad objectives were to: introduce sound, community-based management[1] of the sea cucumber fishery, working in collaboration with the national Department (now Ministry) of Fisheries and Marine Resources and the Provincial governments, and; improve incomes to the fishers for the bêche-de-mer that they produce.

At the Secretariat of the Pacific Community (SPC) Coastal Fisheries Management Workshop (Fiji, March 2003), and at the Third Heads of Fisheries meeting (Noumea, August 2003) heads of fisheries agencies of Pacific Island Countries and Territories emphasised the need for reform of fisheries management systems to ensure coastal resource sustainability. In an external review in 2003 of the SPC Coastal Fisheries Management Program, it was recommended that more attention should be focused on

[1] *This project proposed to use Community Based Management which was interpreted as working in the communities and in partnership with the communities to provide benefits directly to the communities. Community Based Adaptive Management is the term that has been adopted for subsequent work by WorldFish in Solomon Islands.*

"providing fisheries management assistance, including building capacity, providing advice on national strategies, mentoring, and producing technical information understandable at the level at which most management interventions are formulated and implemented". This project built on that mandate, and recognised that the impact of a reduction in income caused by ceasing (or reducing) sea cucumber harvests will be less for communities if offset by income from other sources. For this reason, the project was to be initiated in communities where alternative income sources existed or were being developed. Linkages between this project and agencies such as the United Nations Development Program (UNDP), who at the time the project started were funding the Isabel Province Development Project, were anticipated to provide the administrative framework and knowledge base for developing new sustainable livelihood projects.

This project was closely aligned with the ACIAR indicative research priorities for fisheries developed at the ACIAR Pacific Consultation meeting in Suva in December 2003 [http://www.aciar.gov.au/web.nsf/doc/ACIA-5KX5MW/]. This project also complemented an ACIAR-funded project on sea cucumbers: "Optimal release strategies for restocking and stock enhancement of the tropical sea cucumber, sandfish (*Holothuria scabra*)", (ACIAR project FIS/99/25), the overall objective of which was to develop methods for rebuilding overfished sea cucumber stocks by releasing hatchery-reared juveniles into natural habitat where populations have been depleted. The project was directly aligned with one of the principal WorldFish Center priority programmes at the time that the proposal was conceived: "Restoration of capture fisheries".

4 Objectives

The broad objectives as stated in the project design document were sound, community-based management of the sea cucumber fishery, working in collaboration with the national Department (now Ministry) of Fisheries and Marine Resources and the provincial governments; and better incomes to the fishers for the bêche-de-mer that they produce. The objectives were intended to be achieved by two sets of activities.

Objective 1: To work with selected communities to develop sustainable, community-based sea cucumber fisheries and produce high-quality bêche-de-mer

The activities that were planned to achieve this objective were:

- Describe the social, cultural and economic conditions within which the sea cucumber fishery operates
- Describe the sea cucumber fishery and how it operates in targeted communities
- Describe the Customary Marine Tenure (CMT) systems operating in the target communities
- Assess the status of the sea cucumber resource in selected areas
- Assist the communities to develop a management plan for the sea cucumber fishery of each target community, using biological controls (e.g., minimum size limits set with reference to size at onset of sexual maturity) and harvest controls (limits on quantities of sea cucumber caught, fishing seasons and/or fishing locations)
- Assist in the dissemination and extension of the results of this project to other communities
- Train local people in the elements of conducting resource surveys, and initiate a simple system of stock monitoring to be used by the target communities.

Objective 2: To assist communities obtain improved returns for their bêche-de-mer product

The activities that were planned to achieve this objective were:

- Run sea cucumber processing workshops, and training, to demonstrate methods to produce high-quality bêche-de-mer that meets buyer needs
- Disseminate available material on sea cucumber processing (SPC/ACIAR-produced sea cucumber and bêche-de-mer identification cards; video tapes)
- Assist communities to develop a communication network with processors and other fishers to become better informed of fair prices for sea cucumber and bêche-de-mer.

5 Methodology

The project field work was carried out by a WorldFish Center team based at Nusa Tupe, Gizo, Western Province, Solomon Islands. Led by Dr Warwick Nash from WorldFish Pacific Regional Office in Noumea, the in-country team was led by Dr Chris Ramofafia, supported by a technical team of Solomon Islands national staff (school leavers). In the latter stages the team was assisted by a New Zealand volunteer scientist (Dr Anne-Maree Schwarz) and by a Solomon Islands graduate (Ms Delvene Boso).

5.1 Site selection

The project design allowed for pre-agreed criteria to assist in the selection of project sites. These were:

1. Strong village leadership/governance
2. Reef areas free from tenure conflicts
3. Strong indication of interest, willingness and cooperation
4. Presence of commercially important sea cucumber populations on target reefs
5. Relatively accessible site and easy means of transport
6. Alternative livelihoods available for villagers to turn to from sea cucumber fishing; or projects of this sort under development
7. NGOs with good track record active in this area/these villages now.

Expressions of interest were requested from communities via the Solomon Islands public radio broadcast and using the Gizo town noticeboard. The rationale for specific site selection is elaborated on in section 6. The project worked primarily in two locations; Kia on Isabel in Isabel Province and Jorio on Vella Lavella in Western Province (Figure 1).

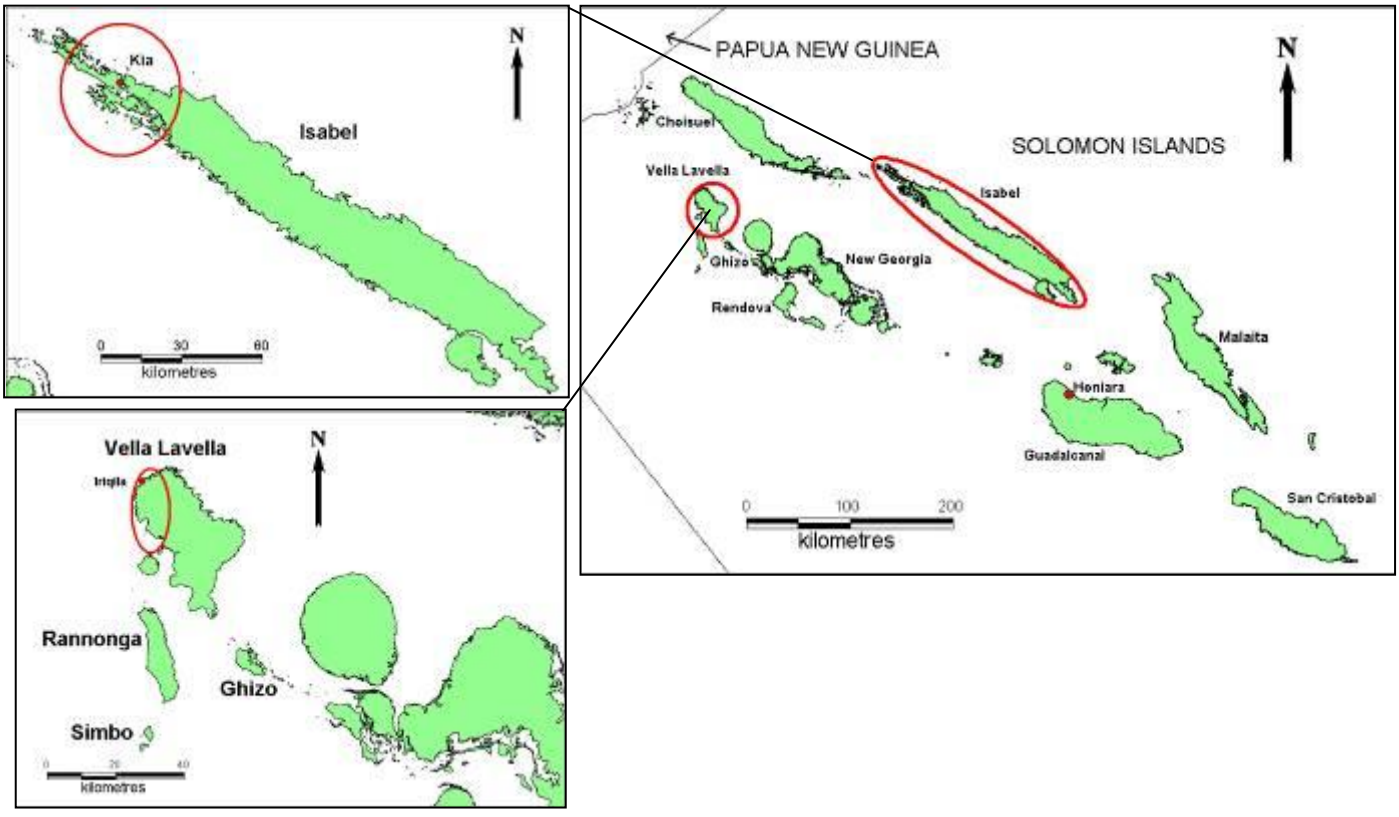

Figure 1: Map of Solomon Islands showing the location of Kia District on Isabel Island and the Jorio region of Vella Lavella Island.

5.2 Broad methodological approach

5.2.1 Management approaches

There is general agreement that commonly adopted approaches to managing small-scale fisheries (SSFs) in developing countries have been less effective than they need to be to ensure sustainability (Garcia and Grainger, 1997; Mahon, 1997; Cochrane, 2000; Welcomme, 2001; FAO, 2003; Cochrane and Doulman, 2005). Given the importance of SSFs in the social and economic fabric of many least developed countries, it is essential that new management approaches are developed and adopted. This is complicated because SSFs present particular challenges to managers in terms of their diversity and complexity (Jentoft, 2006; 2007).

Almost all countries have laws and policies that articulate the broad objectives of their fisheries sector. The approach taken to managing a fishery will largely be driven by these policies and laws, but will also be influenced by international conventions, global goals such as the Millennium Development Goals, and international and regional collaborative agreements. Conventionally, most fisheries seek to maximise production over the long term. Most often this refers to fish catch, but it is sometimes phrased in terms of employment or other societal benefits. The fact that these objectives are increasingly being adjusted to accommodate principles of democracy, human rights, decentralisation, integration, empowerment, accountability and adaptability, among many others, is causing authorities to rethink their goals.

The search for innovation in SSF management is not impeded by a lack of raw material: fishery managers face an overwhelming range of approaches, frameworks, perspectives and methods for analysing fisheries and 'doing' management. Over the last three years, WorldFish has worked with partners to take a fresh look at the tools already available and synthesizing them into a coherent scheme that joins management with innovations in research. In general, the focus of fisheries research and management is shifting along the spectrum from the conventional view that sees threats and solutions as primarily coming from within the domain of the fishery to others that also consider external disturbance and uncertainty, and wider governance dynamics. Effective management requires a range of perspectives and the inclusion of different actors in the management process, as well as better engagement in wider governance within society.

This project is set within two broad approaches to fisheries management: The Ecosystem Approach to Fisheries (EAF) and right-based and co-management approaches. Ecology has been part of fisheries research for a very long time but explicit inclusion of ecological objectives in state-based fisheries management is a more recent phenomenon that is gaining considerable momentum. The ecosystem approach to fisheries (EAF) seeks to balance societal and economic objectives with a natural sciences approach (Murawski, 2000; Browman and Stergiou, 2004; 2005; Arkema et al., 2006).

On the global stage, FAO has led the institutional drive to reform fisheries management by promoting and mainstreaming the EAF (e.g., FAO, 1995; 2003; see proceedings from the Reykjavik conference summarised in Sinclair and Valdimarsson, 2003). The EAF is now incorporated into many international conventions, including Agenda 21, the Rio declaration and the Biodiversity treaty (CBD) (www.fao.org). While law and policy often lag a long way behind conceptual advances (Lugten and Andrew, 2008), the EAF and the associated Code of Conduct for Responsible Fisheries (FAO, 1995), because they are championed by the FAO, have considerable legal and policy status in many jurisdictions and are now enshrined in the national laws of many countries. As a consequence, the EAF provides the most appropriate overarching approach to SSF management in the developing world. As defined by FAO (2003), the EAF:

> *"… strives to balance diverse societal objectives, by taking account of the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries."*

The aspirations included in this definition are unarguable and sufficiently broad to be reinterpreted as advances in research and methods, however there is still much to be done to make it a reality on the ground, particularly in developing countries (Garcia and Cochrane, 2005; Christie et al., 2007; Garcia et al., 2008; De Young et al., 2008).

Interpretation and operationalisation of the EAF as a practical management approach for SSFs in the developing world remain the central challenge for improved fisheries in these countries.Although the EAF provides a sufficiently broad policy umbrella within which advances in research and management can be tested and refined we suggest that progress is hampered by, among other things, the absence of an integrative research tradition that can deliver the necessary assessment of a fishery and the appropriate advice to achieve the EAF ambitions.

Another class of management approaches, the rights-based approaches (such as co-management and community-based management), is less explicit about the objective of sustainability and more concerned with the allocation of rights and responsibilities. Work on common property rights re-established communities as viable stewards of shared resources (e.g. Ostrom, 1990), while work in cultural and political ecology emphasised the right of communities and local people to be involved in managing themselves and their resources (Degnbol et al., 2006). Consequently, there has been a proliferation of participatory and collaborative management forms (e.g., Wilson et al., 2003; Pomeroy and Rivera-Guieb, 2006).

As they are defined and interpreted in a variety of ways, co-management and community-based management are evolving, conceptually, into relatively complex ideas. Collaborative management, in its simplest form, refers to management processes that include various entities in decision-making, usually resulting in a partnership between state and resource-users, but also cooperation with other stakeholders and independent organisations (NGOs and research organisations) (Pomeroy and Berkes, 1997; Pomeroy and Rivera-Guieb, 2006). However, co-management and its derivatives also aspire to embody a number of principles of 'good' governance, including democracy, transparency, accountability and sustainability (Wilson et al., 2003). These principles are necessary to ensure that co-management confers the responsibility to share power, knowledge and capacity, as well as to assign tasks.

This project aimed to contribute to research that continues to examine the conditions suitable for effective communal management of resources (e.g., Agrawal, 2001; 2003), which is proving relatively elusive in practice (Wells and McShane, 2004; Plummer and Armitage, 2007). Property rights and broader access rights continue to be integral to how co-management and community-based management manifest in practice.

5.2.2 Management for resilience

The notion of resilience has risen to prominence in the academic literature on natural resource management in the last decade. Concepts gathered under the 'resilience' banner are characterised by a focus on non-linear change, unpredictability, thresholds, adaptive management, transformation, institutional learning, and vulnerability and adaptation to external drivers (Carpenter et al., 2001; Walker et al., 2002; 2004; Folke, 2006; Folke et al., 2004; Pikitch et al., 2004). Fishing communities in Solomon Islands and other coastal areas are vulnerable to the compounding effects of stresses within fishery systems, as well as to external ecological and social forces that are outside their ability to influence. Vulnerability to such forces was starkly illustrated by two significant and potentially catastrophic shocks to the communities in this project: 1) in the early phase of the project the announcement and eventual implementation of a national ban on bêche-de-mer collection and export and 2) the earthquake and tsunami that struck Jorio, Vella

Lavella in April 2007. Both of these had significant impacts on the community's perception and approach to resource utilisation and management (Schwarz et al., 2007, Ramofafia et al., 2008). Building the adaptive capacity of ecosystems and of people to be resilient to such external shocks is critical to realising the conservation, social and economic potential of SSFs in the developing world.

When integrated within the EAF's overarching legal and policy environment, resilience approaches have the potential to profoundly improve SSF management. However, while resilience has become a powerful metaphor for sustainability, advances in theory have yet to be translated into more resilient aquatic ecosystems or better lives for poor fishery-dependent people in developing countries (Carpenter et al., 2001; 2005). The real challenge is to build bridges between the rapid advances in research and analysis and the real-world legal, policy and organisational constraints of SSF management, particularly in developing country contexts. Poverty and vulnerability, dynamic non-equilibrial ecosystems, and limited capacity and data combine to make this challenge the most important frontier for SSF research.

This project played a critical role in developing WorldFish's methodological approach to resilience-based management and laid the foundation for the follow-on project on resilience in Solomon Island fisheries (ACIAR Project FIS/2007/116). In this report we do not, however, place the project in an explicit resilience framework because that is better developed as part of Project FIS/2007/116.

5.2.3 Implementation framework

Beneath the conceptual approach to managing a fishery, the framework used to implement management provides another level of organisation. In particular, it describes relationships among elements of the research and management problem and suggests an order for doing things. Fisheries implementation frameworks may include many elements that, though overlapping, are distinct phases in the process. Common elements include, for example, scoping, assessment, (adaptive) management, and monitoring and evaluation.

Growing out of experiences in this project, Andrew et al. (2007) proposed an implementation framework that specifically addresses the challenges presented by SSFs in the least developed countries. The management plans and indicators developed for Kia and Jorio villages are the first to be developed using this framework and associated concepts. The PDAM (Participatory Diagnosis Adaptive Management) framework as it has been named is a flexible framework that provides the minimum set of elements required to address the relationship between research and management. It places emphasis on: (i) the broader non-fisheries sector drivers of fisheries management performance and the opportunities and threats they present to people's livelihoods, and (ii) the institutions that govern fisheries, particularly the nature and legitimacy of use rights as a central requirement for effective management (Figure 2). Underpinning this framework is the need to define the fishery and, therefore, make a judgment whether processes controlling the status of the fishery are within the fishery (and directly under the influence of an agreed set of stakeholders; e.g. overfishing) or external to it and therefore not under the direct influence of identified participants in the fishery (e.g. climate change). Management should seek to make the fishery less vulnerable to those external drivers.

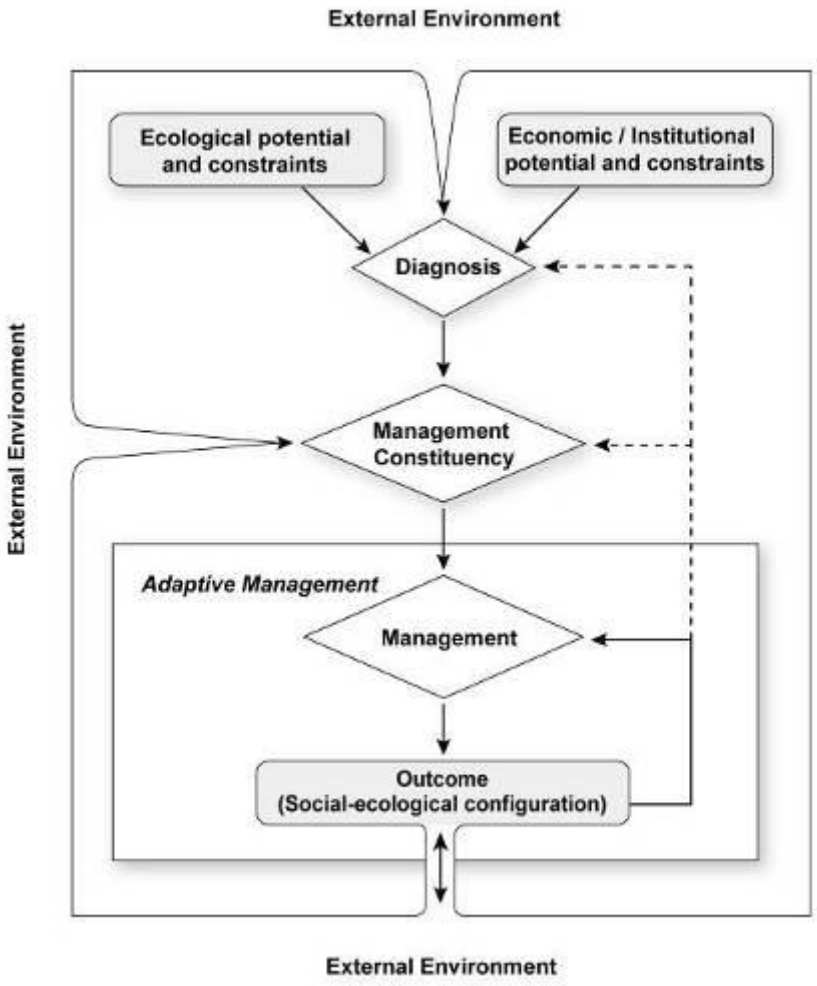

Figure 2: A general framework for diagnosis and management of SSFs in the developing world (Andrew et al., 2007).

This framework attempts to integrate assessment and advice into the management implementation cycle of the fishery. Following others (e.g., Walters and Hilborn, 1978, Charles, 2001; Arthur and Garaway, 2004; Armitage et al., 2009), Andrew et al.(2007) advocate an adaptive management process as the most promising way to learn about the responses of the fishery system to drivers of change and the PDAM framework provides various phases of learning.

5.2.4 Diagnosis and management constituency

Consistent with the approach put forward in the PDAM framework, this project had elements of scoping and assessment which we describe as the 'diagnosis' phase (Figure 2), achieved through household and fishers questionnaires, biological surveys, community meetings and focal group discussions (FGDs).

This approach enabled the management constituency to be defined (e.g. the stakeholders, those with decision-making power, those with the ability to enforce) and issues related to the fishery to be identified. Once issues were identified and prioritised, discussions on the selection and implementation of management measures were able to begin with the relevant actors. This was achieved through a consultative and participatory approach in the community over a number of visits. Relevant training in the community provided by the WorldFish team included participatory community management using

techniques learnt in an Inclusive Community Programme (ICP)[2] Leadership Training workshop attended by the project team in 2005, and awareness and education on biological aspects of target resources and habitats.

5.2.5 Performance indicators

Developing performance indicators is classified in the PDAM framework as the third phase of learning, which occurs once diagnosis and management constituency phases are complete. In the communities participating in this project, the participants in the fishery were identified at an early stage and so the process of moving from identification of issues to management objectives was accelerated.

Performance indicators have to be subservient to the broader objectives of the fishery and directly linked to them so progress can be tracked and management changed as necessary. Sustainability indicators for fisheries management have been used for many years (e.g. Caddy 1999; Garcia and Staples 2000; FAO 2002; Degnbol and Jarre 2004) and come in a range of forms. Indicators are needed because a predictive understanding of the dynamics of the fishery systems is rarely possible, nor the pursuit of such an understanding as a precursor to management desirable. As stated by Garcia and Staples (2000:400):

> *"Indicators are needed to simplify, quantify and communicate information, to structure and standardize reporting, and to facilitate integration of economic and social dimensions. They assist decision-making in problem identification, objective setting, identification of gaps in research and data, monitoring, and performance assessment".*

The frameworks to develop indicators to track management performance are essentially the same as those listed above for issue identification and prioritisation. Indicators that are derived without reference to broader theory or those drawn only from knowledge that is outside the experience of those affected by decisions and rules are unlikely to survive long enough to be useful (Freebairn and King 2003; Fraser et al. 2006).

Information used to develop indicators was elicited from the outcomes of the diagnosis phase (household and fishers questionnaires, biological surveys, community meetings and FGD's.

5.2.6 A simple dashboard to facilitate communication

Dashboards have been used in a variety of natural resource management contexts, including fisheries (OECD 1993, Garcia and Staples 2001, Johannes and Hickey 2002, Caddy 2004, Clua et al. 2005, Rice and Rochet 2005). As part of this project a simple dashboard was developed to facilitate discussion with and within fishing communities, and to allow indicators from different dimensions of the fishery to be integrated onto a single graphic (Figure 3).

The essential features of the dashboard are:

- The 'columns' represent indicators of fishery state or management performance. There may be any number of indicators but experience suggests that fewer is better. Importantly, however they need to be spread across a range of domains of the fishery, including people and livelihoods, external drivers, natural systems, and governances and institutions (Garcia et al. 2008).
- The 'rows' of the dashboard represent the three configurations outlined above: viable, unsafe and crisis, with two thresholds dividing the three states.

[2] ICP was an AusAID funded programme implemented by the Church of Melanesia. Training was organised by Solomon Islands Locally Managed Marine Area (SILMMA) network.

- In this simplest form, management performance is judged by whether each indicator of system configuration has got better (↑), worse (↓), or was about the same as last time it was assessed (≈). If no further information has been collected then the current status with respect to previous assessments is unknown (?).
- For each indicator, participatory methods are used to agree on thresholds between the three states. The most important of these thresholds, below which the fishery slips into crisis, is arguably the most difficult to recognise.

This simple dashboard provides a basis for developing more complex management, but even in this simplest form it is consistent with theory in that: (i) it recognises that there is no single optimum state for the fishery to be in, (ii) it recognises thresholds in fishery behaviour, (iii) it acknowledges that management can often aspire to little more than to influence the 'direction' or trajectory of the system not its precise state, (iv) it can be incorporated into existing fisheries processes (thresholds can be equivalent to limit reference points). Figure 3 illustrates the basic elements of the dashboard for four indicators. Within a 2-two dimensional space, there is an area that is viable, and within which the fishery can assume a range of states that do not threaten its resilience. This space is bounded by thresholds, shown as the critical threshold line in Figure 3. As the fishery approaches those thresholds it becomes increasingly unsafe and ultimately crosses into a crisis.

More quantitative and complex evaluations are possible, but in this simplest form it still provides a basis for a group of people from diverse backgrounds to develop and agree on a set of indicators.

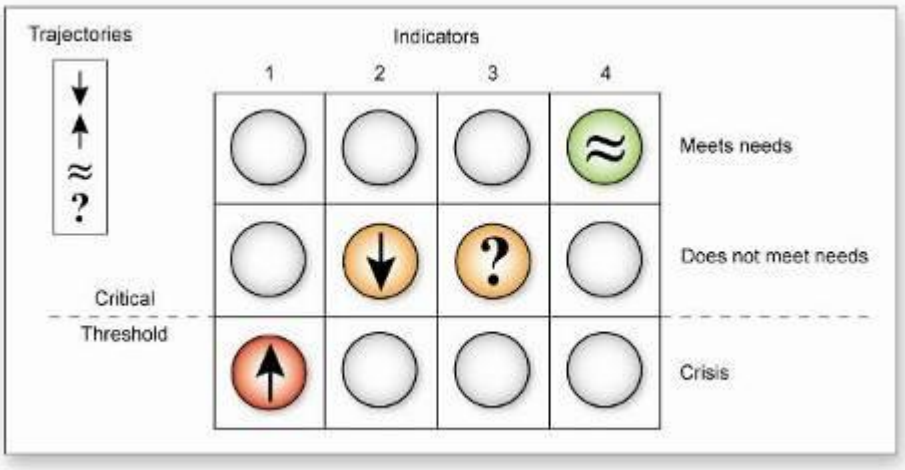

Figure 3: Indicator dashboard, modified to include values around thresholds that determine whether it is at a viable (meets needs); unsafe (does not meet needs) or crisis level.

The intent in developing the Kia (and subsequently the Jorio) management plans was to develop indicator-based monitoring that could be carried out by the communities. Established processes would ensure that monitoring information fed back into the adaptive management process. Indicators provide a way to assess the current situation and to measure the effect of the new management measures on the communities and their inshore fisheries. Indicators related to the sea cucumber fishery and to the community were selected based on findings from the household socioeconomic surveys before and after the ban (Ramofafia et al., 2007, Ramofafia et al., 2008) and on reef surveys for sea cucumber abundance.

5.2.7 Indicator-based monitoring

Agreed management measures were articulated in a written management plan which also described, and placed these within, the management constituency. The management plan included agreed indicators against which a monitoring programme could be developed for evaluation of the impacts of management measures. The intent was that management would be responsive to the outcomes of monitoring. The monitoring was intended to initially be a joint activity between WorldFish, management committees and technical teams and as the committees are strengthened, an activity they could conduct independently.

To implement the plan community members were trained in community awareness and for biological indicators (initially sea cucumber only), community members were trained in field survey techniques (for details see section 6.1.4).

5.2.8 Data management

Immediately following each field trip a short report was prepared and a more detailed report of findings, lessons and discussion points was subsequently compiled. Duplicate paper copies of reports and survey data are stored in WorldFish offices in Gizo and Honiara.

Quantitative and qualitative survey data are all kept in excel spreadsheets and project data is stored in computer files, backed up on CDs and on external hard drives.

6 Achievements against activities and outputs/milestones

Objective 1: To work with selected communities to develop sustainable community-based sea cucumber fisheries

Table 1: The details of achievements and outputs against each activity

no.	activity	outputs/ milestones	completion date	comments
1.1	Describe the social, cultural and economic framework within which the sea cucumber fishery operates	Written report describing the fishing practices, triggers and incentives for sea cucumber fishing, and perceived trends in the fishery over time	2007	Reported in Ramofafia et al., (2007, 2008)
1.2	Describe the sea cucumber fishery and how it operates in targeted communities	Written report describing the fishing practices, triggers and incentives for sea cucumber fishing, and perceived trends in the fishery over time	2007	Reported in Ramofafia et al., (2007, 2008)
1.3	Describe the CMT systems operating in the target communities	Written reports describing the lines of authority within the community, and the existing marine tenure system	2007	Reported in Ramofafia et al., (2007, 2008)
1.4	Assess the status of the sea cucumber resource in selected areas	Estimates of abundance and size composition of the stock of commercially important species, and thence of the status of the stock	2006	Nash and Ramofafia (2006). Recent developments with the sea cucumber fishery in Solomon Islands. SPC Bêche-de-Mer Bulletin 23: 3-4.
1.5	Assist the communities to develop a management plan for the sea cucumber fishery, using biological controls and harvest controls	A Sea Cucumber Fishery Management Plan produced for and in collaboration with each community	2006-2008	Kia District Marine Resource Management Plan implemented 2007, launched May 2008. Jorio District Marine Resource Management Plan implemented in September 2008.

1.6	Assist in the preparation and dissemination of information material on sea cucumber resource management and protection to other communities	Plain-text guidelines on the planning process for developing a resource management plan	2005	Two-page flyer produced suitable for dissemination to villagers in Solomon Islands informing about the project. Further lessons learnt for incorporation into plain text guidelines to be completed as part of (FIS/2007/116). Education and awareness through handouts and posters about marine habitats. Kia technical team attended look-and-learn visits organised SILMMA. Community reps from projects with other NGO's have visited WorldFish at Nusa Tupe to learn about the projects and approaches of WorldFish in the Western Province. Since 2007 additional Solomon Island graduates have been appointed to WorldFish which has provided increased capacity to expand awareness raising activities. Community-appropriate power point presentations prepared and presented.
1.7	Train local people in the elements of conducting resource surveys, and initiate a system of stock monitoring in the target communities.	A simple plain-text manual of monitoring procedures	2006 and 2008	Kia technical team and Jorio technical team trained in resource survey techniques. The technical teams disseminate the results of surveys to other community members through 'awareness' tours subsidised by the project. The teams are able to carry out monitoring independently and analyse data with assistance from WorldFish. Technical teams attending training at Nusa Tupe received simple checklists to assist them with their monitoring. A formal manual for monitoring is yet to be produced as appropriate community monitoring techniques remain a topic of much discussion amongst stakeholders and it was felt that a degree of consensus would be prudent. This will be completed as part of (FIS/2007/116).

PC = partner country, A = Australia

6.1.1 Project activities in Kia District, April 2005-December 2005

Expressions of interest in the project were requested from communities via a public radio station. Kia community in Isabel expressed an interest, and as it fit a number of the site selection criteria was chosen as the first target community. The project was initiated with an implementation workshop held over three days in Honiara in April 2005. Twenty people participated in the workshop, in addition to the WorldFish project team. Participants included representatives from Kia community, Minister for Natural Resources–Isabel Province, Provincial Senior Fisheries Officer–Isabel Province, UNDP–Isabel Province Development Program, the Department of Fisheries and Marine Resources (DFMR) (now MFMR), the International Waters Program, the Foundation of the Peoples of the South Pacific International (FSPI) and The Nature Conservancy (TNC).

In May/June 2005 the project team undertook the first project visit to Kia to conduct village surveys using a questionnaire approach comprising household socio-economic and fishers questionnaires along with focal group discussions (FGDs). The surveys covered

all 159 households in the community. The four components of the survey were: (i) household socioeconomic conditions, (ii) community utilisation and perceptions of the sea cucumber fishery, (iii) community business operations and development, and (iv) community leadership and governance.

Discussions were held on sea cucumber stock assessment, the use of the traditional *tambu*[3] system of rotational closures as a component of fishery management measures, and the creation of a community project technical committee was initiated in preparation for the next visit in August. The August trip didn't eventuate as, shortly after the May/June survey was conducted, the ban on the collection and export of bêche-de-mer was announced by the Solomon Islands Department of Fisheries and Marine Resources.

The announcement of the ban necessitated a realignment of project objectives because the community was reluctant to engage in discussions of management options for the fishery, or to develop a community fishery management plan, for a resource they could no longer fish. As well, there was no fishing activity to which planned project field activities could be linked. Importantly, there was a widespread misconception in Kia that the ban was introduced because of information given by Kia community members to the project team during the first survey. It was therefore necessary to reschedule project objectives and to engage with the community in various ways to regain their trust.

At this stage the project objectives were re-negotiated with ACIAR and the project design was changed through the removal of Objective 2 (agreed with ACIAR in August 2005). Accordingly resources were channelled into an increased emphasis on community participation and finding ways to continue to engage with the community despite this significant "external shock" (an event which happens outside the sphere of influence of the fishers themselves) to the community.

To find a way forward the project team conducted three visits to Isabel Province; one to Buala (the Provincial capital) and two to Kia. Meetings and discussions were held with Kia leaders during the Buala trip (June 2005). In addition, there was extensive public discussion and awareness-raising in Isabel Province about the national ban and its justification (the visit coincided with a week-long Provincial Trade Show). The Kia visits were undertaken to clarify the project team's involvement with the ban, in order to remove community misconceptions that their answering of questions had resulted in the ban. The discussions around this topic were also used to gain further insights into community organisation, governance and leadership through meetings with community members, and then to provide training in participatory community management.

By the time the ban came into effect in December 2005, the project team had regained the trust of the community and had an agreement that management of marine resources remained a vital consideration, to which end the community agreed to continue to engage with WorldFish.

6.1.2 Activities in Kia District subsequent to December 2005

For the remaining two and a half years of the project an adaptive learning approach was adopted, necessarily remaining flexible and taking lessons from Kia and applying them to the next project community.

Diagnosis[4] workshops were conducted in Kia in June and September 2006, using information gathered in 2005 surveys, to discuss with the community the current status, threats, and opportunities of the bêche-de-mer fishery. Once threats and opportunities had been identified the workshops provided an environment where the stakeholders (in

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[3] *Tambu is analogous to the word taboo in English. It refers to a social prohibition or ban, and in this case refers to the traditional closure to fishing of a marine area.*

[4] *Diagnosis refers to the identification, using principles and practice of participatory diagnosis, of the sources of vulnerability and threats to a fishery and fishing communities, from both outside and inside the sector.*

this case community members (men and women) and leaders, provincial fisheries and WorldFish researchers) could begin to identify processes by which the community could negotiate rules or norms that they might consider incorporating into a management plan. In September 2006, 10 months after the ban on sale or export of bêche-de-mer, a further socio-economic survey of 96 households was conducted in Kia to assess the economic and social impacts of the ban. At the same time work began on the development of a sea cucumber resource management plan, under the assumption that the national ban would be a temporary one.

6.1.3 Development of a management plan for Kia District

The technical committee became key to the process of development of the management plan. The Kia technical committee or "technical team" remains active at the time of writing and comprises:

1. Atkin Bale — Chairman/Member
2. Clement Eta — Chief/Member
3. Desmond Habu — Police Constable/Member
4. Patteson Kame — Provincial Fisheries Officer/Member
5. Steven Epysom — Member
6. Nelson Kokonava — Member
7. Frederick Zea — Member
8. Drummond Tagi — Member

The team had the role of liaising with the WorldFish team and with reef owners (for a description of ownership see section 7.1.1), of conducting awareness activities for Kia and Kia District communities and of carrying out technical activities associated with monitoring. This team provided an important avenue for Provincial Fisheries Officer Mr Patteson Kame to be involved in every aspect of the development of the management plan. Mr Kame was the key contact with WorldFish through HF radio at the Bahana Fisheries Center.

Between June and December 2006 rules and options for managing the sea cucumber fishery (including periodic closures and size limit restrictions) were debated by the community and the project team. The extent of the managed areas, that would be subject to rules, and that would contain tambu reefs, was also discussed amongst the stakeholders and re-negotiated as necessary. These discussions were the prelude to writing a management plan.

6.1.4 Biological monitoring surveys and training of a monitoring team in Kia District

In October 2006, seven members of the Kia technical team travelled from Kia to the WorldFish Center field station at Nusa Tupe for training by WorldFish Center staff in sea cucumber survey techniques and methods of recording data. Four days were spent on theory and practical components in preparation for a baseline resource survey.

A sea cucumber monitoring programme that could be used to monitor changes in tambu'd and / or open reefs was designed. In November 2006, WorldFish Center staff and the Kia technical team surveyed eighteen sites on 16 reef systems comprising sites that were relatively close to (day trip) and those that were relatively far from (usually more than a day trip) Kia village. All had been fished up until the time of the ban in 2005. The survey was designed to estimate the daytime abundance of sea cucumbers in three different habitats: sand, reef and seagrass. Six sites were chosen within each of these habitats: three on 'near' and three on 'far' reefs. At each site, six contiguous 100 m long transects were surveyed by four snorkel divers swimming abreast. Each diver surveyed a 2 m wide

strip. As these contiguous transects were not independent replicates, counts from all six, 100 m x 8 m, transects were pooled for each site (4800 m^2 total area per site). In total 8.64 ha was surveyed to a maximum depth of 10 m.

Data from the biological survey were entered into computer on–site, enabling a summary of results to be presented at a community meeting before the WorldFish staff returned to Nusa Tupe. Further surveys were carried out in April 2007 and November 2007, the latter being carried out by the Kia technical team independent of WorldFish (although supported with funding for fuel and associated costs). Data from the November survey were analysed by WorldFish staff for diversity and abundance, and compared with results one year previously (November 2006). Results were provided to the technical team to present to the district communities as part of awareness raising 'tours'.

Plate 1: The Kia technical team during the first biological survey of Kia reefs in November 2006.

6.1.5 Project activities in Jorio region

The Rarumana community in Western Province was the intended second project site having expressed interest at the time of the project inception. As with Kia, at the time of proposal writing this community fit the pre-agreed criteria. It had a sound governance framework in place, alternative livelihoods being developed (including seaweed farming, capture/culture of post larval fish for the aquarium trade), reef areas and their resources very largely free from ownership/access disputes and management issues had been addressed with respect to some of the other marine resources (e.g. shellfish: Aswani and Weiant, 2003). When the project team approached the community however, it became clear to both the community and the WorldFish team that, paradoxically, the relatively high demands on time of the community's engagement in seaweed farming, and capture/culture of post larval fish and crustaceans appeared likely to preclude effective engagement in a resource management project at that time. It was agreed that the timing was not right for Rarumana to embark on such a project.

Nearby Boboe community were aware of the discussions with Rarumana and expressed an interest in being involved. Boboe was selected as site 2 after community consultations in January 2006. In February 2006 a project implementation workshop was held in Boboe that included community members and leaders, and the WorldFish project team. The community accepted the concept of marine resource management and in March 2006, community surveys (household socioeconomic survey, business, fishers and governance and leadership) were conducted (raw data held by WorldFish Center). In April 2006 however the community was forced to withdraw from the project owing to pressure from their regional pastor (not a community member or resident) of the Seventh Day Adventist church. Church leaders were not comfortable with the emphasis on sea cucumber, as Seventh Day Adventists observe the Old Testament ban on eating 'fish without scales', such as shellfish, turtles, and crustaceans. This illustrates the importance of defining all the stakeholders in the management constituency at an early stage.

At this stage an advertisement calling for expressions of interest from Vella Lavella communities to participate in the project was placed in Gizo town. Four communities (Iriqila, Vatoro, Leona, Tiberius) expressed interest in hosting the project, so in July 2006 interviews were held with respective community chiefs and leaders. Iriqila community was selected to host the project. There was some delay due to bad weather conditions but the community was finally notified in September 2006 following a meeting in Iriqila with community chiefs and leaders.

The process and methodology adopted in Iriqila was broadly similar to that applied in Kia, however was refined and modified on the basis of lessons learned. In particular the approach rapidly moved to focus on all marine resources not just sea cucumber.

A project implementation workshop was conducted in Iriqila in October 2006. Participants included chiefs, community leaders, church leaders and youth. In addition to implementing the project, the project staff took the opportunity to gain information on the community by discussing current status, threats, and opportunities relating to the bêche-de-mer fishery in particular, and of marine resources in general. In November 2006, 100 households were interviewed using a survey comprised of the same four components used in Kia in 2005: (i) household socioeconomic conditions, (ii) community utilisation and perceptions of the sea cucumber fishery, (iii) community business operations and development, and (iv) community leadership and governance.

Of significance to the project is that Iriqila results were collected under the conditions of the ban on bêche-de-mer export. This is likely reflected in the fact that 55% of females and 51% of males listed gardening as their primary occupation while less than 3% of the population listed fishing or collection of marine resources as their primary occupation. Nevertheless the community stated that the bêche-de-mer fishery was an important one for the community prior to the ban. For questions involving the bêche-de-mer fishery, fishers were asked to consider their activities and the status of the fishery just prior to the ban being implemented. An important finding to emerge from the community discussions and surveys was that there are a number of communities (including Iriqila) that consider themselves part of one region (Jorio) and that these communities have agreed access to each others reefs. Accordingly Iriqila community requested that the other communities within the Jorio region be included in further discussions about marine resource management plans.

In April 2007 a second major external shock (after the bêche-de-mer ban) impacted on the Western Province communities involved in the project. On the morning of 2 April 2007 an earthquake of magnitude 8.1 struck the western part of Solomon Islands followed by a tsunami with a height of 2-10 m that swept through the coastal areas of Western and Choiseul Provinces. This not only resulted in loss of life in some communities but also extensive damage to infrastructure and reefs. All communities within the Jorio region were affected to some degree. WorldFish funds and staff time were allocated to a rapid assessment of the fisheries-related needs of disaster-affected communities in the Jorio region and in the wider Western Province. Rapid assessments, within communities that WorldFish had not previously had contact with yielded a high level of interest in marine resource issues beyond those immediately related to the disaster. There was a high demand for assistance with implementing community-based marine resource management.

Following on from these assessments, and the previously identified need to include all communities with fishing rights in Jorio (hereafter referred to as the Jorio region), communities from Iriqila to Tiberius became the focus of the work on Vella Lavella (note that all of these communities had initially expressed interest when expressions of interest were called for in Gizo). Each of the Jorio communities was visited by WorldFish and a project awareness discussion was held at a community group meeting. After due internal discussion, all communities confirmed their interest to be involved. The communities of Leona, Vatoro, Paramata and Tiberius all subsequently worked with the Iriqila community

and WorldFish to develop a community-owned document for the full Jorio region; the Jorio Marine Resource Management Plan.

6.1.6 Development of a management plan for Jorio region

When working in Jorio the WorldFish team used their experience from Kia to identify the steps needed to develop a management plan. At a workshop in Iriqila in mid 2007 Dr Chris Ramofafia led the presentation of findings from the socio economic and fishers surveys to community leaders from the Jorio region. At that time the Jorio Marine Resource Management (JMRM) committee was formed, representing all communities in the Jorio region and with the express purpose of developing and administering the management plan. The committee remains active at the time of writing and comprises:

1. Chief John Sina (Iriqila)
2. Chief Winston Vouku (Iriqila)
3. John Tiketike (Iriqila)
4. Jim Vanibule (Vatoro)
5. Norma Iro (Vatoro)
6. Frederick Sori (Leona)
7. Marlon Kuve (Leona)
8. Kent Niko (Leona)
9. Jackson Tovae (Paramata)
10. Robert Rimizi (Paramata)
11. Dulcy Tozaka (Tiberius)
12. Daniel Luluku (Tiberius)

In October 2007, the committee met independently to define the first draft of the rules of the management plan based on their own existing knowledge and ideas. A subsequent workshop with WorldFish enabled discussion of the various options for rules and reef closures; options that had either been suggested by the committee or that WorldFish could describe from experiences elsewhere. Using breakout groups the committee identified ten rules, including the identification of some possible tambu reefs to take back to their respective communities for discussion.

Plate 2: (Left) Children fishing and collecting marine resources in front of Iriqila village and (right) members of the Jorio Marine Resource Management Committee and the WorldFish team depart Iriqila after a workshop.

The initial list of rules for discussion with the community (for open reefs) was as follows:

1. No harvesting of juveniles. This includes all fish, shells and sea cucumbers
2. Use of poison leaf is banned
3. Use of hookah/compressor is banned
4. No destruction of mangrove habitats, including unnecessary cutting of trees
5. No harvest of juvenile crayfish and mud crabs and those with eggs
6. No harvest of trochus less than 8cm and over 12cm according to fisheries regulations
7. No spear-fishing at night
8. No net fishing

   OR

   a) Netting for esky business banned
   b) Netting for tobele banned
   c) Nets less than 2.5 inches banned
9. No harvest or fishing on breeding/spawning sites of fish
10. Rocket bombs for sea cucumber harvest are banned

The committee members returned to their respective communities to discuss these proposed rules in public meetings. A draft management plan was formulated by WorldFish, based on the outcomes of these discussions, for representatives to discuss with community by December 2007. The timing of this process was strongly driven by the committee who were anxious to see progress being made.

This management plan was based on the Kia model but was simplified for ease of understanding by a wide cross section of the Jorio communities. The committee was anxious to implement the plan as soon as possible, and most communities did so early on an un-official basis. It was also agreed that WorldFish would provide assistance by conducting a more extensive educational campaign designed to create a greater depth of understanding within each community. This was carried out under ACIAR funded project FIS/2007/116 *Improving resilience and adaptive capacity of fisheries-dependent communities in Solomon Islands* in September 2008. This approach resulted in much public discussion about marine resource management in general and the proposed Jorio Marine Resource Management Plan in particular. It was also a vital forum for providing feedback before the plan was finalised and rules were officially implemented by the chiefs of each community on 30 September 2008.

6.1.7 Biological monitoring surveys and training of a monitoring team in Jorio region

In March 2008 two men from each of the five communities within the Jorio region travelled to WorldFish at Nusa Tupe to receive training in survey techniques; this group went on to comprise the technical team for Jorio. In April 2008 the baseline Jorio reef survey was conducted by the newly trained Jorio technical team with the assistance of WorldFish staff. With the exception of some information available from WorldFish post-tsunami rapid assessment surveys this was, as far as we were aware, the first biological survey to be conducted on reefs in the Jorio area. The baseline survey was conducted seven days after the national ban on sea cucumber harvesting and exports came into effect again (i.e. following a one year period of re-opening to assist victims of the earthquake and tsunami disaster).

Following the methodology described above for Kia, a total of 13 reefs were surveyed for sea cucumber and other key benthic invertebrates within the marine managed area. All of these reefs had been earmarked by the community for periodic closure as part of the management plan. The survey team recorded the species and size (length and width) of any sea cucumber sighted. Total numbers of trochus, clams and triton were also recorded on each transect. This was repeated at maximum of six contiguous transects at each site. In certain cases the size of the reef (at Tokekolo) or weather conditions (at Tabezaru and Poro) did not permit the team to complete six transects. Hence 3, 4 and 5 transects were done on Tokekolo, Tabezaru and Poro respectively.

Average counts, by site and by species, were calculated by WorldFish staff and findings were presented by the technical team back to the communities.

6.1.8 Education and awareness programme

Education and awareness activities were a component of work within the target communities, which was conducted in parallel with the development of management plans. Written handouts describing the project and posters about marine habitats have been distributed and well received. A critical component of the education and awareness programme has been for WorldFish staff to train the technical team in resource management concepts, survey techniques and interpretation of data. The technical team, in Kia in particular, have then conducted awareness raising of these concepts in communities throughout the district. Awareness raising also comprised a description of the project goals, a discussion about the status of the development of a marine resource management plan, an explanation of the rules that are within the managed area and a description of the boundaries of the managed area. It was evident that the education and awareness programme was a vehicle that encouraged other reef owners to choose to have their reefs included in the list of tambu'd sites.

Members of the Kia technical team have attended look-and-learn visits organised by the Solomon Islands Marine Managed Area Network[5] (SILMMA) in association with other community based management (CBM) initiatives in the country. Community representatives working with other organisations on CBM, have visited WorldFish at Nusa Tupe to learn about the projects and approaches of WorldFish in the Western Province.

Since 2007 additional Solomon Island graduates have been appointed to WorldFish which has provided increased capacity to expand awareness raising activities. These graduates have developed community-appropriate power point presentations that describe WorldFish projects, and in particular those relating to CBM. These have proven popular in the communities and engender much discussion. Experience of the WorldFish team, incorporating feedback from the communities, has allowed for an improved and more extensive communications strategy to be designed for the subsequent project *Improving resilience and adaptive capacity of fisheries-dependent communities in Solomon Islands (*FIS/2007/116).

[5] *SILMMA is the Solomon Islands national network of the Locally Managed Marine Area Network which comprises of marine conservation practitioners working in the Asia-Pacific region. Members of the network share an approach to marine resource management including strong community involvement.*

7 Key results and discussion

7.1 Kia District

7.1.1 Socio-economic and fishers surveys (pre-ban)

Through community meetings and FGDs the management constituency within Kia District was described to the project team. Kia District is located on the northern tip of Isabel Province. It is one of eight districts in the Province: Bugotu, Gao, Maringe, Kokota, Havulei, Kia (Zabana), Katova and Hograno. Kia district is made up of 14 communities of which Kia community is the largest. Home to about 900 people belonging primarily to nine clans, the village was established in the 1900s following the arrival of Anglican missionaries in 1903. Kia community is organised into 4 zones or groups around which communal activities are organised. Each zone is led by an elected leader. The church in Kia community is a parish of the greater Isabel Diocese of the Anglican Church and plays an important role in the life of the community. The church provides the main force of unity and in 2005 church related organisations accounted for 50% of all community organisations. Community life centers on an annual church calendar with Easter, Christmas and Saint Luke Day being major community events.

Bordering Kia community in the south are Babahaero, Alohaki, Mamarava, Vulu, Kolokofa and Sasare. To the northwest of Kia community are the Barora Fa Island settlements of Ritamala, Kupikolo, Legaha and Zaguto. Bordering to the east are the communities of Kolopakisa, Tubi and Pikao. Community profiles obtained in June 2007 (this project) show a population of about 600 people in these 13 communities, ranging from 120 in Kolopakisa to nine in Pikao.

Kia District is governed by the Kia District House of Chiefs which consists of 26 chiefs. Four chiefs represent the four zones of Kia and 22 chiefs represent the district communities. There are no women representatives. Kia community has its own governing body called the Eta House of Chiefs, which consists of 24 chiefs including two women. Decisions that affect the life of the community are made by the House. House responsibilities include making and enforcing decisions, planning community programs, monitoring community social issues, solving disputes and providing advice on custom. Decisions reached by the House are provided to zone leaders who then inform respective zone members for implementation.

In the past, the responsibility for management of each sea area within the Kia region was through each tribal group. Accordingly, the Kia District communities share the same resources as the people of Kia community as many have tribal ties to Kia. The tribes are: Mamara kokolo, Etieti kokolo, Etingi kokolo, Sinagi kokolo, Sinagi Laena butubutu, Paekei kokolo, Kokopi kokolo, Rurugu kokolo and Saleikoraba kokolo. Some other tribes reside principally under marriage alliances but are not resource owners.

Although in the past only the members of the tribe were allowed to use that tribe's marine resources, some groups adhere only loosely to this at present. The sea in the immediate area of Kia village is a special area under the control of the Eta group. Under an arrangement made by their leader in 1903, all members of the Kia village community are allowed to use that sea area for food for their families – but not to take marine resources for sale.

Leaders, or in some circumstances, individual families within the nine resource (including reef)-owning tribes, of the district are identifiable as reef owners and retain the right to decide to close or 'tambu' reefs and to enforce rules related to the resources.

The results from socio-economic and fishers surveys in Kia community, and the way in which these guided the development of management plans and community management structures, are detailed in Ramofafia et al. (2007) and summarised here.

In 2005 a population of 846 was recorded for the 159 houses surveyed in Kia community. The average family size of 5.3 people is similar to, the average family size of the Isabel province (5.7) determined from the last census (Solomon Islands Government, 1999). Kia has a high proportion of young people with 52% less than 21 years old.

People in Kia are sea-going people and this is reflected in the fact that outboard motors and fibre canoes were amongst the most common material assets owned by respondents. More than 90% of the 159 households interviewed belonged either to land- or reef-owning tribes. In this regard, it was essential that the project, while seeking the guidance and leadership of the chiefs, paid equal attention to resource owners who, in the case of Kia, include much of the wider community. Any project-related activities regarding resources needed to secure the acceptance of resource owners.

The occupational profile of Kia is similar to those reported for other neighbouring communities (Mahanty, 1995) and reflects a general rural Solomon Island setting (Solomon Islands Government 1999). Occupations such as fishing and farming (gardening) (Figure 4) that enable food to be gathered directly, and that can provide cash rapidly to the family, took precedence over opportunities requiring longer term vision and investment (i.e. running a business enterprise). Fishing provided the greatest proportion of household income (Figure 4a) and was primarily the men's responsibility (Figure 4b), while gardening and housekeeping were primarily the women's responsibility (Figure 4c). The strong reliance on both fishing and gardening for day-to-day food supply for the community means that although fishing is predominantly men's responsibility, women's views regarding sustainable resource management must be sought and considered.

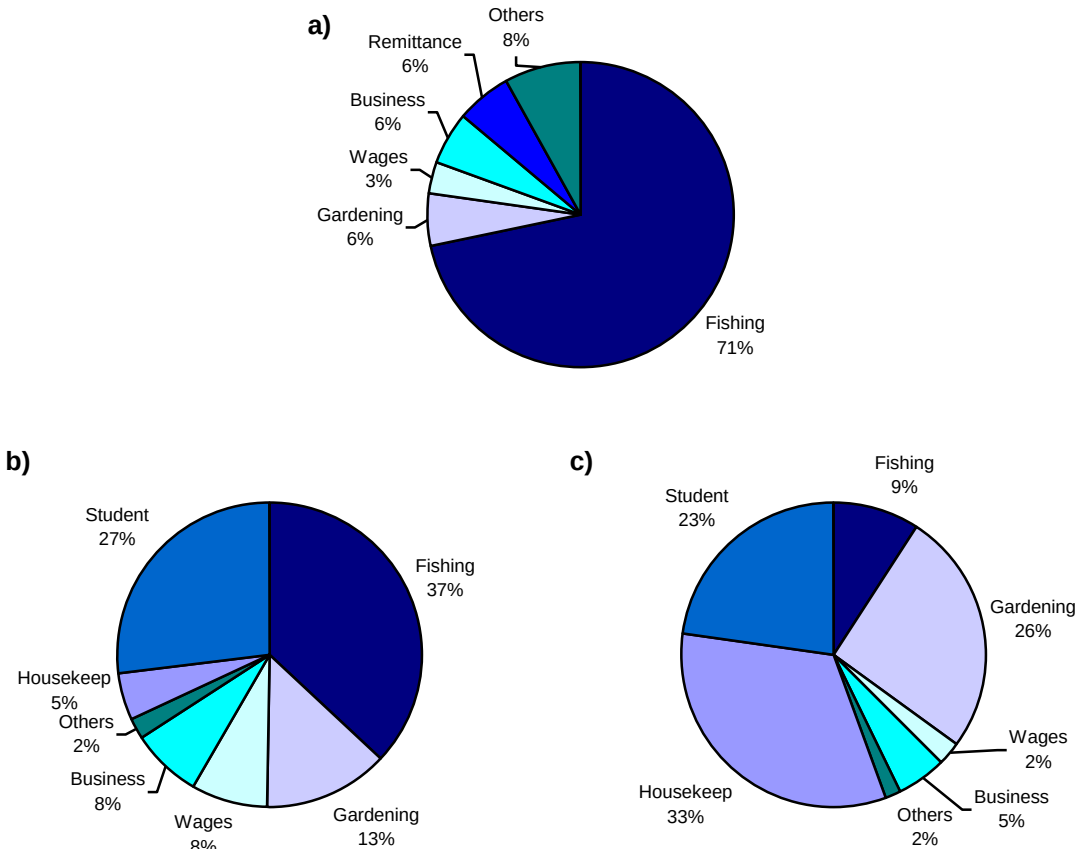

Figure 4: a) Primary income source of surveyed households (n=159) in Kia, and primary activity of b) male (n=373) and c) female (n=462) household members above age 10 in 2005.

The practice of raising animals for income was limited in Kia. Those who raised pigs and chickens did so mainly for subsistence and animals were sold for cash generation on an opportunistic basis. Although more than half of the population in Kia grew coconut and betel nut trees, these trees were not being utilised for income generation at the time of the survey. Interest in making copra was lacking as prices were low compared to bêche-de-mer. In mid 2005, 20 small-business enterprises were operating in Kia. These largely provided goods and services related to fishing (e.g. fuel and batteries for torches for night diving) or household basics (e.g. kerosene and food items) to local people. All shops had credits owing to them from community members. Debts were created by taking shop items on loan and hoping to repay the loan from the sale of bêche-de-mer. Full debt repayment was not always achieved as the financial return to fishers from bêche-de-mer did not always match the level of debt.

The earning power of the majority of the respondents was relatively high compared to the average for Isabel province (Mazini and Bako, 2003), with more than 65% earning more than SBD $500 on a monthly basis. Fishing was the main source of income for the community (Figure 4a) and sea cucumber fishers were the highest earners in the group, consistent with the high market value for bêche-de-mer in the country (Kinch, 2004). This high dependence on marine resources for subsistence and cash was also found by Mahanty (1995) for the Kia community, and is similar to that reported for coastal communities elsewhere in Solomon Islands (Solomon Islands Government, 1999).

7.1.2 Sea cucumber fishery: Community utilisation and management perceptions

In 2004 WorldFish marine scientist Dr Chris Ramofafia worked with Peter Ramohia of the Department of Fisheries and Marine Resources (DFMR) to examine bêche-de-mer fishery export statistics for evidence of overfishing. Key characteristics of the bêche-de-mer commodity that have been shown elsewhere to indicate over-fishing (Lovatelli et al., 2004), were evident from the results of the fishers and small business enterprise survey. First, bêche-de-mer exports in the early/mid-1990s were of a small number of high-value species, but by 2004 the number of species exported had risen to 32, and the proportion of high-value species in the exports was small (Ramofafia, 2004). This trend reflects progressive depletion of species, over time. Second, the mean size of individuals, considered by species, within the exports declined steadily over the same period. In addition, the use of destructive fishing methods including the use of 'rocket bombs' and dredge nets had increased, and the number of export licenses issued by DFMR increased from nine in 2001 to 22 in 2003 then decreased to 17 in 2004. Dwindling export volume was the principal reason cited for the decrease in licenses in 2004. Collectively, this evidence of overfishing is at least as strong as that derived from trends in fishery catch rates alone; as catch rates can be maintained by fishers moving further afield when stocks in one area decline. In this context, the fishers survey explored some of these indicators at the community level by assessing harvesting trends over time, investigating local biological knowledge, determining average catch size and species composition, exploring markets and income trends, and obtaining information useful for developing management options for the fishery. Interviewees' responses to questions about the past are prone to inaccuracy and are in many cases unverifiable. Nevertheless, the trends in catch rates and in species composition over the past few years, as reported by respondents, are broadly consistent with those reported by Ramofafia (2004). The 2005 findings and Ramofafia (2004) provide evidence that the value (in SBD) of species found within Solomon Islands had increased by 20-60% over the last decade due to shifts in market values. Of the 32 species harvested nationwide, 10 (31%) were high-value while six (19%) were medium-value. The remaining species (50%) were of low-value. In Solomon Islands the white teatfish had increased in value from $30 in 1991 (Adams et al., 1992) to $220-$260 in 2005 at which time low-value species attracted buying prices of less than $50 per kg dry weight. This large increase in high-value species was partly because of continued depreciation of the Solomon Islands dollar against major overseas currencies. This means that the take-home income for the fishers was an increasingly significant proportion of the family income.

Plate 3: Activity at the bêche-de-mer buyer in Kia community, 2005.

7.1.3 Socio-economic and fishers survey results (post-ban)

Nine months after the imposition of the national ban on collection and export of bêche-de-mer a comparison of findings with those from May 2005, prior to the ban (Ramofafia et al., (2008), showed that the closure of the fishery had effectively reduced household earnings; many households (83%) experienced financial difficulties in the post-ban situation. The highest income bracket of more than $500 for the majority (69%) of households in Kia in 2005 had reduced to between $50 and $200 monthly for more than 50% of the households. The reduced income earned was not enough to meet basic needs at home, and some households experienced difficulty in paying school fees meaning some children had been taken out of school.

The financial difficulties experienced by the households stemmed from the cash-dependent lifestyle that had been adopted by the community when heavy exploitation of sea cucumber resources was possible. The easy-to-make money derived from bêche-de-mer had shifted attention from the traditional and cultural subsistence food garden production. When the ban came into force the reduced income to meet the cost of food stuffs from shops, coupled with low or zero subsistence garden production meant that household food was difficult to find. During group discussions within the community it was highlighted that the difficulty was most severe in the first three months after the ban while subsistence food gardens were being re-made.

A direct consequence of the ban was a loss of business enterprises. Prior to the ban, 20 different business enterprises were active in the community but nine months after the ban this had reduced to eight. The closure of the bêche-de-mer fishery also resulted in increased fishing effort on other fisheries in attempts by fishers to secure income. In May 2005, 87% of 114 fishers targeted sea cucumber, 4% trochus and 2% sharks. In September 2006, of the 78 households that fished for income 45% fished for trochus and 27% fished for sharks. This represents a greater than eight-fold and a ten-fold increase respectively in the number of households fishing for trochus and shark.

Whilst there were severe negative impacts on the community, the ban also provided evidence of community resilience. With reduced income, people began to cultivate subsistence food gardens. The majority of households interviewed cultivated one or two new gardens with some cultivating up to six new gardens. The involvement of men in garden activities increased from 6% in mid 2005 to almost equal to that of women (15%). The increased reliance on subsistence gardens for food supply meant an increased consumption of local food and a lesser reliance on store bought goods.

The community described a perceived increase in quality family time and improved health. Prior to the ban, night diving for sea cucumber was a daily activity but at the time of this study, had ceased. Respondents attributed a reduced incidence of common cold and pneumonia to this change, furthermore, the absence of night diving resulted in more time being available to fishers to spend with their families and to contribute to household activities.

With respect to the sea cucumber resource status, the community considered that a positive impact of the ban was the return of sea cucumbers to fishing grounds. When thinking back community members said they had seen eighteen species in 47 different locations. The most frequently cited were *S. hermanni, H. atra* and *B. argus.* In contrast, a quantitative biological survey conducted during daytime at 18 sites in Kia District waters in November 2006, as part of Kia community management plan activities, recorded 11 taxa at very low densities, and in many habitat types no animals were seen. This reinforced the importance of collecting quantitative data and correctly interpreting biological surveys to assist in verifying community perceptions and for informing the community on marine resource status.

On the basis of survey findings three key considerations (discussed below) were identified that could contribute to the resilience of small-scale fishery-dependent coastal communities in Solomon Islands. Similar findings have been reported elsewhere in Solomon Islands and the Pacific region (Kaly, 2005; Koczberski et al., 2006; Schwarz et al., 2007).

1. A strong agricultural subsistence base is important for food security

Cultivation of subsistence gardens stands central to the rural Solomon Islands setting (Solomon Islands Government, 1999). The Kia experience supports the view that a transition towards a cash-dependent lifestyle increases the vulnerability of communities to external shocks (Fisk, 1995; Warner, 2007). Garden production was low in Kia prior to the ban as households used cash to purchase food items. Earning cash was difficult during the ban and this affected household food availability as well, particularly for those with no gardens. Any management interventions for reduction of fishing pressure requires consideration of the possible consequences for the community and in this case would have benefited from the promotion of cultivation of subsistence gardens prior to the ban being enforced.

2. Resource management plans are required for sustainable utilisation of commercial resources

Despite an increase in gardening since the imposition of the ban, and therefore the creation of a sustainable supply of food for the community, evidence from this study clearly indicates continued high levels of exploitation of marine resources. This is particularly so for commercial resources for derivation of household income that is used for items such as school fees and church contributions; financial commitments that cannot be met by garden products alone. In Kia (and elsewhere) the closure of the bêche-de-mer fishery has led to intensive exploitation of trochus and sharks. This highlights the urgent need for management plans to ensure sustainable use of marine resources in general, and for the adoption of sustainable alternatives which may come from outside of the marine sector.

3. Stakeholder participation is important in management interventions

Despite the potential for negative socio-economic impacts of a ban (analagous to a fishery collapse) being highlighted in a UNDP report by Kinch (2004), this risk was apparently not acknowledged by the Ministry of Fisheries and Marine Resources when the ban was put in place. To the best of our knowledge there was no consultation with rural communities, particularly those who depended on the target resources for income, to prepare them for the consequences of reduced income generating opportunities. In the light of the findings, we strongly recommended that the MFMR consult widely with relevant stakeholders before implementing a similar ban in the future and that development of sound management plans for the country's inshore fisheries resources would limit management by ban; a tool of last resort. Subsequent to this, project scientists (Nash and Ramofafia) used findings from the work in Kia to assist MFMR in drafting a framework for a national management plan for sea cucumber. At the time of writing that remains in draft form with MFMR.

7.1.4 2006 biological monitoring survey results

The November 2006 biological survey detected 487 sea cucumbers from ten species at the 18 sites surveyed (Table 2). *Holothuria atra* was differentiated into two forms of the same species recognised by Solomon Island fishers (Ramohia, 2006): lollyfish, with a characteristic covering of fine sand (Colin and Arneson, 1995) are found in shallow inshore waters and are generally smaller than deep (reef) lolly, which are uniformly black, and are more commonly found on outer reefs (SPC, 2004). Deep lolly dominated the reef sites in this survey, was not found on sand and was only occasionally recorded on seagrass. An additional three species (Prickly redfish (*Thelenota ananas*), Stonefish (*Actinopyga lecanora*) and Surf redfish (*Actinopyga mauritiana*)) were recorded outside of the main survey sites.

The abundance of sea cucumbers ranged from 0 to 119 per site. Overall, site densities ranged from 0.12 to 48.6 ha^{-1} (Table 2). With the exception of lollyfish, densities were less than about 3 ha^{-1}. This is similar to densities encountered around Solomon Islands in 2004, prior to the ban (Ramohia, 2006), and shortly after the ban came into effect (SPC 2006) but low compared to other places in the Pacific (Friedman et al., 2004).

Table 2: Number, percent contribution, and density of sea cucumber species recorded at all survey sites on Kia reefs in 2006.

Local trade name[1]	Scientific name	Number	% of total	Density (animals/ha)
Lollyfish	*Holothuria atra*	397	81.52	48.57
Deep lolly	*Holothuria atra*	28	5.75	3.43
White snakefish	*Holuthuria impatiens*[2]	23	4.72	2.81
Brown sandfish	*Bohadschia vitiensis*	16	3.29	1.96
Tigerfish	*Bohadschia argus*	12	2.46	1.47
Blackspotted	*Pearsonothuria graeffei*	4	0.82	0.49
Greenfish	*Stichopus chloronotus*	2	0.41	0.24
White teatfish	*Holothuria fuscogilva*	2	0.41	0.24
Amberfish	*Thelenota anax*	1	0.21	0.12
Black teatfish	*Holothuria nobilis*	1	0.21	0.12
Pinkfish	*Holothuria edulis*	1	0.21	0.12
	Total	**487**	**100**	

[1]Local trade name refers to that used by local fishers and buyers. All other identifications follow the convention of SPC (2004). [2]According to Massin (1999).

Sea cucumber densities differed among habitat types with higher numbers recorded on seagrass than on reef or sand (Figure 5).

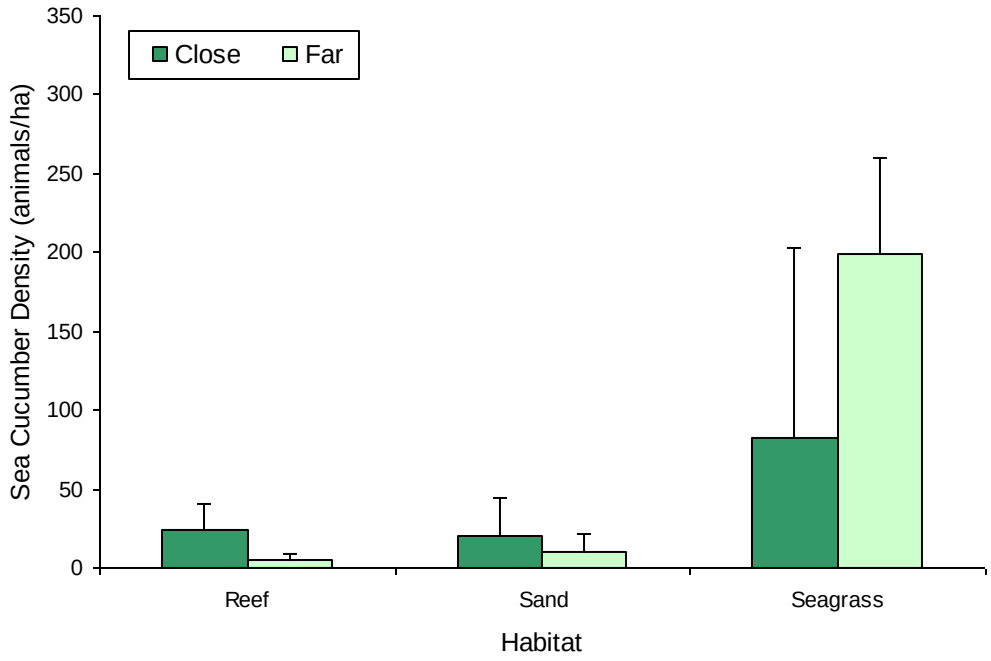

Figure 5: Mean density of sea cucumbers in reef, sand, and seagrass habitats both close to (<1 day of travel) and far from (>1 day of travel) Kia (n= 3 sites per category) in 2006.

Length-frequency analysis of the four most abundant species (*Holothuria atra*, *Bohadschia vitiensis, Bohadschia argus* and *Holothuria impatiens*) showed that most of the animals encountered were adults according to common adult sizes given in SPC (2004). The exceptions were lollyfish and white snakefish where animals less than 50 mm long were found (Figure 6a, d).

Deep lolly were generally larger than lollyfish (the shallow form) (Figure 6 a, b). All brown sandfish encountered ranged from 150 to 400 mm (Figure 6c). A similar length frequency relationship was observed for tigerfish (Figure 6e). White snakefish (Figure 6d) was the smallest of the commercial species recorded.

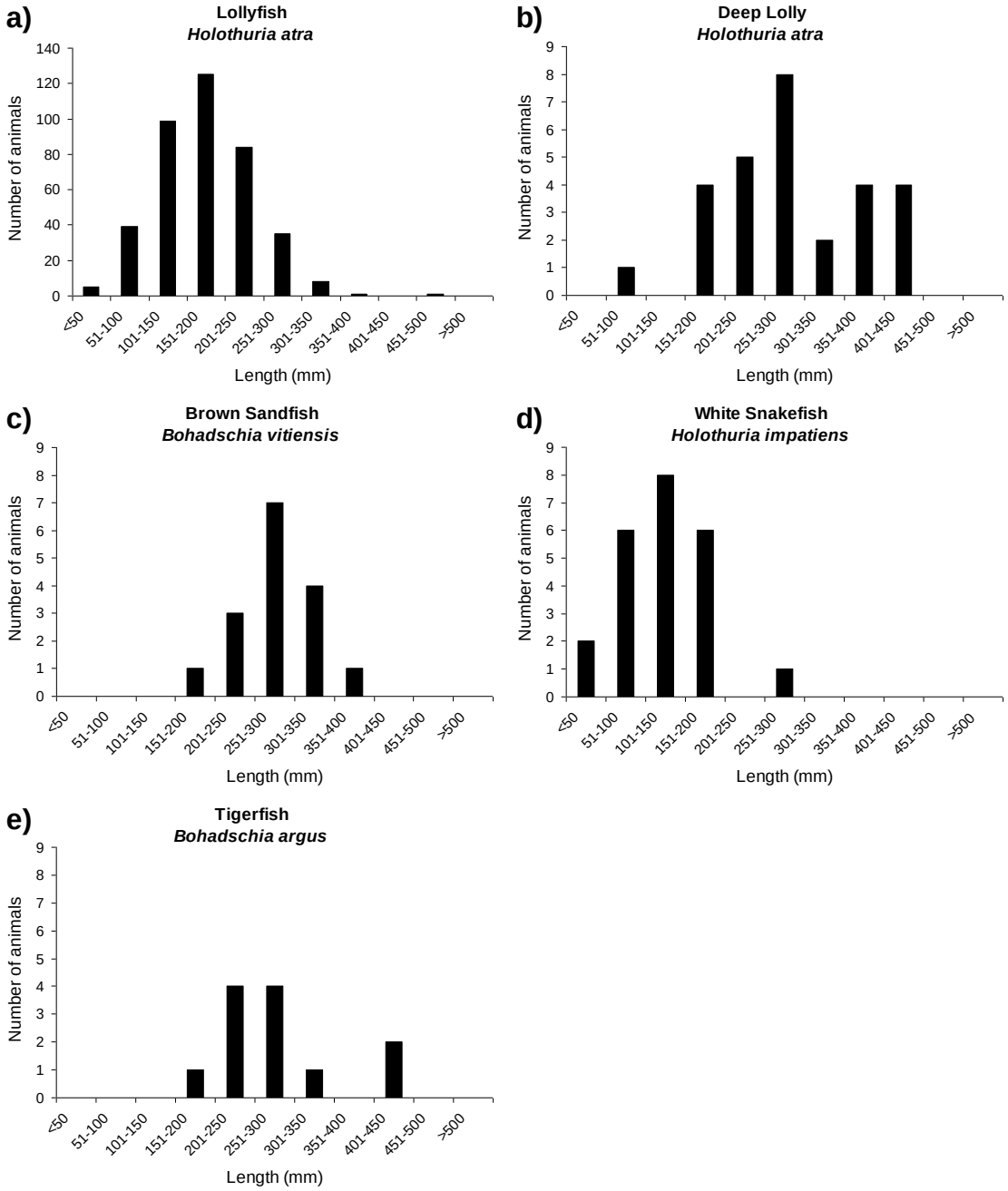

Figure 6: Length frequency distribution of the four most abundant species of sea cucumber at Kia in 2006. a) shallow water Lollyfish (*Holothuria atra*), b) Deep Lolly (*Holothuria atra*), c) Brown Sandfish (*Bohadschia vitiensis*), d) White Snakefish (*Holothuria impatiens*) and e) Tigerfish (*Bohadschia argus*).

7.1.5 Implications for fishery management

The findings from the 2006 baseline survey suggested that sea cucumber stocks were low, undoubtedly because of unsustainable levels of fishing prior to the national ban (Nash and Ramofafia, 2006). The absence of a clear pattern in abundance between 'near' and 'far' sites would appear to support the contention that fishing pressure was high throughout the Kia District. Although 'far' sites were not as readily accessible, fishing trips to these sites were reportedly for 2 to 3 weeks at a time.

Information on age-size relationship (i.e., patterns of growth) of sea cucumber in Solomon Islands is absent. However, based on our experience and on the literature from elsewhere in the Pacific (Conand, 1993; SPC, 2004), animals less than 50 mm length

(and probably larger) were juvenile. Accordingly, with the exception of lollyfish and white snakefish almost all animals encountered on the survey were adults.

The low counts of small animals (i.e., recruits during the year since the ban) might be due to the fact that they are often buried or otherwise difficult to see. The other possibility is that recruitment since the closure of the fishery in December 2005 has been low. Given the very low densities observed for all species except *H. atra*, and the low fertilisation rates observed for holothurians and other sedentary invertebrates when distances between males and females during spawning exceed 5-10 m (Babcock et al., 1992, Levitan et al., 1992; Levitan and Sewell 1998; Babcock and Keesing 1999), low rates of recruitment are to be expected.

7.1.6 2007 biological monitoring survey results

In 2007 a total of 666 sea cucumber individuals were recorded compared to 487 in 2006. The increase was largely due to low value lollyfish of which there were 599 recorded in 2007. There may be two reasons for this: 1. the higher densities of lollyfish (Table 3) meant they were able to have a higher success of successful sexual reproduction and / or 2. because lollyfish are able to reproduce asexually through budding (Laxminarayana 2006),they have a greater chance than other species that do not have this capacity, to increase their populations more rapidly. Ten sea cucumber species were recorded in both surveys, however only six taxa were observed in both surveys (Amberfish, Brown sandfish, Black teatfish, Deep lolly, Lollyfish and Tigerfish).

Table 3: Total number, percent contribution to abundance and density of sea cucumber species recorded at all survey sites on Kia reefs in 2007.

Local trade name[1]	Scientific name	Number	% of total	Density (animals/ha)
Lollyfish	*Holothuria atra*	599	89.94	69.1
Tigerfish	*Bohadschia argus*	23	3.45	2.66
Black teatfish	*Holothuria nobilis*	9	1.35	0.98
Deep lolly	*Holoruthia atra*	9	1.35	1.04
Surf red	*Actinopyga mauritiana*	8	1.2	0.92
Ripplefish	*Pearsonothuria graeffei*	7	1.05	0.81
Brown sandfish	*Bohadschia vitiensis*	4	0.6	0.46
Pricklyfish	*Thelenota ananas*	3	0.45	0.37
Amberfish	*Thelenota anax*	2	0.3	0.23
Brown curryfish	*Stichopus hermanni*	1	0.15	0.12
Snakefish	*Holothuria coluber*	1	0.15	0.12
	Total	**666**	**100**	

Densities of sea cucumbers on different habitat types were, as for 2006, highest at seagrass sites (both close and far) and lowest at distant (far) reef and sand sites (Figure 7). There was no significant difference in the density (paired t-test, P=0.230) or the number of species at all sites between years (paired t-test, P=0.519).

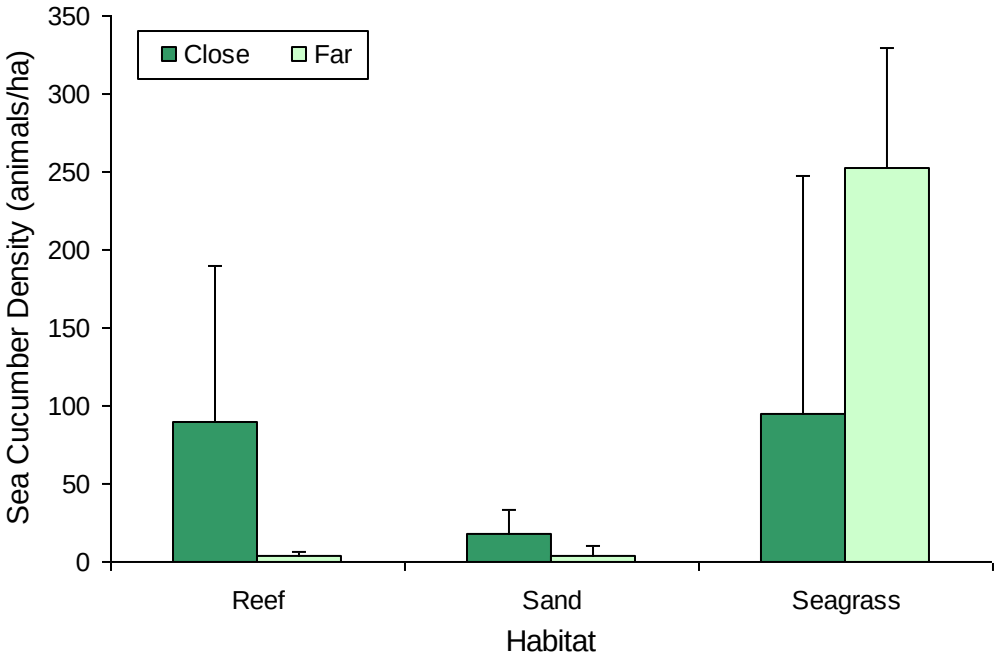

Figure 7: Mean density of sea cucumbers in reef, sand, and seagrass habitats both close to (<1 day of travel) and far from (>1 day of travel) Kia (n= 3 sites per category) in 2007.

If densities of sea cucumber stocks elsewhere in Solomon Islands are similar to those in Kia waters, population recovery throughout the country following closures is likely to be slow. Not only are stocks, and therefore likely egg production, low, but fertilisation success is likely to be very low too. Community expectations of recovery rates of sea cucumber stocks after a fishery closure may be too high.

In April 2007 the national ban on collection and export of sea cucumber was lifted. Many of the Kia reef owners chose to keep their selected reefs closed to fishing; however some of the 18 sites above were fished between April and November 2007.

The surveys to date have shown that changes in the numbers of sea cucumbers are slow. Increases in numbers are likely to happen over years rather than months. For this reason it was recommended that surveys be conducted annually in November and that the draft management plan reflected this. In the meantime reef owners were requested to keep careful records of the activities on reefs including recording any fishing of sea cucumber while the ban was lifted, or poaching while the ban was in place.

7.1.7 Management plan development process and progress

The presentation of summaries of findings from all of the above surveys to the Kia technical and management committees provided a framework for participatory discussions on management options and the definition of indicators. By December 2006 a draft community-led management plan (*Kia sea cucumber management plan*) was agreed on between the project team, the Kia technical team, and the zone chiefs and became available for wider comment and discussion.

During 2007 two main influences directed the current form of the management plan: the community's desire for the plan to more explicitly cover all marine resources, not just sea cucumber; and the desire for numerous small communities in Kia District, not just Kia community itself, to be parties to the management plan. The first of these reflected the community's belief that policing would be easier if reefs that were closed for specified periods were closed to all fishing, not just sea cucumber. The second was necessary since ownership and user rights extended to communities beyond Kia. Accordingly,

largely under the direction of the Kia technical team assisted by funding from the project, the management plan was widened further to encompass all marine resources. Awareness trips were made by the technical team to outlying villages within the district to ascertain support and to describe the implications.

Regulations on control of resource exploitation were developed. These include management rules that apply to tambu (closed) reefs, open reefs and selected non-commercial and commercial invertebrate species. The management plan currently covers a sea area of 450 km ^{2}.

For tambu (closed) reefs, reef owners were able to decide what reef(s) to include in the management plan as listed 'closed reefs' and on the period of closure. Reef owners have the final say on whether a reef will be closed but the stakeholders, via the technical team, agreed as a group on the designated 'closed' reefs to ensure that there were enough open reefs to enable artisinal fishing to continue. Reefs must be free of ownership dispute to be included in the management plan. Once a reef is closed, it's a 'no-go' zone and is out of bounds to all people, except the resource survey team during data collection activities. When closed reefs are periodically opened, rules governing open reefs apply in full. The Kia technical team keeps records of if and when tambu reefs are opened, and for what reason, for the purposes of monitoring in the plan.

For open reefs, defined as those that are not made tambu, and for all tambu reefs when they are declared open, a series of rules apply. Rules include banning of certain types of fishing gear and practices: e.g. use of outboard motors to harvest Kekeo (milkfish); dynamite and traditional poison leaves; sea cucumber trawl nets; and small mesh-size nets. Other rules relate to night diving and seasonal (e.g. breeding) closures on harvesting a range of marine resources and to controlling near-shore pollution. Rules may also apply specifically to habitats (e.g. mangrove) or to selected commercial and non-commercial invertebrate species. National Fisheries Regulations are incorporated.

Indicators were proposed for each of the three components of the resilience-based dashboard approach. Three levels were defined for a given indicator; indicator meets needs; indicator does not meet needs; or indicator is at crisis level (Table 4). Four indicators were described as being related to community and three to the fishery. The seven indicators overlap the three components of ecology (1), exploitation (2) and socio-economics (4) proposed by Clua et al., (2005). In accordance with the original goals of the project a decision was made early on that sea cucumber would be the target taxon for biological monitoring[6].

[6] *It is anticipated that additional taxa including fish will be included in monitoring from 2008 onward.*

Table 4: Management indicators for the assessment of social-ecological benefits derived from the fishery.

Relation to components proposed by Clua et al., (2005)	Indicators	Measure	Target (1. meet needs, 2. does not meet needs, 3. crisis)
	Community		
Socio-economics	1. Compliance with management rules	# of incidences of illegal fishing	1. Less than 5 incidences reported; 2. Between 5 – 10 incidences reported; 3. More than 10 incidences reported
Socio-economics	2. Continual cultivation of gardens for subsistence	# of new gardens cultivated	1. One new garden per family 2. Maintenance of old garden 3. No garden cultivated
Socio-economics	3. Reduced reliance on beche-de-mer for income	# of fishers deriving income from beche-de-mer	1. Less than 40% of households relying on beche-de-mer for income 2. Between 40 – 70% relying on beche-de-mer for income 3. Between 70 – 100 % of households depend on beche-de-mer for income
Socio-economics	4. High school attendance	# of students sent back to the community due to lack of school fees	1. No student sent back to the community 2. Between 1-3 students sent back to the community 3. More than 3 students sent back to the community
	Sea cucumber fishery		
Ecology	1 Abundance of adult and juvenile sea cucumbers	# of animals encountered on the reefs	1. More than 100 animals/100 m transect 2. Between 40 – 100 animals/100 m transect 3. Less than 40 animals/100 m transect
Exploitation	2. High value species contributed to the catch	# of species caught per fishing trip	1. Four or more species contributing to the catch 2. Between 2-3 species contributing to the catch 3. Less than 2 species contributing to the catch
Exploitation	3. Absence of the use of destructive gear	# of incidences of the use of destructive gear	1. Less than 5 incidences reported 2. Between 5 – 10 incidences reported 3. More than 10 incidences reported

By December 2007 the re-named and expanded *Kia District Marine Resource Management Plan* (KDMRMP) drafted by WorldFish staff following the recommendations of the technical team, became available for discussion at the chiefly level. Responsibilities for administration, enforcement and penalties were spelt out in the plan in and are consistent with the governance structure of Kia District communities. This means that infringements can be reported by any community member and that enforcement is the responsibility of the reef-owning tribe or family or group and if necessary offenders can be taken to the district House of Chiefs.

It was recognised from the start that there was a need to have appropriate recognition from the management plan at the Provincial and National level as well as at the community level. As a step toward making this happen, in early 2008 the Kia District Marine Resource Management Committee felt strongly that an official launch of the plan would mark an important milestone for the work they have done to-date. The KDMRMP was officially launched in Kia village on 23rd May 2008 (Figure 8).


Our environment

Kia villagers unite to protect marine stock

TABU NO FISHING DIVING

CHURCH OF MELANESIA

Tender: External Audit for Church of Melanesia

Figure 8: Press release following the launching of the Kia District Marine Resource Management Plan.

In the early stages of the project there was promising interaction with the UNDP provincial strengthening project in Isabel Province in that the programme was supportive of the project approach and was open to finding ways to engage. However a change of provincial government in 2005 coincided with the end of the UNDP project and there were few opportunities for meaningful engagement after that time. Nevertheless, the province has been represented throughout the activities in Kia through a Fisheries Officer being a member of the technical team. Specific and effective interaction with DFMR, (later MFMR), were however hampered by an ineffectual ministry undergoing the very early stages of an institutional strengthening project (SIMROS). Throughout this WorldFish project every attempt has been made to engage with MFMR and project scientist Dr Ramofafia sat on the Fisheries Advisory Council ensuring that there was a clear flow of information to fisheries decision makers in the country. Nevertheless, a lack of capacity within the ministry meant that few initiatives were acted upon over that period.

In the final six months of the project (December 2007 – June 2008), the co-incidence of a change of national government, the coming of age of the SIMROS project and the appointment of project scientist Dr Ramofafia to the Permanent Secretary of MFMR meant that new and exciting opportunities for effective engagement became possible. The best example of this was the community participation forum held by MFMR in July 2008 in Honiara titled ”Netting Community Knowledge”. The objective was to discuss their Community Strategy with stakeholders including community fishers. Representatives from both Kia and Jorio attended the forum and WorldFish project staff joined other stakeholders to present findings to the forum. The recent progress made by MFMR in developing a community strategy and in consultations regarding improved recognition of community based management plans, is a significant positive step.

For Kia, the management plan’s monitoring and evaluation program remains reliant on external input for assistance with fuel and data analysis. At the end of the project in June 2008, WorldFish was still fulfilling that role. Although the Kia community team are technically able to independently conduct resource surveys, an important part of the follow on ACIAR project, *Improving resilience and adaptive capacity of fisheries-dependent communities in Solomon Islands (*FIS/2007/116) that began in July 2008, is to assist the Kia District Marine Resource Management Committee to investigate means of funding such surveys. One member of the KDMRM committee was assisted to attend a SILMMA proposal writing workshop and since that time has prepared and submitted a proposal for funding to MFMR. In early 2009 the committee was been successful in receiving funding for a boat and engine for the purpose of conducting activities associated with the management plan implementation.

Despite the considerable progress that the community has made all stakeholders (WorldFish, the technical and management committee, MFMR, community members, TNC, provincial government) present at the launching of the management plan recognised that this is just the beginning. The launching set a time-mark from which the adaptive management process will continue, including incorporating lessons learned from monitoring and general compliance. The management plan contains a facility for review every two years, however it is recognised that review may be required at before two years have passed.

7.1.8 Indicator-based monitoring

Development of the Kia District Marine Resource Management Plan has been used by WorldFish as a case study for the design and implementation of a framework for diagnosing and managing small-scale fisheries in developing countries (Andrew et al., 2007). The framework is being tested across a diverse range of fisheries, the first three case studies being in the Niger Basin (west Africa), post-tsunami Aceh (Indonesia) and the present study. The participatory approach adopted in the project with a strong adaptive management focus began to test whether the diagnostic framework can be effectively adapted to accommodate the diversity of fisheries in the developing world, in this test case a rural village bêche-de-mer fishery.

A strong emphasis within the framework is to broaden the management arena to include potential shocks and drivers from outside the resource domain, and beyond the direct control of the resource users. Examples pertinent to the Kia fishery that are clearly external to the resource domain include changes in fuel costs, trends in world markets and civil disturbances. Defining this environment in the community context assisted the fishers in determining the things they could or could not have any control over as well as assisting them to identify areas of vulnerability.

Examination of the Kia community socio-economic conditions enabled a better understanding of the dynamics of resource utilisation and the factors that contribute to, and influence, their usage. The findings will provide a reference point for monitoring of socio-economic indicators within the management plan.

Final decisions regarding marine resource management rested with the chiefs and leaders as is customary in Kia, informed by the technical committee. The committee were tasked with maintaining a good understanding of the participatory diagnosis process as management rules and interventions were developed, to enable them to communicate these effectively to the community and to community leaders. All members of the community (men, women and youths) were able to participate in decision making through public meetings and through opportunities to feed back on written documents to the resource management committee. The role of the WorldFish project team was to facilitate relationships with local and national government, to provide information and guidance when required by the community and to facilitate the actual writing and preparation of an agreed management plan.

According to the current sea cucumber abundance management indicator despite some increases in numbers in 2007, the sea cucumber fishery in the Kia region remained at crisis level. At this stage the levels used to define these criteria need to be revisited. For example the crisis trigger – 40 animals per 100 m transect (800 m^2) is a relatively high density and would still be a healthy stock for many species (Sewell and Levitan, 1992). More suitable ranges are under discussion although to date, these still place the Kia fishery at crisis level.

The suite of indicators selected is now open to testing through the implementation of the Kia Marine Resource Management Plan and the durability and outcomes from the management plan over the coming years will be the ultimate test of the effectiveness of the process taken to get to this stage.

7.1.9 Kia supplementary livelihoods

Opportunities for alternative livelihood generation through the UNDP provincial strengthening project did not eventuate. Early in the project, in 2005, an attempt was made by WorldFish to introduce post-larval capture and culture (PCC) techniques to fishers in Kia, as an alternative means of income. Under a separately funded ACIAR project WorldFish staff visited Kia and trained fishers and a provincial fisheries officer in the techniques. The objective of this livelihood option was to provide a cash income through the export of maricultured fish and crustaceans to the international aquarium market. Uptake was not sustained. At the time of introduction incomes were comparatively high from bêche-de-mer and it was generally believed that this factor reduced the attractiveness of the PCC alternative. Further analysis is required to better understand the mechanisms of success of introducing supplementary marine livelihood options Seaweed farming is one option that is planned to be trialled by MFMR in the Kia district in 2009.

7.2 Jorio region

7.2.1 Socio-economic and fishers surveys

Iriqila is the biggest village in the Jorio region with a population of 1600. Iriqila is led by a paramount chief with individual chiefs heading each tribe. The roles of leaders are to control the village and to take responsibility for community well being. All community group leaders work with the church and the community and meet quarterly at circuit[7]. Traditionally if a tribe wants to tambu a reef the leaders hold a meeting and then tell the community the decision. The penalty for breaking a tambu is custom money[8], cash is accepted but must be to the value of the custom money. In consultations the leaders stated that there were no tambu'd reefs at the time the project began.

The leaders considered that marine resources were very important to community livelihood and that the main problem facing these resources was that stocks were dwindling. The leaders suggested that they could make their own rules and by-laws to protect resources if they were able to engage with the project to obtain advice on options for rules.

The leaders also stated that they would like to see more business opportunities in the community. At the time of the socio-economic and fishers surveys there were seven business owners in the community one of whom was a marine resource buyer. At the time of the survey he was only buying trochus. The community have hosted community livelihoods projects in the past; co-operative society; agriculture (cattle) and the creation of a copra buying point, none of which were active at the time of the survey. They saw opportunities for selling fish, bêche-de-mer (note that the national ban was active at the time of the survey), blacklip oyster (note that a national ban was active at the time of the survey) and trochus were important ways for the community to make money. The leaders identified the beginning of the school year, the Christmas and New Year period and the impending opening of the new church as times of greatest need for money.

Subsequent to the initial Iriqila surveys the decision was made to include the whole Jorio region. Accordingly further surveys were later carried out in the four additional main villages of Leona, Vatoro, Paramata and Tiberius. Results from socio-economic and fishers surveys are detailed in an unpublished WorldFish data report. A summary of those findings and how they guided the development of management plans and community management structures for Iriqila are summarised here.

The average family size (5.9 people) of the population of 594 in Iriqila reflects that of 6.0 recorded for the Western Province (Solomon Islands Govt., 1999). There was a high proportion of young people in the community; 87% of the population surveyed were less than or equal to 40 years old and 58% less than 21 years old. More than 90% of both males and females that were old enough to have attended school, had undergone at least some primary school education. Seventeen percent of both men and women had secondary or tertiary levels of education.

In Iriqila copra, gardening, fishing and working for wages were the primary sources of cash income (Figure 9a). Gardening was the most common primary occupation for more than half of both men and women (Figure 9b and 9c), followed by attending school (27% and 26% for men and women respectively). Housekeeping was primarily the women's responsibility.

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[7] *Circuit is a term used to describe the administrative zone of the United Church (similar to parishes of the Catholic Church) and are broadly geographically defined based on accessibility.*

[8] *Custom money refers to items that were (and still are at times) used for purchasing, barter, dispute resolution and traditional ceremonial acts. The nature of items used for custom money vary between region and ethnic group. For example in Western Province 'bakiha' ('shell money') which is carved shell jewelry is used.*

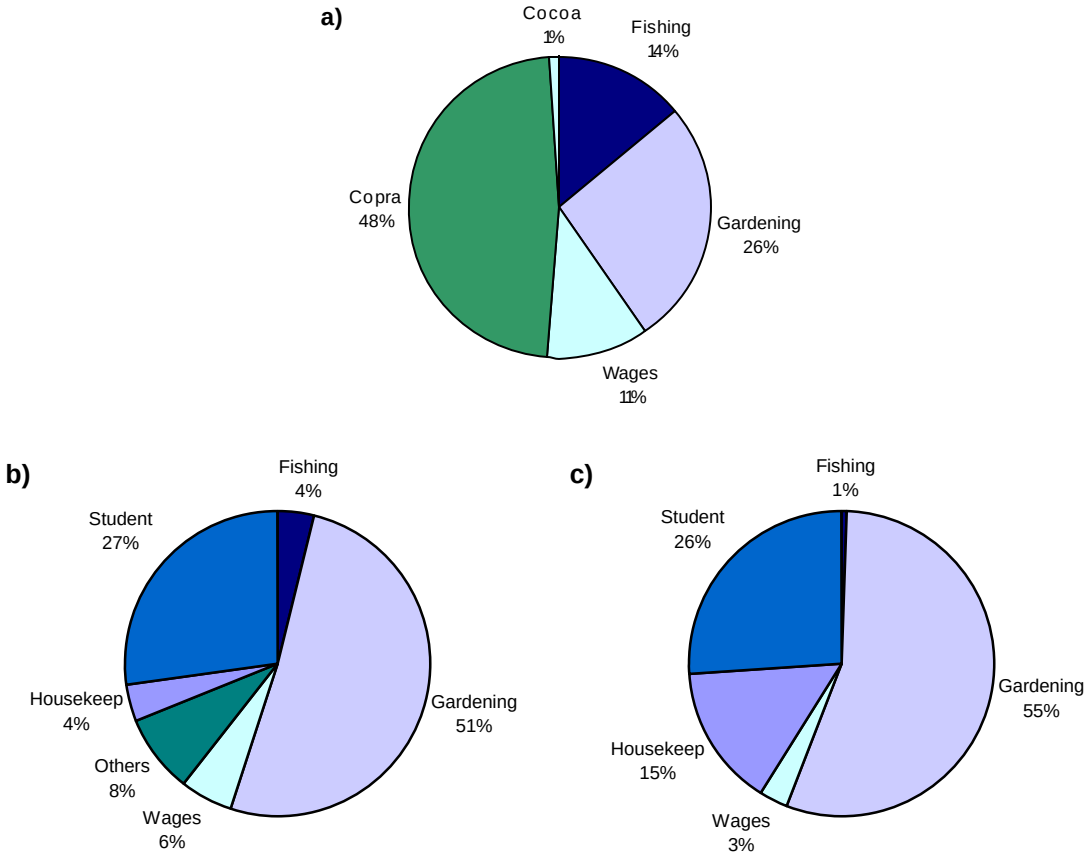

Figure 9: a) Primary income source of all surveyed households in Iriqila (n=92), and b) primary activity of male (n=213) and c) female (n=183) household members above age 10 in 2007.

The four most common occupations (gardening, student, housekeeping, and wage employment) were undertaken by both men and women although more women than men listed housekeeping as their primary employment while more men than women listed wage employment (6% and 3% respectively for male and female).

Fifty five percent of the interviewed households in Iriqila owned land or belonged to land owning tribes. In Iriqila most of the land area is registered and so is communally owned, otherwise land is tribally owned. However the situation for the sea areas is not so clear cut as the status of the sea area adjacent to the registered land is not always agreed on. Nevertheless a third of those questioned described themselves as reef owners or belonging to reef-owning tribes.

Raising animals as a form of income is limited in Iriqila. Whilst a number of respondents (20-30%) raised pigs and chickens, only a few sold them to obtain cash. This likely reflects that the primary purpose of raising animals being for household consumption, and the remoteness of the village (meaning that markets are opportunistic in nature). Coconut and betelnut were the two most commonly planted trees, with coconuts (i.e. in the form of copra) being utilised by the majority of respondents as their primary source of cash income.

The income range of a majority of respondents was $200-$299 a month, with copra (48%) and marketing garden produce (26%) being primary sources of income at the time the bêche-de-mer ban was in place. Fishing (including trochus) provided income for 14% of respondents (Figure 9a). This contrasts to Kia where fishing remained the main source of

income for 80% of people during the time of the bêche-de-mer ban (Ramofafia et al., 2007).

Food comprised the greatest expenditure for 74% of households. Of non-food item expenses, schooling was the greatest overall expense comprising an average of 41% of monthly expenditure. This was followed by the purchase of durable assets; fuel (8%) and clothing (6%). Every household owned at least one hurricane lamp. After this, the most common durable assets owned by respondents were cassette player or radio (33%), sewing machine (28%), outboard motor (12%) and fibre canoe (8%).

A fishing line was the most common fishing gear owned and was owned by 68% of respondents (Table 5). More than half of the respondents owned homemade spears and 42% owned spear guns using store bought rubber. Swimming goggles were owned by 37% of respondents but only 3% owned a full diving mask.

Table 5: Percent of respondents with at least one of these items of equipment (n= 30).

Equipment	% of respondents
Line	68
Spear	56
Speargun	42
Goggle	37
Gill net	8
Mask	3
Rocket Bomb	1
Shark fishing	1

Shop-bought goods used for meals on a daily basis were predominantly rice and sugar. Noodles, tea, taiyo (tinned tuna), biscuits and salt were regularly consumed. Depending on the household, between $2 and $125 per week was spent on food from the market. Fifty-four percent of respondents owed money to various persons; 43% to shopkeepers, 10% to wantoks[9] and 1% to unspecified others.

The survey also targeted information that would clarify community perspectives on well-being, leadership and governance. The majority of respondents felt that community leaders worked well together (Figure 10a) and that the community respected their leaders. The general sense of strong leadership (59% believed that leadership was strong or very strong, 24% believed it was variable and 17% described it as weak (Figure 10b)) was viewed as being a likely positive factor in the further development of marine resource management in the community. Successful implementation of community-based management measures requires effective and strong governance structures to be in place.

Although fishing was not a common primary occupation, 90% of households agreed or strongly agreed that marine resources were important to their livelihoods. However, despite getting cash benefits from marine resources, 83% of households stated that they would experience little or no hardship if cash benefits from marine recourses ceased. The remaining 17% believed that they would face difficulties if no further cash could be obtained from marine resources; difficulties included going hungry and/or no longer being able to afford school fees and medicine.

[9] *From the English "one talk", refers to a person or group of people that share the same language and ethnicity. The extent of the affiliation (e.g. village, region, country) can depend on the context in which it is used.*

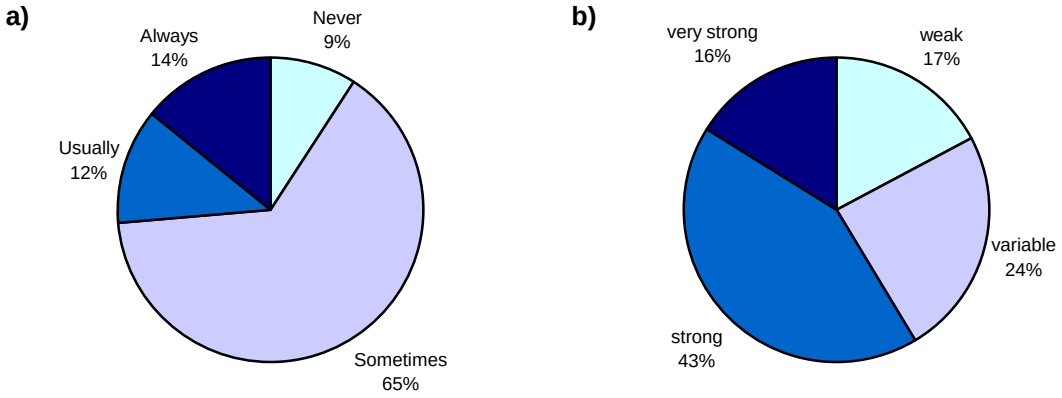

Figure 10: Perception of surveyed households (n=99) in Iriqila of a) how well community leaders work together and b) the strength of community leadership in 2007.

7.2.2 Sea cucumber fishery: Community utilisation and management perceptions

Fishers were asked to consider sea cucumber numbers 2 years and 5 years prior to the ban and whether they had noticed any changes in their fishing areas over this time. The majority (83%) of the fishers reported they had seen a decrease in sea cucumber numbers while 17% had noticed no change. Fishers stated that by 2005 finding sea cucumbers was quite hard (80%) or very hard (20%). Fishers were asked what they thought the reason was for this; the difficulty was attributed to several reasons including (i) decrease in sea cucumber numbers over the years (80%), (ii) increased number of fishers due to the absence of alternative ways of generating income (10%) and (iii) rough weather (3%).

Twenty taxa of sea cucumber were regularly collected by Iriqila fishers from all reef habitats (Table 6) including inter tidal, lagoon, reef flats, reef slopes and near mangroves. In 2005, 73% of the 30 fishers were fishing the same fishing grounds they were fishing 2 and 5 years ago. The remainder who had moved to other fishing grounds cited reasons such as decreasing sea cucumber stocks and the discovery of new and healthy fishing grounds. Similarly, 70% of the fishers fished the same depth in 2005, 2003 and 5 years ago, while the remaining 30% fished at different depths. Reasons cited for the change in fishing depths included decreasing sea cucumber stocks in shallow waters and that high value species, no longer seen in shallow waters, could still be found in deeper waters.

Fishers conducted their fishing activities in their designated customary owned reefs or they could fish in areas belonging to other tribes. In that case, special arrangements were made which could involve (i) a marriage relationship, (ii) permission to fish from reef owners and (iii) going on joint fishing trips with reef owners. Fishing was also allowed on some reefs that were open to all (free access).

In general fishers used a paddle canoe, goggles and a torch to harvest sea cucumber. The processed catch was sold to buyers in the village or in Gizo town. On a regular basis, buyers from Gizo travelled to Iriqila to purchase bêche-de-mer. The average monthly income earned from these sales ranged from less than $500 up to between $2000 and $3000.

Table 6: Sea cucumber species caught in Iriqila from 2000 to 2005 based on fisher surveys 2007. Species are arranged in alphabetical order of local trade name.

Scientific Name	Local trade name
Actinopyga miliaris	Blackfish
Holothuria nobilis	Black teatfish
Stichopus sp.	Brown curryfish
Stichopus hermanni	Curryfish
Bohadschia vitiensis	Brown sandfish
Bohadschia similis	BS4 (Chalkfish)
Actinopyga echnites	Deepwater redfish
Holothuria fuscopunctata	Elephant trunkfish
Stichopus chloronotus	Greenfish
Holothuria atra	Lollyfish
Stichopus horrens	Peanutfish
Holothuria edulis	Pinkfish
Thelenota ananas	Prickly redfish
Holothuria sp.	Red Snakefish
Holothuria scabra	Sandfish
Holothuria coluber	Snakefish
Actinopyga lecanora	Stonefish
Actinopyga mauritina	Surf redfish
Bohadschia argus	Tigerfish
Holothuria fuscogilva	White teatfish

Sixty percent of fishers stated that the closure of the fishery was a problem for them and their families as bêche-de-mer was one of their primary sources of income. Forty percent indicated that they were not affected by the ban. For those who were affected, they had resorted to other activities to earn money. These activities included marketing garden products, making copra, harvesting trochus, and making canoes. Other less common sources of income were from finfish fishing, gardening, betel nut selling, building local houses, making paddles, and from waged employment. All interviewed fishers who were married (with the exception of one) had gardens and all spent two or more days per week in the gardens.

Sixty-seven percent of the 30 fishers practised self-imposed size selection of sea cucumber, but the remainder harvested all animals encountered. Three reasons were given by the 20 fishers who harvested only adult animals and these included (i) smaller animals were undersized and immature, (ii) buyers rejected undersized animals and (iii) undersized animals yielded less value for money.

The responsibility to manage and protect sea cucumber habitats was, according to 78% of the 30 fishers, the chiefs' responsibility. Ten percent thought that management of sea cucumber habitats was the responsibility of the chiefs with the assistance of others. The remainder thought that individuals, the villagers, and / or village leaders should be responsible.

At the end of the survey, the fishers were asked if they wanted to share their view on the bêche-de-mer fishery. Thirty three key issues were raised. Of these, 48% related to the need to lift the current ban as fishers now had financial difficulties. On the other hand, 18% supported the current national ban as they believed restoration of sea cucumber stocks was needed. A further 18% of the comments related to the need to increase the buying price once the fishery become open again. Two (6%) other comments related to the need for fishers to be provided with information on sea cucumber biology and ecology. Also raised was the need for the village fishery to have a management plan (3%), the need for a bêche-de-mer buyer to be located in Iriqila (3%) and for buyers to buy unprocessed animals (3%).

7.2.3 Biological monitoring survey results

The 2008 baseline surveys of 13 Jorio reefs found a total of 66 individuals comprised of 10 sea cucumber species (Table 7). Of these, 30 were low value lollyfish.

Table 7: Total number, percent contribution to abundance and density of sea cucumber species recorded at all survey sites on Jorio reefs in 2008.

Local trade name	Scientific name	Number	% of total	Density (animal/ha)
Lollyfish	*Holothuria atra*	30	45.5	4.8
Deep lollyfish	*Holothuria atra*	9	13.6	1.44
Ripplefish	*Pearsonothuria graeffei*	6	9.1	0.16
Leopardfish	*Bohadschia argus*	6	9.1	0.48
Pinkfish	*Holothuria edulis*	4	6.1	0.64
Black teatfish	*Holothuria nobilis*	3	4.5	0.48
White teatfish	*Holothuria fuscogilva*	3	4.5	0.48
Brown sandfish	*Bohadschia vitiensis*	2	3	0.16
Prickly redfish	*Thelenota ananas*	2	3	0.32
Elephant trunkfish	*Holothuria fuscopunctata*	1	1.5	0.16
	Total	**66**	**100**	

Of the 13 reefs; the highest densities were recorded on Modiudu, Tibitibi and Pezokombukombu (Figure 11). Tibitibi, Bebea and Sauka were the most species rich sites, with 6 and 4 species each for Bebea and Sauka. Less than 5 individuals were seen on each of Omauva, Reva, Pipiturai, Rosiamati, and Tabezaru, and no sea cucumbers were seen at Poro and Tokekolo.

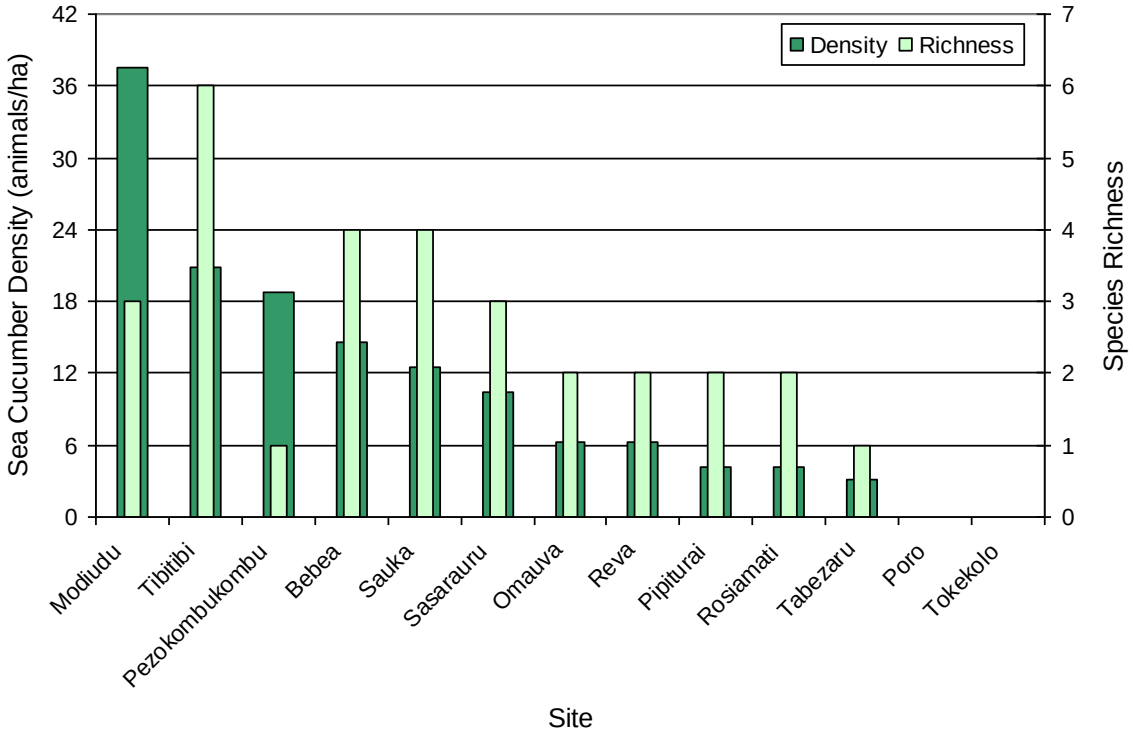

Figure 11: Sea cucumber density and species richness at coral reef sites (pooled from 6, 800 m^2 transects per site) within the management area of Iriqila in 2008.

7.2.4 Jorio region management plan development process and progress

The findings from the household and fishers surveys in Iriqila provided a framework for participatory discussions on management options for the Jorio region. The management plan included similar management rules to those developed for Kia. They apply to tambu (closed) reefs, open reefs and selected non- commercial and commercial invertebrate species.

In summary the rules state that with respect to tambu (closed) reefs tribal leaders decide what reef(s) to close and for what period. There is no fishing or diving for the purpose of collecting any marine resource on closed reefs. Once a reef is closed, it is a 'no-go' zone and is out of bounds to all people (Jorio and outsiders) including reef owners themselves, however WorldFish staff and community representatives conducting biological surveys can gain entry to these closed reefs for the purposes of data collection for community information. Each reef owning group in the Jorio region has defined a protocol for opening and closing reefs and these are listed in the plan. The liberty to change these protocols at times when the management plan is reviewed remains the responsibility of the reef-owning group and users of the respective reef. Closed areas may be proposed specifically for Sivele (mangrove shell).

All rules governing open reefs (these include harvest size limits, banning of certain fishing methods and gear, regulations on net size and restrictions of fishing at spawning aggregations) apply to closed reefs when they are open meaning that the management plan covers a sea area of approximately 170 km^2.

The key activities that have taken place in Jorio communities as part of the process of developing the management plan are briefly summarised below.

2006 activities included:

- Planning discussions with Iriqila community
- Socio-economic and fishers surveys (Iriqila)

2007 activities included:

- Post-tsunami rapid assessments (Iriqila and Leona)
- WorldFish visits to other Jorio communities (Tiberius, Paramata, Vatoro, Leona)
- Workshop with community representatives and WorldFish at Iriqila to introduce project
- Community representatives select JMRM committee
- Committee met independently to define the rules sections of the management plan
- Workshop with WorldFish and JMRM committee at Iriqila to formulate rules
- Committee members return to communities to discuss rules in public meetings
- WorldFish visits each community independently to answer questions from the community
- Draft management plan formulated for representatives to discuss with community [December 2007]

2008 activities included:

- Training of JMRM technical team, comprised of two representatives from each community in surveying of benthic invertebrates
- Baseline survey of resources carried out by JMRM technical team and WorldFish
- Tiberius / Paramata and Leona independently implement tambu's on selected reefs and mangrove areas [February 2008]
- WorldFish marine resource awareness trip to all communities
- Finalise management plan
- All rules to be implemented by September 30 2008
- Prepare and erect signboard on tambu reefs (materials provided by WorldFish, signs painted by artist in Paramata community)

Plate 4: Women and children in Iriqila attend an awareness session.

7.2.5 Jorio supplementary livelihoods

To date supplementary livelihoods have not formed a part of the work in Jorio. Since the start of this project in 2005, WorldFish staff have made considerable progress in understanding the feasibility and limitations of current supplementary marine livelihoods on offer. At this stage the need for further product development (pearls and sponges) and transport limitations, including high fuel prices (marine aquarium trade in corals and clams) mean that current options that are available through WorldFish are not yet economically feasible for the communities for Jorio. As part of FIS/2007/116 relationships with other non-marine supplementary livelihood projects or providers, e.g. coconut oil presses and Kastom Gaden[10] will be explored, however our primary approach in working with the community has been focused on them determining what management processes they can put in place that do not hamper their ability to retain food security.

[10] *Kastom Gaden" is a Solomon Islands Pidgin language term meaning customary gardening. The Kastom Gaden Association works with Solomon Island communities to improve their food security.*

8 Impacts

8.1 Scientific impacts – now and in 5 years

This project played a critical role in developing WorldFish's methodological approach to resilience-based management and laid the foundation for the follow-on project on resilience in Solomon Island fisheries (ACIAR Project FIS/2007/116). The outcomes and lessons learned from this project have contributed to the intellectual basis (e.g. Andrew et al., 2007) of the WorldFish global Resilient Small-Scale Fisheries campaign that is being turned into research projects with partners in Asia and Africa as well as the Pacific. Growing out of experiences in this project, Andrew et al., (2007) proposed an implementation framework that specifically addresses the challenges presented by SSFs in the least developed countries. The management plans and indicators developed for Kia and Jorio villages are the first to be developed using this framework and associated concepts.

In Solomon Islands the utilisation of the PDAM framework in the development of CBAMPs has the potential to accommodate existing tools for participatory techniques to facilitate communities in developing effective co-management arrangements. In five years time it is anticipated that communities will be able to easily access information about agreed processes required to develop a management plan and to have it recognised within national fisheries policy, and have access to national or provincial resources to make that happen.

Within Solomon Islands the socioeconomic characterisation of the bêche-de-mer fishery and its utilisation provides an important basis for planning and executing the fishery management plans within Kia as well as more widely throughout the country. The ongoing collection of data on the status of wild stocks of sea cucumbers in Kia and Jorio waters will add to the growing body of information on the status of sea cucumbers in Solomon Islands that has been collected by other organisations working in the country including SPC's ProcFish program, Foundation of the People of the South Pacific International (FSPI), WWF-Solomon Islands, The Nature Conservancy (TNC) and MFMR. Specifically it provides a scientifically robust baseline dataset for the project communities at sites where follow up surveys will be completed.

In five years time monitoring will have provided crucial data to contribute to the testing of the hypothesis that the utilisation of a PDAM with CMT in Solomon Islands can result in increased resilience of communities and fisheries. The elements of successful co-management of coastal marine resources will be identified over the next five years through building a participatory management approach around the concept of resilience. Scaling up from these experiences we expect to see significant progress toward the development of an experience-based suite of resilience indicators for fishery systems in the developing world (Andrew et al., in prep). Regardless of the final form, a clear process is required to select from long lists of diverse, potential indicators (Rice and Rochet 2005) and it is expected that through subsequent work that builds on this project, and that works with the communities to effect their management plans, such a process will be determined for Solomon Islands, wider Melanesia and other countries in Asia, Africa and the Pacific. The next five years is expected to see considerable progress on the challenge to build bridges between the rapid advances in research and analysis and the real-world legal, policy and organisational constraints of SSF management, particularly in developing country contexts.

8.2 Capacity impacts – now and in 5 years

Capacity impacts are primarily at the community level and at the national staff level. At the community level these included:

1. Participatory community leadership training for the bêche-de-mer Project Management Committee and men of Kia community (November 2005).
2. Participatory community leadership training for the Provincial Fisheries Officer (Kia), the youths and women of Kia community (September 2005).
3. Kia Project Management Committee members attended SILMMA's 'look and learn' trip to Roviana and Tetepari Community-based programs (February 2006).
4. Biological survey training of the Kia 'technical team' at WorldFish Center, Gizo (October 2006).
5. Resource monitoring survey of Kia district reefs by the Kia technical team (November 2006 and November 2007).
6. Attendance at a SILMMA proposal writing workshop by a member of the Kia management committee (2007). This was expected (and has subsequently been proven to be the case) to assist Kia District to obtain funds from MFMR to allow monitoring and assessment to continue relatively independently into the future, as set out in the Management Plan.
7. Biological survey training of the Jorio region 'technical team' at WorldFish Center, Gizo (March 2008).
8. Resource monitoring survey of Jorio region reefs by the Jorio technical team (April 2008).
9. Attendance at the fist community workshop for coastal fisheries held by MFMR, Honiara. In mid 2008 representatives from both Kia and Jorio (along with representatives associated with related projects in other parts of the country) attended this important workshop, which had the goal of 'netting community knowledge' to better ensure coastal community participation in Solomon Islands inshore and coastal fisheries management. This was the start of the process of recognising the work of communities such as themselves, in fisheries legislation and policy.

The participatory approach taken to develop management plans has provided the communities with a greater understanding of how to develop a management plan and to identify some steps that can be followed for similar endeavours in the community. Participatory discussions have helped build understanding of how a community can identify its own problems and seek solutions appropriate to their local situation. Ownership of the management plans was vested in the community who have frequently voiced a desire to work hard to implement the plan successfully due to this sense of ownership.

Capacity impacts were also achieved at a national staff level. In 2007 a Solomon Island graduate in marine science was brought on to the WorldFish team. This addition was a great bonus to the team in assisting the in-country project leader to progress data analysis and write-up. The graduate's involvement in this (and the subsequent phase II ACIAR project) is providing her with a wide range of skills in community based management that will equip her to engage fully in decision making regarding Solomon Island marine resource management into the future.

A significant development was associated with a change in national government in Solomon Islands. In January 2007 the in-country project leader Dr Chris Ramofafia left WorldFish to take up the senior government post of Permanent Secretary of the Solomon Islands Ministry of Fisheries and Marine Resources. While this was a loss to the project, the capacity that he has built through this (and other) projects will be a critical factor in the success of his career in MFMR and so the medium to long term future of marine resource management in Solomon Islands. It has also provided an opportunity for WorldFish to

recruit a new MSc graduate who in 2008/2009 is taking a leading role in ACIAR project FIS/2007/116. At the time of writing project FIS/2007/116 has a strong component of utilising the apparent window of opportunity to incorporate Community Based Management into the new Fisheries Act and MFMR strategies.

8.3 Community impacts – now and in 5 years

Community impacts were achieved through the project's participatory approach and various training workshops. The communities have gained a realisation that effective resource management can be most effectively achieved under strong community leadership and governance, and that there is a link between effective resource management and the ability of the community to govern and care for itself. The formation of project management and technical committees to support the project at the community level, have been important steps towards community commitment to better stewardship of resources. Despite this progress, the high population growth rate and high proportion of young people in the target communities have important implications for co-management approaches that require greater emphasis. The high numbers of young people will be placing greater demands on marine resources in the future and will eventually move into positions of decision making. Targeting them specifically while developing co-management approaches requires specific consideration within the PDAM process. Some progress toward this has been made in the target communities; young men in the Kia and Jorio communities are now able to independently conduct resource surveys, understand what the data is showing and spread that information to other community members. This supports their personal observations of diminishing resource abundance and size, resulting in a greater realisation by the community of the need for some sort of marine resource management.

The development of both the Kia and the Jorio management plans has provided avenues for participatory discussions on management. This has resulted in a strong sense of ownership of the plans and an increased willingness by the community to take the lead on conserving and managing their resources. There is also increased realisation that they must take the initiative to manage their resources, while continuing to seek assistance from appropriate partners.

The women in Kia were very involved in the initial meetings, discussions and trainings in 2005-06, however another priority took precedence in that there was an imperative to complete the construction and beautification of their new district church which was officially opened in 2007. In May 2008 they were ready to take on new challenges and they approached the WorldFish team to request specific training for a newly formed women's group (through the church) to spread the word to other women about marine resource management and their management plan. Men and women in Kia identified that by empowering all women in the households there was the opportunity to get the message to the wider family and especially the children, thereby strengthening and improving marine resource management in the longer term. After piloting in Kia, development of this training for all project communities will be an important output for ACIAR project FIS/2007/116.

Apart from working directly with the communities in rural areas it can also be important to consider Honiara community members to ensure successful community based marine resource management in the rural areas. For Kia, some meetings specific to the development of the KDMRMP plan have been held with community members who are based in Honiara but we recognise that formally including Honiara members for all areas where we work is something that, on a case by case basis, is likely to require more effort. "Buy-in" from the Honiara based community members has the potential to assist in long term success of CBM, through funding and through providing the link to decision makers in Honiara.

8.3.1 Economic impacts

Although low in commercial value compared to pelagic (tuna) fisheries, nearshore fish stocks are an important, sometimes critical, source of income for coastal rural communities in Solomon Islands. These include sea cucumber, trochus, fin fish (for domestic urban markets), shark fin and, in Malaita, gastropods for the shell money trade.

The value of artisanal, or subsistence, fisheries has not been measured precisely; however, it is the basis of both food security and cash for most of the 80% of the population that comprises the rural sector of Solomon Islands. On average between 2001 and 2004 the sea cucumber fishery supported SBD$2.8 million worth of bêche-de-mer exports (Kinch et al., 2006). The economic impact of the loss of the bêche-de-mer fishery would be significant to the rural sector.

For fisheries (including sea cucumber) that are declining or depleted because of unsustainable levels of fishing, the quantities harvested and income earned are likely to fall in the short term once management measures such as size limits, fishing seasons or other management restrictions are imposed to reduce fishing pressure, either through national laws or as part of the types of Community Based Management that is central to this project. This will not be the case for lightly fished species where current levels are considered sustainable; management will aim to constrain catches from increasing to unsustainable levels.

The long-term net economic impact of not introducing sustainable fishing practices would almost certainly be worse: high income in the short term would mean lost opportunity for income for many years (perhaps decades), as examples from inshore fisheries (including sea cucumber) elsewhere would suggest (Skewes et al., 1999; Lawrence et al., 2004; Battaglene and Bell, 2004).

8.3.2 Social impacts

Immediate benefits from this project have accrued to the communities where the work has been done. They have been empowered and encouraged to make decisions about their marine resources themselves. Social benefits have ensued through capacity building and through (i) the implementation of the marine resource management plans; and (ii) the establishment or strengthening of marine resource management committees.

By building communities' capacity to manage their customary resources effectively, the project has stimulated and strengthened community stewardship and collective action mechanisms, thereby increasing the ability of the community to increase its own resilience.

This community resilience and associated ability to adapt to change is further expected to be increased by diversifying patterns of resource use, increasing (or maintaining) resilience of the resource base, and by encouraging supplementary livelihood activities. This in turn will decrease the vulnerability of the communities to external shocks that would otherwise impact negatively their livelihood, food security and overall welfare. An additional expected benefit of increased community awareness of the status of, and threats to, their marine resource is an increased ability to engage at the provincial and national level with policies that affect the communities' ability to utilise their resources.

8.3.3 Environmental impacts

Marine organisms and the habitats they live in are inextricably linked. Reductions in habitat quality or quantity (i.e. indiscriminate destruction of mangroves) or a reduction in the abundance of one or more taxa caused by fishing (or any other reason) are therefore likely to affect the wider marine environment. For example, sea cucumber species assist in keeping the sea floor in a well-oxygenated state by their burrowing and feeding activities, and this allows the establishment of a rich and diverse infaunal invertebrate community and associated fish community. This project has assisted Kia and Jorio communities to identify aspects of concern in relation to marine habitat quality and to

identify rules to try and prevent further reductions in habitat quality in the future. These include rules related to mangrove cutting, commercial fishing, specific marine taxa and fishing methods. Reducing overfishing and destruction of near-shore habitats will contribute to a resilient ecosystem, more able to recover from external shocks.

By including these rules within management plans they will, as they become embedded, contribute to the conservation of biodiversity through sustainable resource use. This will be effected by increased awareness via targeted education in the communities and monitoring programmes and through establishing long lasting mechanisms (management plans and strengthened governance at community, provincial and national levels) that can adapt and be applied to changing local and external conditions.

8.4 Communication and dissemination activities

Communication and dissemination activities have occurred with a variety of target audiences in mind. These range from reports and articles targeting regional practitioners to face to face discussions with rural communities in their villages. Each target audience requires a different media, a different approach and in many cases different people to carry out the communication activity.

Four reports or articles[1-4] have been produced directly from the project. These have been made accessible to a wide range of regional practitioners through inclusion in the ReefBase Pacific Database http://pacific.refbase.org ; a WorldFish led database project that began in 2006.

Within Solomon Islands general public information about the community based management work of the project has been disseminated through two-page fliers about the project goals suitable for dissemination to villagers and to interested people visiting the WorldFish offices in Gizo and Honiara. Fliers have also been made available at MFMR/ NGO stalls at the annual, national trade show where WorldFish staff have been on hand to give Powerpoint presentations and to answer questions from the general public.

The local national newspaper, the Solomon Star, has published articles marking milestones of interest to rural Solomon Islanders including articles describing the completion of the resource survey carried out by WorldFish staff and the Kia community survey team in November 2006 and the launching of Kia District Marine Resources Management Plan.

The communities in which the project has been working have (during the life of the project) had no telephone, television or email access and occasionally see out of date newspaper. This means that workshops and trainings where various stakeholders can come together and learn from each other, are a vital component of the mix of communication and dissemination activities.

During the project such opportunities have been provided through the project implementation workshop, Honiara, April 2005; training on participatory community management for Kia women and Youth, Kia community, September 2005; training on participatory community management for Kia men and community project committee, Kia community, November 2005; resource survey training seven men from Kia (2006) and ten men from Jorio (2008) and attendance by community representatives at the MFMT "Netting community knowledge" workshop in Honiara in 2008. Feedback from such trainings is positive and enthusiastic with participants almost always asking for more information. As a further opportunity to learn from each other the Kia technical team attended SILMMA's 'look and learn' trip to Roviana and Tetepare community-based programs (February 2006). From experience and training within the project the technical team were confident to conduct awareness trips themselves within the Kia District and were largely instrumental in bringing a further 13 communities under the banner of the management plan.

WorldFish purchased a power point projector and portable generator in late 2006 enabling us to start preparing and presenting targeted presentations within the communities where we work. This form of media which is presented by Solomon Islands staff and can be very interactive, has proven very popular in the communities engendering much discussion. While the community members frequently express gratitude at the new lessons they have learned, the process of presenting has also taught WorldFish staff a great deal about the type of presentation that works, what information people want to know and through experience we have improved on ways to explain sometimes complex ecological principles in pidgin.

Powerpoint presentations are now a regular part of our community work and are constantly being modified to fit the target audience and their particular needs. Presentations have included general marine resources biology and awareness, summaries of findings from resource survey's to the Kia and Jorio communities through presentations at community meetings by WorldFish staff (2006-2008) and the post-tsunami community Powerpoint presentation roadshow in 17 Western Province communities May/June and again in August/September 2007. We have occasionally shown DVD's produced by other organisations as part of the presentation and these are well accepted. However we find that the Powerpoint presentation is a highly interactive tool enabling the community to ask questions and to refer back to particular slides within the presentations.

Another target audience has been the decision makers in National government in Honiara. Dr Ramofafia presented on the 'Status of the local bêche-de-mer fishery: is the ban on bêche-de-mer harvesting and exporting necessary?' at the Solomon Islands National Fisheries Conference, Honiara, July 2005 and Dr Schwarz presented the findings of the project and the plans for future work at the MFMR CBM workshop in July 2008. Dr Ramofafia was a member of the national fisheries advisory council and was replaced by WorldFish staff member Mr Cletus Oengpepa when he left to join MFMR in early 2008. This is a position of influence at the national government level in determining the direction of Small Scale Fisheries management, including CBAM, in Solomon Islands.

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2. Nash W. and Ramofafia C. 2006. Recent developments with the sea cucumber fishery in Solomon Islands. SPC Bêche-de-Mer Bulletin 23: 3-4.
3. Ramofafia C., Nash W., Sibiti S., Makini D. and Schwarz A. 2007. Household socio-economics and Bêche-de-mer resource use in Kia community, Isabel Province, Solomon Islands (June 2005). Unpublished project report to ACIAR prepared by the WorldFish Center as an output from the ACIAR/ WorldFish Center Sea Cucumber Fishery Management project FIS/2003/051– Solomon Islands.
4. Ramofafia C., Schwarz A., Sibiti S., Makini D., Notere D. and Nash W. 2008. Life after the ban: impacts of the national sea cucumber harvest and export ban on household socioeconomics of Kia community, Isabel Province, Solomon Islands. Unpublished project report to ACIAR prepared by the WorldFish Center as an output from the ACIAR/ WorldFish Center Sea Cucumber Fishery Management project FIS/2003/051– Solomon Islands.

9 Conclusions and recommendations

9.1 Conclusions

The project was focused on the Solomon Island sea cucumber fishery. Two target communities (community clusters) went through a participatory and consultative process that included; household socio-economic and fishers questionnaires and focal group discussions, identification and implementation of management measures and the development of a community marine resource management plan. Villagers were trained to conduct biological surveys of the status of the sea cucumber stocks in order to implement a village sea cucumber monitoring program.

The process took three years to produce a management plan in Kia and two years in Jorio. The shorter time in Jorio was due to implementation of lessons learned, through an adaptive learning process by the WorldFish team, and an increased capacity in the WorldFish team.

At the commencement of the project the national team had significant ecology and related community experience in Solomon Islands. However the community based management approaches for marine resources utilised and developed through this project were innovative in the Solomon Islands context and required the project team to develop both their skills and approach.

All project communities had an interest in including a wider range of marine resources than just sea cucumber under their management plans and this is reflected in the wording of the plans but is not yet adequately reflected in the selected indicators. The definition of indicators was an integral part of the development of the Kia Community Marine Resource Management Plan. The proposed indicators were strongly based on the results of the household and fishers surveys and attention was given to ensuring they were measurable within the context of the project, meaningful and easily understood by all stakeholders. Indicators were proposed for each of the three components of a resilience-based dashboard approach; socio-economics, ecology and exploitation. Three levels were defined for a given indicator; indicator meets needs; indicator does not meet needs; or indicator is at crisis level. Effective monitoring and assessment of indicators, incorporation of community based management plans into policy and reviewing management plans are some of the challenges identified by communities for effective implementation of co-management into the future.

Both communities experienced external shocks over the study period: for the Kia and Jorio region, the bêche-de-mer ban; and for the Jorio region, the 2007 earthquake and tsunami. Both have shown elements of resilience to these shocks by shifting from one income stream to another (gardening or a different marine commodity) but a lack of cash has also led to lifestyle changes in some cases such as less children being able to attend school. The need to deal with these two significant external shocks proved that flexibility in the project and the adaptive learning approach were appropriate mechanisms for ensuring long term goals could still be achieved despite the need for shorter term changes in direction.

This project played a critical role in developing WorldFish's methodological approach to resilience-based management and laid the foundation for the follow-on project on resilience in Solomon Island fisheries (ACIAR Project FIS/2007/116). The outcomes and lessons learned from this project have contributed to the intellectual basis (e.g. Andrew et al., 2007) of the WorldFish global Resilient Small-Scale Fisheries campaign that is being turned into research projects with partners in Asia and Africa as well as the Pacific. Growing out of experiences in this project, Andrew and colleagues (2007) proposed an implementation framework that specifically addresses the challenges presented by SSFs in the least developed countries. The management plans and indicators developed for Kia

and Jorio villages are the first to be developed using this framework and associated concepts.

Lessons and challenges identified in the communities have been central to guiding development of the follow on ACIAR project *Improving resilience and adaptive capacity of fisheries-dependent communities in Solomon Islands (FIS/2007/116)* within which there is a stronger focus on working with MFMR to incorporate CBM plans into a legislative framework. WorldFish will continue to work with Kia District and Jorio and will also work with three 'new' communities bringing the number of provinces to a total of three (Isabel, Western and Malaita).

9.2 Recommendations

A number of lessons have emerged from this project and the recommendations made here intend to build on those lessons.

The PDAM framework is proving to be an effective way to organise activities in the community and within which to define stakeholder milestones. The more that activities can be organised within the framework the clearer the pathway is for practitioners and communities alike. The effectiveness of the management feedback from indicator monitoring remains to be tested and will require partner (NGO or government) input to the communities in the initial years after management plans are launched.

Hasten slowly and remain adaptable. The closure of the Solomon Islands sea cucumber fishery in December 2005 and subsequent impact of this on the relationship between the project team and target communities led to a much longer engagement with the initial community than anticipated. This led, eventually, to a much better mutual understanding of each other's world view, a deeper level of trust, and a more effective adoption of the management planning process. As a result 14 neighbouring villages over a distance of about 120 km of coastline requested to take part in the management planning process. There needs to be sufficient time available and flexibility of schedules for projects to fit with the communities timetable.

Identify the elements of resilience. Longitudinal studies of the communities as part of ACIAR project FIS/2003/051 showed that the closure of the sea cucumber fishery removed a primary income source, thereby creating severe financial difficulties both at the family and community level. Absence of cash led such things as a reduction in purchase of shop food, the closure of shops, and inability to pay school fees. Nevertheless, elements of resilience were evident in Kia; cultivation of gardens for daily subsistence increased during the fishery closure. This led to increased consumption of local food and reduced reliance on shop-bought food items.

Integration into provincial and national policy is desired by the communities to support enforcement at the community level. The Kia community in particular has progressed far enough with its management plan to experience the difficulties associated with community level enforcement. Support from the appropriate chiefs is not always forthcoming and an inability to police all fisher's activities means that repeated breaking of rules can go unpunished. Insufficient staff resources in WorldFish, in the initial stages of the project meant these activities could not adequately run in parallel. Future activities include strengthening the Management Plan Committee and working with the provincial and national government to strengthen these aspects of management plan implementation.

People need money even in remote rural areas. Few marine alternative livelihood options that are currently available to rural Solomon Islanders are suited to remote communities without adequate transport networks. If non-marine livelihood options appear suitable it is recommended that links are made with appropriate NGOs to progress these opportunities. Facilitating supplementary livelihoods within the PDAM framework will ensure that recommendations highlighted by O'Garra (2007) are addressed. These include assessing any existing social conflicts amongst the target group, and whether there is a real desire

for conflict-resolution; the extent of leadership support and strength of leadership; assessing whether existing decision-making institutions are robust, and whether support is needed to develop stronger decision-making processes.

Simple and reliable indicators are an important component of a CBM project. Indicators can provide an effective and efficient way to assess the current situation and to measure the impacts of changed situations on both communities, their resources and their fisheries e.g. to determine the impacts of new management measures. The socio-economic and biological indicators that have been developed through this project will be built on and refined in ACIAR project FIS/2007/116 '*Improving resilience and adaptive capacity of fisheries-dependent communities in Solomon Islands'.*

A common approach amongst NGOs working in Solomon Islands is preferred. At an MFMR / FSPI national workshop on community based resources management (CBRM) held in Honiara in March 2007 through the SILMMA network, proposed principles for CBRM in Solomon Islands were agreed upon. These principles were jointly agreed by MFMR, SILMMA and other NGOs. They were based on lessons learned by all participants and form a platform to which further lessons learned can be added, enabling the principles to be refined. The principles are included here with permission of the sponsoring organisations.

9.2.1 Proposed principles for CBRM in Solomon Islands

National Workshop on community based inshore resources management

CYP, Ranadi, Honiara, 6-9 March, 2007

PROPOSED PRINCIPLES FOR CBRM IN SOLOMON ISLANDS

1. Roles and responsibilities

MFMR is the lead agency responsible and:

- Organisations should provide them with information about intended workplans and target communities and sites
- All NGOs should work towards having MoUs or mutually acceptable agreements with MFMR
- Organisations should ensure reporting of project progress back to all responsible bodies (MFMR, SILMMA, donors, province, communities)

2. Relations between stakeholders – partners should ensure

- That communities are clear on the intended goals, responsibilities and likely consequences and that information is shared appropriately and regularly. This **may** be covered in a written agreement between community and project. Communities will be involved in project design wherever possible.
- Broad and inclusive participation of all stakeholders is vital at the community level (women, youth, churches, resource owners, etc) - the bottom up approach
- Consultation and appropriate involvement of provincial government, appropriate national ministries and NGOs in collaborative partnerships.
- Resources such as information, skills, personnel, gear, publications and reports are shared as much as possible to all levels. Communities should have improved access to information.
- Networking is a good mechanism for achieving resource sharing and assisting MFMR to liaise with different stakeholders. The existing national SILMMA network is an appropriate body for this.

3. Management approach should ensure that

- People, their aspirations and livelihoods are a central focus
- External and broader issues, risks and long term implications including sustainability are considered
- Capacity building at all levels plays a central role
- Mechanisms for monitoring and evaluation (internal and external) are defined
- Special consideration of land and marine tenure as well traditional and customary values is made
- Management process is flexible and adaptive – experiences and lessons learned should inform and improve management on a continual basis
- Management / action plan should be documented and contain minimum agreed information
- Due regard and support for the present and future legal framework is made
- If possible, fair distribution of CBFM projects in all provinces

A general "best practice" guideline for a CBRM process in Solomon Islands

1. Community request / genuine expression of interest
2. Consult all stakeholders at national, provincial and local level
3. Effective community awareness and project clarification*
4. Community based problem and situation assessments
5. Participatory management and action planning resulting in a clear and simple management/action plan
6. Implementation (and monitoring) of the action plan
7. Adaptive management = monitoring, reporting and plan review
8. Long term, sustainable / exit strategy

* Points for effective community awareness

- literacy may be a barrier
- exchange visits and hearing from other communities may be most effective
- pijin may not be as good as English
- be clear who you are targeting, ensure it is the right people for the project
- must be a continued process
- appropriate timing and place
- Awareness for education/information is different from awareness as part of enforcement.

Some recommended tools for CBRM in Solomon Islands

Community awareness tools

- Posters
- Dramas
- Radio
- Ads
- Publications

Participatory situation assessment and management planning tools

- Research / scientific knowledge
- Participatory Learning and Action (PLA) and other participatory techniques:
  - Resource mapping / transect walk
  - Resource use pattern
  - Historical time line
  - Seasonal calendar
  - Venn Diagram
  - Threats / problem identification
  - Problem / solution trees
  - Traditional seasonal calendar
  - Community time line
- Customs / traditional / Local / historical knowledge
- Action / management plan

Resource management tools

- MPA / Reserves
- FADs
- Diversification
- Bylaws

Monitoring and research

- Socio-economic survey
- Biological survey
- Community led monitoring

General tools and skills

- Technical expertise
- Facilitation
- Workshops
- Negotiation skills
- Group discussion
- $$$$$$$$
- Community meetings / workshop
- Research and advise on tenure and legal
- Community news letter

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