

# A Review of Ecosystem Approach to Fisheries within The Nature Conservancy's Community Engagement Processes in Melanesia



Pere Village, Manus © Simon Foale

by:

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## Supported by:



Federal Ministry for the  
Environment, Nature Conservation  
and Nuclear Safety

This Project was made possible through support provided by The Nature Conservancy and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety supports this project within the framework of the International Climate Initiative. The content and opinions expressed herein are those of the author and do not necessarily reflect the position or policy of The Nature Conservancy or the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and no official endorsement should be inferred.

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**Published by:** The Nature Conservancy, Indo-Pacific Resource Centre

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**Suggested Citation:**

Foale, S. 2009. A Review of Ecosystem Approach to Fisheries within The Nature Conservancy's Community Engagement Processes in Melanesia. TNC Pacific Island Countries Report No. 2/09.

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**Available from:**

Indo-Pacific Resource Centre  
The Nature Conservancy  
51 Edmondstone Street  
South Brisbane, QLD 4101  
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## EXECUTIVE SUMMARY

In many ways The Nature Conservancy (TNC) is already successfully implementing a great many of the imperatives of the Ecosystem Approach to Fisheries in their work in Papua New Guinea and Solomon Islands. The following TNC platforms are much in line with the EAF: 1) The Marine Managed Areas / Marine Protected Areas (MMA/MPA) approach, backed up by local level legislative support, 2) collaboration with a range of other relevant institutions, particularly in relation to the mitigation of sedimentation from terrestrial developments, 3) consistent and sustained outreach, and 4) involvement of local people in monitoring and enforcement. TNC's marine resource management work is clearly one of the most culturally, politically and ecologically enlightened programs in the region. This can be attributed in large part to the presence of high calibre teams at all of the project sites I visited, which include a large number of highly experienced, motivated and effective staff, many of whom TNC has recruited from the governments, primarily the fisheries departments, of both countries. The group also benefits from a strong support team in Brisbane, with a similarly impressive collective experience, and a broad range of regionally-relevant expertise.

To further improve on this excellent performance, and to bring the group's work more in line with the EAF, the following issues may warrant closer attention or greater emphasis:

- Systematic monitoring of sedimentation in Kimbe Bay would improve understanding of the importance of sediments as a stressor, relative to other impacts including coral bleaching and Crown of Thorns Starfish. This would provide greater leverage in negotiations with groups responsible for the generation of sediment loads.
- There is some scope for improving social and economic baseline work, and ongoing monitoring, particularly in the area of reporting, and communicating findings within and outside of the organization. Closer attention to marine tenure claims, given their flexibility and the penchant many rural Melanesians have for reinterpretation of their rights in different contexts, would assist TNC to design more watertight management plans and agreements.
- An increase in the amount of Catch Per Unit Effort (CPUE) data, including baseline data generated at the commencement of programs, would allow TNC to more effectively demonstrate the direct economic benefits of its fishery management programs. It would also be very useful where Fish Aggregating Device (FAD) programs are used to absorb fishing effort that is displaced by reef closures.
- There is some room for improvement of outreach programs, particularly in the area of communicating stock-recruitment concepts, and the biology and ecology of reproduction and dispersal in marine fish and invertebrates. Training and equipping local people to deliver this sort of material would also help, as would collaborating with schools where possible.
- Increased efforts should be made to engage community and church leaders about the inevitable pressures that current rapid rates of human population growth place on marine resources, particularly in places like Pere Village and Kimbe Bay. However, such an objective is somewhat beyond the scope of TNC, and is ideally something conducted at the national level.
- Mining is a sector that is expanding in both countries, and presents significant potential threats to marine ecosystems at several sites. A pre-emptive approach to dealing with these threats could include a review of mining legislation in Solomon Islands, ideally in collaboration with governments, other interested NGOs (such as Oxfam) and the mining sector. I believe TNC has already commenced engaging with some mining companies.
- There is room for improvement in information management, and training of local volunteers. While TNC's record in both these areas is already good, they are important and potentially productive aspects of the organisation's work. A staff exchange program with Mahonia Na Dari may facilitate the cross-fertilisation of ideas on outreach programs.

# INTRODUCTION & TERMS OF REFERENCE

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The Ecosystem Approach to Fisheries (EAF) is an approach to fishery management that has received a great deal of attention in the last few years. The Secretariat of the Pacific Community (SPC) with the support of The Nature Conservancy (TNC) recently commissioned a report on the EAF (Preston 2008)<sup>1</sup>. The report is based on two workshops, a questionnaire survey, an extensive literature review, and inputs from 21 independent experts. TNC aims to incorporate the ecosystem approach to all of its marine resource management and coastal marine programs in the Pacific, including the Melanesian countries of Papua New Guinea and Solomon Islands.

My review consists of a brief overview of the SPC/TNC Pacific EAF report, followed by an outline of the work of the project sites I visited for the review. This is followed by a series of discussions of broad subject areas of key relevance to the implementation of the EAF to fishery management in Melanesia. These include 1) land and marine tenure, 2) governance, 3) livelihoods, 4) engagement and collaboration with other institutions, and 5) population pressure and family planning. I then review what I believe TNC is doing right as far as implementing the EAF in its Melanesia work, followed by an outline of areas in which there may be room for improvement. Finally, I include a brief trip report outlining the timing of my visits to Kimbe Bay, Manus and Honiara, and the people I interviewed for this review. I did not have time to visit Kavieng, therefore will not attempt to review the work being done there.

The Terms of Reference for this review are as follows:

## OBJECTIVES

There are a number of key questions we propose this consultancy addresses:

1. How can we ensure that our various community engagement / Conservation Action Planning (CAP) / Locally Managed Marine Areas (LMMAs) approaches in Melanesia are effectively dealing with fisheries issues, at least as far as MMAs / MPAs can?
2. How can we ensure that EAF principles and concepts are being captured in our community-based approaches?
3. What information, capacity and training needs are there within our field teams, and at the community and provincial levels, to ensure that fisheries issues – including EAF principles and concepts – are effectively included in our community and local government engagement processes (e.g. CAP, MMA, etc.)?

## SCOPE OF WORK

Review the SPC/TNC Pacific EAF report and related literature and provide recommendations on how the EAF principles could be effectively applied to community, local and provincial level marine resources management in Melanesia.

Review, including site visits, TNC's Melanesia Program's community and local government engagement, CAP and MMA / MPA processes in Kimbe Bay, Manus and Solomon Islands and provide recommendations on:

- Ways to improve the processes to ensure that fisheries issues and objectives are being adequately and effectively addressed, as far as MMAs / MPAs are able to do so.

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<sup>1</sup> The report can be found at:

<http://conserveonline.org/workspaces/pacific.island.countries.publications/CoastalMarine>

- How to ensure EAF principles and practices can be effectively incorporated at the community and local/provincial levels.
- What are the information, capacity and training needs for TNC field staff and key local partners to ensure effective management of marine resources (including EAF) within the context of MMAs / MPAs.
- What additional strategies will be required to ensure the effective management of marine resources at the community and local government levels in addition to MMAs / MPAs.

## DELIVERABLES

- A brief trip report, following site visits to Kimbe, Manus and Honiara, with summaries of meetings with project staff, government partners and community partners.
- A report addressing the scope of work above.

## A BRIEF OVERVIEW OF THE SPC-TNC EAF REPORT

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In this section I will give a very broad overview of the general message of the EAF approach, as it is described and reviewed by Garry Preston (Preston 2008), and will then focus on some key concepts and how they pertain to TNC's work in PNG and Solomon Islands. In a later section I will outline some more of the ingredients of the EAF approach, and make observations on how TNC is already using these, or alternatively could potentially be giving more attention to them.

The EAF is essentially a more holistic way of thinking about fisheries that moves beyond some of the more ossified and narrow fisheries paradigms of the 1950s such as Maximum Sustainable Yield (MSY), which have to some extent facilitated, in the context of various political drivers, the collapse of many fisheries worldwide. The EAF assumes among other things the Precautionary Principle, and embodies other newer concepts such as the delivery of ecosystem goods and services (Millennium Ecosystem Assessment 2003). Of particular relevance to The Nature Conservancy, the EAF also moves beyond a conservation approach that prioritises the *inherent value* of species (Foale and Macintyre 2005; Foale 2008), and other strictly scientific values attached to biodiversity conservation, and instead emphasizes the maintenance of ecosystem functionality in the interest of sustaining ecosystem service delivery for the custodians of those ecosystems (Kareiva and Marvier 2003; Kareiva and Marvier 2007). The Nature Conservancy should of course be applauded for embracing the goal of implementing the EAF in its marine conservation work in Melanesia and beyond, since a large body of research has now shown quite conclusively that approaches such as the EAF are far more likely to actually work in places like the Solomon Islands and Papua New Guinea, than more 'traditional' approaches to marine conservation (Foale 2001; Van Helden 2004; Dowie 2008).

Managing terrestrial impacts on marine systems is a major concept in the EAF. Since PNG and Solomon Islands are predominantly comprised of large high islands, all of which are undergoing various forms of terrestrial development - logging, mining, plantations, subsistence farming, urban development and mangrove deforestation - this aspect of the EAF is fundamental to TNC's work in the region. Sediments from all of these forms of development can and do kill corals, thereby threatening the functioning of these systems and the important subsistence and artisanal fisheries they support. Sediments have been identified as a significant stressor of coastal fringing reefs in Kimbe Bay (Munday 2004; Hinchley et al. 2006), and there is the potential for some sediment impact on Pere reefs (from mining prospecting, and possibly later mining, on mainland Manus) and Choiseul and Isabel (from logging, and also potentially mining). Separating the impacts on corals of sedimentation from the impacts of rising sea temperature (coral bleaching) and Crown of Thorns Starfish (COTS) is a necessary part of understanding and mitigating the former. I will deal with this issue in more detail later in the report.

Preventing and ameliorating overfishing is another central aspect of the EAF, although it may not seem so at first glance. Overfishing of grazing species of fish, particularly when it takes place in conjunction with other stressors such as sedimentation and eutrophication, can lead to significant and often irreversible ecosystem

damage, such as the coral reef phase shifts made famous by Terry Hughes and colleagues (Hughes and Connell 1999; Hughes et al. 2003; Hughes et al. 2007). The preamble to the terms of reference to this consultancy contains the following statement: “The Nature Conservancy strongly believes that effective marine biodiversity conservation in the Pacific cannot be achieved without addressing marine resource use, especially coastal fisheries”. Such a sensible and pragmatic approach shows clearly that TNC has indeed learned the key lessons of doing conservation and development in Melanesia of the past decade and a half. The impacts of other categories of overfishing are at present incompletely understood. The broader ecological impact of the removal of a vast number of sea cucumbers from lagoons, shoals and reefs of Solomon Islands and PNG, while it includes the formation of dense algal-fungal mats on many sandy sea beds, is in need of continued scientific investigation.

## **SUMMARIES OF PROGRAMS IN EACH LOCATION**

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### **KIMBE BAY (WEST NEW BRITAIN PROVINCE, PNG)**

Kimbe Bay is by far the largest of TNC’s conservation operations that I visited. It includes a large number of sites, at various stages of planning. The sea area encompassed by Kimbe Bay is around 19000km<sup>2</sup>. There are around 160 communities currently engaged at some level with TNC’s work (though not all of these are presently working with TNC), and around 50,000 people, if those living inland on catchments adjacent to MMA/MPA projects are also counted. There are three local level governments in Kimbe Bay – Bialla, Hoskins and Talasea. Each of these passed Marine Environment Laws to safe-guard MMAs/MPAs between 2004 and 2005. TNC uses the Centre for Environmental Law and Community Rights (CELCOR) routinely for training of communities about the legalities of the marine management agreements at the final stages of the Participatory Conservation Planning (PCP) process. TNC has been using the PCP process quite extensively in Kimbe Bay, and this process appears to be working quite well in the main. The Lolobau community was reported to have a management plan in place that was ready to be signed by their LLG at the time of my visit, and the PCP process, resulting in the development of the management plan for Tarobi LMMA was completed and the plan launched in August 2008. However TNC and its partner Mahonia Na Dari has found it much harder to obtain cooperation on MMA/MPA schemes in the communities closer to Kimbe town, largely due to greater concentrations of unemployed migrants, many of whom engage in poaching.

TNC has a historical connection with Mahonia Na Dari (as a local counter-part NGO) but is no longer financially associated with them. Mahonia na Dari focuses on environmental education and, with financial support from TNC, was responsible for the establishment of Locally-Managed Marine Areas (LMMAs) in the communities of Kulungi, Ruango, Patanga, Pasiloke, Kilu and Tamare in the Talasea LLG areas. The Kimbe MMA/MPA zoning plan has been designed using the Marxan model software which, while it did incorporate some social and political data from the work of Koczberski et al (2006)<sup>2</sup>, is based mainly upon ecological criteria. There are some risks associated with this approach in Melanesia, given the system of marine tenure there, and the importance of gaining a detailed understanding the political and social ‘landscape’ of coastal communities prior to committing funds to engaging with them about resource management. The Kimbe Bay project is funded by USAID (which ends in 2009) and private foundations.

The defining feature of Kimbe Bay is the immense expanse of oil palm plantations there, about which Gina Koczberski and George Curry have written a great deal (Koczberski et al. 2001; Koczberski and Curry 2004; Koczberski and Curry 2005; Koczberski et al. 2006). The oil palm plantations are designed around a nucleus estate / smallholder system, and large numbers of migrants from other parts of PNG were brought in to work on the land settlement schemes (LSSs) during the late 1960s and early 1970s. Census data from earlier in the decade shows the population density of these areas to be very high, at 222/km<sup>2</sup> in the Hoskins LSSs in 2000 and 187/km<sup>2</sup> in the Bialla LSSs in 2002.

Koczberski et al. (2006) observed that there appears to be an inverse relationship between access to export cash crops (mainly oil palm but also cocoa) and level of dependence on marine resources. The two isolated

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<sup>2</sup> Along with many years of prior experience of the organisation in Kimbe Bay.

villages of Potou and Baea have the highest reliance on fish for income of the villages that these authors studied, while the village I visited for this review, Tarobi, gets most of its income from oil palm (for men) and beche-de-mer (for women). At the time of my visit the palm oil price had dived from a high of around K450/tonne early in 2008 to around K100/tonne. However this price was still above the level that the price had been for several years before it boomed in 2007/8, so most people were apparently still harvesting fresh fruit bunches on the plantations. This price ‘wobble’ does however give cause to wonder what might happen if world commodity prices continue to slide. At some point declining palm oil prices must inevitably cause a significant proportion of farmers to switch to exploiting marine resources, leading to overfishing and ecosystem damage in areas that are already experiencing high levels of fishing pressure. The extent to which the existing network of MPA/MMAs would be enforced in such a scenario is difficult to predict at this stage.

There are aspects of the conservation planning process that the LMMA Network uses that are also used by TNC, and some Kimbe Bay TNC staff have LMMA links. However the LMMA Network has no independent presence in Kimbe Bay. TNC appears to have an active and collegial relationship with New Britain Palm Oil Limited (NBPOL) which is probably their most important partner other than the coastal communities, given the importance of terrestrial impacts, particularly sedimentation, on coral reefs in the bay. TNC sits on the Round Table on Sustainable Palm Oil (RSPO) and has applied for full membership to this group. TNC has also signed an MOU with NBPOL. TNC is also working with the Provincial government on land use planning.

In addition to the legal mechanisms being used at LLG level, TNC has worked with the Government to include a provision in the Maritime Zones Bill to establish MPA’s, and a section in the Fisheries Bill pertaining to Community-based Fisheries Management.

## PERE VILLAGE (MANUS PROVINCE, PNG)

With a more recent and very different genesis from the Kimbe Bay operation, TNC’s project at Pere Village on the south coast of Manus has its beginnings in a campaign to conserve Fish Spawning Aggregations (FSAs) that were threatened by artisanal night spearfishing and Live Reef Food Fishing companies. The current program has a strong emphasis on protection of these FSAs, most of which are located along the western slope of the large reef complex that extends westward of Pere Island.

Pere Village is a very large community – around 1000 people at latest count – and is still growing rapidly. The population is mostly very poor, and many struggle just to survive. These people have relatively little land, and are descended from Titan people originally living in stilt houses around the tiny, limestone islands of the Kwichou group, located in the shallow lagoon of the large reef complex to the west of the present village. With such a heritage these are very maritime-oriented people, who fish daily (and nightly) for their subsistence, for barter with mainland-based horticulturists and for a small cash income from sales of smoked fish to mainlanders and residents of Lorengau. People have also made money from trochus and beche-de-mer fisheries, but these both appear to be seriously over-fished at present, and of course are the subject of restrictions in the current management plan, along with the FSAs. The local economy benefits, like much of Manus, from a strong remittance flow from relatives employed elsewhere, mostly in the big urban centres of Lae and Port Moresby. Many Pere people are strongly dependent on remittances for payment of school fees. Most of the small number of permanent houses in the village are owned by salaried professionals who work or have worked in government or business in one of the big towns.

The community has a complex history and political structure, which is partly responsible for some ongoing tensions about marine tenure, which I deal with in more detail below. They moved to the current village location in 1967, when it was still a coconut plantation. The land was legally purchased from the expatriate plantation owner at the time. Many of the residents of Pere at the time had been working as labourers on the plantation.

Service provision is generally very poor. There is one aid-sponsored windmill supplying a water tank and pipe, and most of the few permanent houses have their own rainwater tanks, but water is quite unevenly supplied throughout the village. There are no roads to Pere, and relatively few outboard-powered dinghies resident in the village. There appears to be no regular shipping service apart from dinghies. All Pere families

have at least one sailing canoe, and it is from these vessels that most of the fishing is done. Pere women selling smoked fish in Lorengau rarely have any spare cash after they have paid transport costs and bought starch staples and other necessities for their families. The clinic is a run-down little building, which at the time of my visit had a total of four boxes of medicine in stock according to TNC's volunteer socio-economic monitor. The local top-up school is in somewhat better shape.

There is now a very mature version of the Pere Environment and Conservation Area Management Plan (PECAMP) which is due to be signed at a major launching event by clan representative, the five ward councillors, and the President of the Nali Sopat Penabu Rural Local Level Government in March this year. The plan outlines a complex mosaic of restrictions of various kinds in several areas (all GPS-referenced) of reef and mangrove forest around Pere, and includes plans for restocking of trochus in front of the village, and replanting of mangroves in areas where they have been depleted. While there are tensions (none of which are at all surprising) within this very large and politically fragmented community, the planning process appears to be well designed and managed thus far. A FAD program is planned, to hopefully absorb some of the fishing effort displaced by the closures in the management plan, but implementation presently depends on whether the grant application made to the National Fisheries Authority is successful. Alternative livelihood options are few and none look particularly promising.

## ARNAVON ISLANDS, CHOISEUL AND ISABEL (SOLOMON ISLANDS)

The Nature Conservancy's work in the Solomon Islands started with the establishment of the marine reserve in and around the Arnavon Islands in the 1990s (Arnavon Community Marine Conservation Area). The primary focus of this work has been the hawksbill turtle rookeries on these islands. It was later expanded to include commercial marine invertebrates. The project has largely succeeded despite some recent and significant problems with poaching (Hamilton et al. 2008), mainly by residents of neighbouring Wagina Island.

More recently TNC has expanded the scope of its MMA/MPA program into Choiseul and Isabel, with eight communities around Choiseul and one in Isabel. In the late 1990's and early 2000's the politically powerful and influential Luru Land Conference of Tribal Community (LLCTC), headed by MP and Uniting Church Bishop Leslie Boseto, invited TNC to participate as an observer to its annual conference which brought together 300 community leaders and practitioners. TNC has attended all of the LLCTC annual conferences since then.

In 2004 TNC and the Arnavon Community Marine Conservation Area (ACMCA) management committee invited leaders of the Luru Land Conference to visit the Arnavon Islands. The leadership of LLCTC were impressed with the success of the Arnavons, and in 2003 TNC signed an MOU with LLCTC. Under this MOU TNC and the LLCTC declared they would work together on addressing environmental issues in Choiseul. The upsurge in interest in MPAs in Choiseul in 2004. This experience was pivotal in inspiring some of these chiefs to want to establish MMA/MPA programs around their own reefs.

Choiseul is the least densely populated of all of TNC's project sites (density around most of the 5km coastal strip is less than 10 people/km<sup>2</sup>), and being that little bit further away from Honiara, distance and infrastructure barriers place significant brakes on commercial fishing for reef fish at present. However, market forces from culturally related and neighbour, Bougainville is more likely to drive reef fish markets in Northern Choiseul. The combination of low population density and weak market penetration mean that there is relatively little stress on most of the reefs around Choiseul. As such it should be a relatively easy place to work, since food security is higher, and alternative sources of protein easier to access. According to the recent Ausaid Forestry Update Report (URS Sustainable Development Project Managers and Consultants 2007), there is quite a lot of logging activity going on in Choiseul at present, whereas most of the logging leases in Isabel are logged over.

## LAND AND MARINE TENURE ISSUES

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Marine tenure is a fundamental aspect of marine resource management in Melanesia. Although there are some contradictions among different bodies of legislation that pertain to marine tenure, generally speaking traditional claims to rights over the near-shore seabed and associated renewable resources are respected by the governments of both PNG and Solomon Islands. There is a large literature on customary marine tenure (e.g. Carrier 1981; Hviding 1996; Otto 1998; Foale and Macintyre 2000; Macintyre and Foale 2007) which I will not attempt to recap here. While clan- or tribe-based exclusive claims over sections of coast are commonly assumed to be a boon for marine resource management (see more on this below), they can also present potential obstacles to spatial management in some contexts (Foale and Manele 2004). If governance over a particular marine territory – even a small one - is weak, then it is still possible for ‘micro’ tragedies of the commons (Hardin 1968) to occur.

Marine tenure is clearly a contentious issue at Pere Village, but not an insurmountable one. The Pere people have not always lived on the site of the present village. They migrated from the nearby Kwichou Islands to the site of the village cemetery in 1956, and had mostly moved to the current location, which was previously a coconut plantation owned by an expatriate businessman, by about 1967. The systems of rights exercised over fishing gear, species of fish, and places, as it was recounted to me during my visit, were reminiscent of the complex systems of rights described by James Carrier for the Ponam people (Carrier 1981; Carrier 1982). For the Pere people, rights to fishing gear were traditionally subject to strongly exclusive claims, among clans, and rights to those species targeted by each gear were treated with similar exclusivity. Rights to locations on the other hand were not subject to quite the same level of exclusion, but if a clan that had rights to use gear type X wanted to use that gear in location Y, this choice tended to be respected by the other clans who would choose to fish elsewhere. This description of the traditional rights system is currently used by Manuai Matawai (and others) to argue that the large reef complex extending to the west of Pere Island should now be regarded as being communally owned by all clans in the Pere community.

One of the senior members of the Pere Community made exclusive claims to a certain patch of reef south of the Kwichou Islands during the village meeting that I attended and spoke at, on 1<sup>st</sup> of February, 2009, and this claim was later discussed with this man and with other members of the community including Manuai Matawai. The man making the claim appears to be largely isolated in that most of the other people I spoke to regarded his claim as a reinvention and one that ran counter to the consensus which had been formerly reached (that of communal ownership), and which is outlined in the current draft resource management plan for Pere, which is due to be gazetted next month.

It appears that the exclusive claim to a patch of reef within the area that is regarded by most Pere people as communally owned may be in part motivated by some kind of political agenda, and such motives must be expected in a community the size of Pere, which is presently at a size (ca 1000 people) regarded as the maximum size most Melanesian villages reach before dividing politically.

The reinvention of rights to both land and sea is extremely common throughout Melanesia and on the coast has occurred most conspicuously in the context of the development of commercial fisheries, beginning with the establishment of trochus, pearl shell and beche-de-mer fisheries in the late 19<sup>th</sup> century (Macintyre and Foale 2007). From a system where most of the seabed and foreshore in front of most villages was essentially open access pre-colonially (with the exception of a few sacred sites), the exclusivity of claims to coral reefs and lagoons has essentially mirrored the increase in monetary value of commercial fisheries (Allan 1957; Turner 1994; Otto 1998; Foale 2005). Pere Village is currently divided into five contiguous wards: Patusi, Mwachopwar/Loh, Pwanchal, Pere 1 and Pere 2. Each ward nominally contains people belonging to a particular set of clans and subclans, though with intermarriage, many people now live in wards other than the one they nominally belong to. This has not deterred people from making exclusive claims to the reef and reef flat in front of each ward in the context of trochus and other fisheries, a practice about which there is still some debate within the village.

A few observers have commented that the enthusiasm of some Kimbe Bay communities for the MMA/MPA schemes in TNC’s marine conservation program is primarily motivated by the desire to exclude ‘outsiders’, particularly the large numbers of migrants who came to Kimbe Bay with the Land Settlement Schemes of the

1960s and 70s. While this is not a bad thing of itself, it nevertheless provides no reliable indication that the people claiming exclusive rights to the MMA/MPA zones will necessarily abide by the associated fishing restrictions themselves. However the process of enshrining the management plans for each site in local and/or provincial law is one of a suite of approaches within TNC's program that addresses this particular risk.

Probably the best way to deal with the highly flexible and contextual nature of marine tenure claims in the context of the marine resource management program at Pere (and at the other sites in PNG and Solomon Islands) is to attempt to achieve and maintain consensus over tenure claims, whatever they are, within (and between) village communities (this can obviously take some time, and in some communities may not in fact be possible), and to strengthen this consensus with appropriate legislative support. This is exactly what TNC is doing at Pere (as outlined on page 24 of the current draft of the Pere Environment and Conservation Area Management Plan) and indeed at all of its sites in PNG and Solomon Islands, and the process should simply be followed through and strengthened as far as possible.

## GOVERNANCE

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There can be no marine resource management without effective governance, and it is critical for effective governance to operate at all scales, including and perhaps most importantly the local scale, for marine resource management to succeed in PNG and Solomon Islands. TNC has invested heavily in establishing legal mechanisms at the local scale to support the enforcement of fishing restrictions associated with its MMA/MPA programs. There are many examples of these in the various marine resource management plans that I have reviewed, and they appear to me to be the most sensible way to achieve effective governance of fishery management systems at this scale, particularly given the inexorable weakening of traditional authority throughout most of the region. The engagement of the Centre for Environmental Law and Community Rights Inc. (CELCOR) in PNG to assist communities in understanding their various rights under the law, as well as the legal aspects of the management agreements, also appears to have been an excellent move.

Judging by the remarks of TNC staff I interviewed, as well as the findings of a recent review of various Marine Protected Area programs around the Asia-Pacific region (Leisher et al. 2007), it appears that local level governance often improves in response to the process of establishing marine resource management systems. The very process of establishing the various committees (youth, women, church, teachers, etc) that play a role in catalysing community commitment to marine resource management plans, seems to bring communities (by which I mean the residents of a village) closer together so that they begin to function more effectively as a social unit. Such observations give cause for optimism and definitely warrant further research attention. Through my recent engagement with an externally funded infrastructure development project in the Solomon Islands I have in fact come across very similar responses by some communities to the engagement process associated with the construction of schools, clinics and roads. The role of local leadership however is also quite critical to the increases in social cohesion associated with these projects.

As heartening as they are, such increases in social cohesion do not always translate to effective enforcement against poaching from marine reserves. The TNC Solomon Islands team recently reported on a rather depressing case of poaching of commercially valuable species, including the vulnerable green humphead parrotfish, *Bolbometapon muricatum*, from the Arnavon Community Marine Conservation Area (Hamilton et al. 2008). I also observed poaching first hand on 'Donna's Reef' when driving past it to go diving on 'Susan's Reef' during my stay in Kimbe. These two cases involve reefs that are far from any residences (including the residences of the rangers at Arnavons) and so aren't necessarily representative of the risk for other MMA/MPA schemes located closer to villages. Hamilton et al. (2008) also recount the opening of cases against several poachers but the lack of any prosecution at the time of writing of their report. Officers of the Regional Assistance Mission to Solomon Islands (RAMSI) did however confiscate banned fishing equipment including a compressor, in relation to one of these cases. One major problem is the lack of efficient and well resourced court systems in both countries.

## LIVELIHOOD DEVELOPMENT

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While externally funded agents such as TNC are under no obligation to provide assistance with alternative livelihood developments in places like Solomon Islands and PNG, such developments are a potentially useful means of assisting people to offset the immediate economic costs associated with the reductions in fishing effort required by MMA/MPA programs. There are many hazards and obstacles associated with attempts at generating alternative, environmentally sustainable livelihoods (Macintyre and Foale 2004; Koczberski and Curry 2005; Foale 2008), and failure rates are usually very high.

Tourism is an avenue that seems to be perennially in favour with Western conservationists and environmentalists, and the idea is also very popular with rural Papua New Guineans and Solomon Islanders, who often have unrealistic expectations of the benefits, and little idea of the costs. While tourism has some potential in some locations, the reality is that material benefits to rural communities from tourism to date have been very small, and most of the benefits from dive tourism and other forms of nature-based tourism have been and continue to be captured by expatriate-owned and managed businesses such as Walindi Plantation Resort. There are very good reasons for this – one is a lack of training and skills in business management. Of equal, or in many cases greater importance, is the ubiquitous obstacle to successful engagement with capitalist enterprise represented by the wantok system. The demands for money made by relatives and friends often result in aspiring entrepreneurs giving away all or most of their liquid capital, and then being unable to pay for running costs, including maintenance of equipment, which frequently precipitates the collapse of the business (Curry 1999; Foale 2008; Fukuyama 2008).

Another hazard is that people are frequently unrealistic about marketing, and about the various costs associated with production and sale of a particular commodity. Vanilla has been tried at Pere, but after at least two growers had established vanilla plantations and successfully grown a crop, they discovered that there are no buyers in Manus, and transporting the product to buyers in other provinces was more difficult and costly than anticipated. Poor communications and transport services are of course also a significant impediment. Often project donors are also culpable for not thinking through the project adequately. Jeff Kinch reports on a snapper fishing project in Madang Province which required fishers to repay loans for boats and equipment through sales of snapper to an exporter in Madang. The scheme was soon abandoned by the fishers who were involved, in favour of fishing for tuna and other pelagic species around FADs (which were supposed to provide bait for the snapper fishing) and selling these on the domestic market (Kinch 2005).

There are of course many potential ventures that need not run foul of the above hazards, and these mostly include primary production of various commodities. Seaweed production on Wagina, after faltering in 2007, has made a resurgence of late, assisted by an increased price. Kava is now apparently being grown around Kia, and I was told in December last year that the dried roots were being sold for up to SBD400 (ca AUD78) / kg. Pere is hampered by isolation and lack of land, and Kimbe Bay families who do not have oil palm blocks similarly suffer from the fact that most of the arable land in Kimbe Bay has oil palm on it. A perennial hazard with investments in one particular agricultural commodity, as has been shown for copra over the past half century, vanilla over the past five years, and palm oil over the past six months, is the lack of control over global price, which can plummet without warning. Gina Koczberski and George Curry describe and analyse some of the innovative and diversified livelihood strategies being pursued in response to the intense land pressure in Kimbe Bay (Koczberski and Curry 2005) – perhaps a diversified approach is worth promoting in other locations as well. FADs may have some potential in both Kimbe and Manus, but risks associated with these, including potential arguments with neighbouring groups, and the fact that people who own outboard engines may benefit disproportionately, must also be thought through carefully.

## **ENGAGEMENT & COLLABORATION WITH OTHER INSTITUTIONS (INCLUDING GOVERNMENT)**

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The holistic nature of the EAF necessitates agencies embracing the approach to network effectively with other organizations that can assist with integrating land and catchment management, governance, enforcement, and outreach to more directly focused management approaches such as MMA/MPAs. EAF is an unavoidably collaborative approach. The Nature Conservancy appears to be extensively networked with other organizations in each of its project sites. A brief summary of some of the main partners at each project site (excluding Kavieng) follows.

- Kimbe Bay: Local communities, New Britain Palm Oil Limited (NBPOL), Hargy Oil Palm Limited, PNG Oil Palm Research Association Inc. (PNGOPRA), Walindi Plantation Resort, Liamo Resort, James Cook University (Geoff Jones et al), University of Papua New Guinea, Mahonia Na Dari, National Fisheries Authority, West New Britain Provincial Government (including the Provincial Fisheries Advisor), FORCERT, Bialla, Hoskins and Talasea Local Level Governments, Centre for Environmental Law and Community Rights (CELCOR), LMMA Network.
- Pere Village: Manus Provincial Government, World Wide Fund for Nature, LMMA Network, James Cook University (Glen Almany), Nali Sopat Penabu Local Level Government, CELCOR
- Local communities, Choiseul and Isabel: Lauru Land Conference of Tribal Community (LLCTC), Isabel Council of Chiefs, Ministry of Fisheries and Marine Resources (MFMR), Foundation of the Peoples of the South Pacific (FSPI - who represent the LMMA Network in the Solomon Islands), Isabel Provincial Government, Choiseul Provincial Government, Member of Parliament for Katupika Constituency, Arnavon Community Marine Conservation Area management Committee.

Relatively few of these alliances appear to be tokenistic and many of them have considerable bearing on the success of the various management plans that have been drafted for the communities within each area.

## **POPULATION PRESSURE & FAMILY PLANNING**

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Since humans are an integral part of an ecosystem, it follows that human population growth should be a focus for management attention as part of the EAF. Population pressure in Kimbe Bay is high (Koczbarski et al. 2006) and in Pere Village is very high (just over 1000 people at present residing in the village), particularly given the limited marine, and even more limited terrestrial resources accessible to the Pere people. Concern is routinely expressed about population growth in relation to these resource limits. An obvious rational response would be for the members of this community to choose to have fewer children. According to the local volunteers conducting ongoing social and economic monitoring (which includes demographic data) the population growth rate in Pere is high (around 3.1%). The problem is that effective distribution and use of contraception in PNG and Solomon Islands is extremely low. Government inaction on this is partly to blame, but there are also significant cultural obstacles. Many men not only resist the use of condoms, but they discourage or indeed forbid their wives from using contraceptives. Women are also pressured by in-laws to have more children than they may want to. For Catholics such cultural pressures can be added to by the dictates and policies of the Catholic Church, which obviously presents yet another obstacle to the goal of reducing population growth rates.

Research in other parts of the world (Sen 1994; Jejeebhoy 1995; Basu 2002) shows that educating women leads to lower rates of fertility. The mechanisms are complex and as yet not completely understood, but the correlation is compelling. Economic independence (primarily via education and employment) was linked to a rapid increase in uptake of contraceptives (both Depo-Provera and The Pill) by women at Lihir in New Ireland Province in 2001 and 2002 (Macintyre and Foale 2003). The money generated by the Lihir gold mine, which was constructed in 1995 and started production in 1997, obviously played a key role in this trend. The United Nations Human Development Indicators data as presented in 'Gapminder' ([www.gapminder.org/world](http://www.gapminder.org/world)) show the negative correlations between 1) fertility and female education, and 2) fertility and per capita income (which is also positively correlated to education). The relationships between

fisheries, demographic patterns, education, governance and the other economic sectors of PNG and Solomon Islands are complex, but an understanding of them is critical to the long term success of marine resource management programs (Foale 2008).

Population pressure in Choiseul and Isabel is generally extremely low by comparison with both Kimbe Bay (more people live in Kimbe Bay than on Choiseul and Isabel combined) and Pere Village, which means that the level of reliance and pressure on marine resources is lower, and opportunities to set up MMA/MPA schemes and alternative livelihood ventures greater.

## WHAT IS TNC DOING RIGHT?

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TNC's approach is presently low key, and it should remain so. A low key approach is vital to the success of this sort of work, as has been amply documented now by a number of 'lessons learned' type studies of integrated conservation and development projects in Melanesia (McCallum and Sekhran 1997; Van Helden 1998; Foale 2001; Van Helden 2004; West 2006).

TNC's recognition that managing fisheries effectively protects biodiversity is also to be commended, as is the approach that prioritises locating communities who are likely to be interested in and capable of implementing management, over prioritizing biodiversity objectives and consulting communities afterwards. Obviously where there is room to choose among willing and capable communities then biodiversity/connectivity factors should be used as a second order of prioritization of conservation effort. This apparently may prove to be necessary in Choiseul according to the recent flood of interest there reported by Solomon Islands TNC staff. However given the complexity and flexibility of customary marine tenure claims, it is important to ensure that contradicting claims and other potential sources of conflict within target villages do not pose significant risks to resource management outcomes before committing to an engagement with a particular group. I discuss this issue in more detail below in the section on social and economic research. Although the design of the Kimbe Bay program is derived primarily from biodiversity priorities, the discussions I had in Tarobi suggested that at least some people there support the conservation agenda. However such a willing acquiescence to an external conservation imperative (which is of course yet to bear fruit in terms of actual conservation achievements) cannot be guaranteed in all such cases. Below I detail TNC's successes against a range of key criteria for implementing the EAF.

### *Limiting fishing pressure to ensure sufficient survival until spawning age*

This is clearly a central goal of most of the MMA/MPA programs within TNC's projects, and is also a key component of the organisations outreach material.

### *Directly protecting spawning aggregations from directed fishing*

Dr Richard Hamilton and his colleagues have already chalked up an impressive record of locating and characterising fish spawning aggregations (FSAs) of groupers and other reef fish species for the Society for the Conservation of Reef Fish Aggregations (SCRFA), and more recently for TNC (Hamilton 2003; Hamilton 2003; Hamilton et al. 2004; Hamilton and Matawai 2006; Hamilton and Potuku 2007). FSA conservation is a central platform of TNC's programs at Pere and Kavieng, and is also a component of conservation plans at several of the Kimbe Bay and Choiseul sites.

### *Controlling fishing through effective enforcement*

Enforcement is difficult in all fishery management and in Melanesia it is hindered by the low level of government capacity from local through to national levels. Despite the huge investment in the Arnavon Community Marine Conservation Area (ACMCA) over the past decade and a half, poaching is still a major risk and recent raids by Wagina residents have badly damaged stocks of several high value species within the reserve (Hamilton et al. 2008). Despite these setbacks TNC has probably done as much as reasonably could be expected to try to avert poaching and facilitate prosecution of key perpetrators. Enforcement is easier on

reefs close to (within sight of) communities and this should obviously also be a consideration in choosing sites for conservation.

### *Prohibiting destructive fishing practices*

TNC, together with partners such as Mahonia na Dari, the National Fisheries Authority in PNG and the Ministry of Fisheries and Marine Resources in Solomon Islands, has been actively campaigning against the use of blast fishing and fish poisons for as long as it has been working in the area. It has produced posters and other outreach materials explaining the damage to fisheries caused by these practices and these are obviously routinely used in outreach work. Blast fishing and poisons are prohibited under the Fisheries Act in both countries.

### *Ensuring availability of food for growth to adulthood (through protecting stocks of prey)*

The use of spatial management systems such as MMAs/MPAs, including the specific protection of mangrove and seagrass habitats, is probably the most effective way of achieving this objective, and is part of TNC's ongoing work. The baitfish fishery no longer plays a significant role in the tuna fishery in either country since the shift to fleets dominated by purse-seiners, and so is not a threat in any of TNC's areas of interest.

### *Reduction of by-catch and improvement of its survival through gear and other regulations*

Most of the fisheries that TNC is assisting communities to manage in its areas of interest are multi-species and small-scale, so by-catch is not a significant issue.

### *Adopting reactive (adaptive) management schemes*

The TNC strategy of reviewing management plans on a regular basis, along with regular biological and socio-economic monitoring, indicates compliance with this objective.

### *Introduction of rights-based management*

Rights-based management is essentially unavoidable in Solomon Islands and PNG, since people already claim traditional user rights to reefs and the fish stocks they support, and these claims are largely recognized by the state. It should be noted however that rights-based management is only as good as the level of social cohesion and quality of governance *within* a given rights-holding group.

### *Integration of fisheries into coastal area management plans*

An integrated coastal management approach is being taken in Kimbe Bay, where Walain Ulaiwi is presently tasked with overseeing this aspect of TNC's work there and he has forged productive collaborations with New Britain Palm Oil and the Provincial Government to this end. He has also succeeded in persuading New Britain Palm Oil Limited to voluntarily establish the policy of not clearing and planting any new areas with slopes higher than 25 degrees.(the former threshold was 35°). He is working pre-emptively to anticipate where new clearing will take place to anticipate the impacts of sedimentation from these watersheds.

While TNC's performance in Kimbe Bay is admirable, there is much yet to do on this issue at the other sites. TNC's alliance with The Lauru Land Conference of Tribal Community in Choiseul may prove useful in this respect.

### *Actively campaigning against land-based pollution (in the context of integrated coastal area management)*

TNC has some significant achievements against this objective in Kimbe Bay, but there is much yet to be done, both in Kimbe Bay and at the other sites. See the next section for more on this.

## *Preventative measures to combat habitat degradation*

The marine habitats in TNC's areas of interest include coral reefs, seagrass beds and mangrove forests. Coral reefs are potentially degraded by sedimentation, destructive fishing, overharvesting of grazing species, and climate change-related coral bleaching. All but the last of these can be preventatively addressed at the local scale, via the programs TNC already has in place, with the exception of addressing sedimentation threats in Manus, Kavieng, Choiseul and Isabel. This issue is discussed in the following section. Mangroves are most commonly threatened by small-scale harvesting for firewood (in some cases for processing of beche-de-mer), clearing for new house sites, some commercial logging and in Kimbe Bay some oil palm expansion. Generally these issues are dealt with on a local level by the various management plans that have been drafted within TNC's program. Seagrass can be both threatened and expanded as a consequence of sedimentation, depending on the context. There are some minor threats at TNC's sites including boat activity at Tarobi in Kimbe Bay.

## *Establishment of habitat reserves or marine protected areas*

This is a central part of TNC's work at all sites.

## *Rebuilding of depleted populations through restocking and introduction of artificial habitats (which assumes reduction of over-capacity)*

The current draft of the conservation plan for Pere Village includes plans to restock trochus on the reefs in front of the village, and a mangrove planting program.

The Pere community have already submitted an application to the National Fisheries Authority for the funding of two Fish Aggregating Devices (FADs) that would potentially absorb some of the fishing effort that will be displaced by the proposed MMA/MPA scheme. Similar efforts should be made, where practical, at the other project sites. The West New Britain Fisheries Advisor, Mr Newell Sinaigawi, is very much in favour of the use of FADs as a means of absorbing fishing effort that is displaced by MMA/MPA programs.

## *Protection of endangered species*

The Arnavon Islands Conservation Project is probably the oldest and best known turtle conservation project in Melanesia, and despite various setbacks over the years appears now to be leading to increases in numbers of nesting adults according to Peter Ramohia. Protection of turtles and dugongs is a standard aspect of all of TNC's conservation work in the region.

## *Other aspects of TNC's work that are broadly in line with the EAF*

TNC's programs are impressively consistent across sites.

Outreach is performed in neighbouring communities as well as those that claim rights to the MMA/MPA areas. This should be continued.

The 'Stresses' approach being used in Kimbe Bay is very sensible and in line with EAF and current thinking about coral reef ecosystem functionality.

Training of TNC field staff, community members and local and provincial government partners is an excellent strategy and should be expanded where feasible.

Pilot/demonstration programs – TNC has used the build-up of biota in the Arnavons to great effect, inspiring community leaders in both Choiseul and Isabel to set up MMA/MPA programs on their own reefs. This has also facilitated the establishment of a very productive collaboration with the Lauru Land Conference of Tribal Community, a powerful and widely respected indigenous land owner organization in Choiseul.

## WHERE CAN TNC IMPROVE ITS WORK?

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### *Sediment Monitoring*

There is scope for some new data generation on the monitoring of sediment and nutrients in Kimbe Bay. Discussions with NBPOL representatives Ben Rich and Bob Prior, as well as discussions with Walain Ulaiwi, suggested that NBPOL manage both fertilizer and pesticide inputs with diligence. However erosion and consequent sedimentation appears to be a less manageable problem, which has been investigated by one commissioned study already (Hinchley et al. 2006). This impressive study looked closely at land use patterns relative to topography, altitude and proximity to watercourses in all of the catchments around the bay, and shows that there is a significant area of both oil palm and food gardens on slopes greater than 5%. Much of the steep slope gardening is driven by the planting of oil palm on flat land that would otherwise have been used for gardens, and by the large numbers of migrants attracted by the palm oil sector (Koczberski et al. 2001; Koczberski et al. 2006). Urban developments and the very large networks of unsealed roads throughout the catchments adjacent to the bay are also certain to contribute significantly to sediment loads in the bay.

As advocated by Hinchley et al. (2006) and no doubt many others, routine sediment monitoring around river mouths and at control sites, perhaps in collaboration with NBPOL and/or PNGOPRA (The PNG Oil Palm Research Association, Inc.) would be very useful in understanding the importance of sedimentation as a stressor of coral reef ecosystems in the bay. Since the Hinchley et al. study shows the Dagi and Kapiura catchments to have the highest potential to affect reefs targeted for management by TNC, reefs off these catchments ought to be prioritized in any sediment monitoring program. However it would also be prudent to establish permanent sediment monitoring and bottom cover monitoring transects in catchments that are currently not impacted, but are likely to be cleared for new plantations in the future.

In combination with routine bottom cover monitoring using point counts along fixed transects, sediment data would also help to separate the impact of sedimentation from that of climate change (i.e. coral bleaching) and Crown of Thorns Starfish on the health of coastal corals in the bay. There are various methods for monitoring sedimentation, the simplest being the routine use of a Secchi disk along fixed transects. Other methods include the deployment of fixed sediment traps (this method has been used extensively on Lihir, where sedimentation is a significant issue close to the mine site) as well as the measurement of coral tissue thickness (Rotmann 2001). Dr Katharina Fabricius ([k.fabricius@aims.gov.au](mailto:k.fabricius@aims.gov.au)) of the Australian Institute for Marine Science could potentially advise on the most appropriate methods for monitoring sediment stress on corals (e.g. Fabricius and Wolanski 2000).

Similar programs should be established at TNC's other sites in line with availability of funds and other land use information. The recent Ausaid Forestry Update for Solomon Islands is a very useful source of information on logging activity for the Solomon Islands sites (URS Sustainable Development Project Managers and Consultants 2007). Systematic and detailed sediment monitoring and reef condition data can help to encourage or pressure (depending on circumstances) partners in the conservation process, such as plantation managers, logging companies and governments, to take immediate and specific actions to reduce erosion within their respective spheres of influence.

### *Social and Economic Research*

My visit to Pere Village, and particularly the meeting that was organized about the marine conservation program, made it very clear to me that the complexities of marine tenure in that place underpin some of the more significant challenges facing TNC's Melanesia Program. While Manuai Matawai's very skilful handling of political conflict at Pere will most likely resolve the issues that were raised while I was there, it seems there is a case to be made for careful, detailed research into marine tenure at all locations where the decision is made to spend conservation dollars, along with adequate reporting of this research<sup>3</sup>.

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<sup>3</sup> Such work is likely to be more important (and harder to do) in large, politically complex, and resource-stressed villages like Pere, than in smaller communities with larger resource assets such as those in Choiseul and Isabel.

The observation made by a few people I have spoken to now, that some of the Kimbe Bay communities have been motivated to subscribe to the MMA program primarily because of a desire to exclude ‘outsiders’ (including migrants to the oil palm plantations), presents a significant risk to the success of the MMA/MPA program. If people are not motivated to restrict fishing effort primarily in the interest of improving fishery performance and conserving the ecological integrity of their marine environment, then long term management is far from guaranteed. Two sources of social data would improve TNC’s ability to gauge the importance of this risk to the future compliance of community members to the proposed conservation measures: 1) Basic social mapping around areas of interest, including careful investigation of tenure claims, past and present, 2) Attitude surveys – to what extent do people see their own fishing activities as having a deleterious impact on the resources, as opposed to the activities of outsiders?<sup>4</sup>

When the term ‘socio-economic monitoring’ is used, it too frequently refers to economic monitoring, and there is rarely any actual social research of any substance included. Social structure, including tenure systems, is a fundamental aspect of marine resource use and management in Melanesia, and deserves a greater level of attention and indeed expertise than it commonly receives. Tenure systems are usually unwritten, and subject to a variety of often contested interpretations. Understanding the different rationales used by protagonists to disputes, including the role of various bodies of legislation in these rationales, is an important set of baseline data to acquire prior to investing in a conservation program. Generally speaking TNC understands the importance of these issues, which is why they have commissioned studies such as Koczberski et al. 2006, and have placed high importance on the establishment of local and provincial-level legislative support for the various programs, with the assistance of legal groups such as CELCOR. Determination of clan boundaries is also a key step in the Participatory Conservation Planning process. There is nevertheless some room for improved baseline data generation on customary marine tenure claims for some of TNC’s project areas, given the complex, flexible and frequently contested nature of these claims.

### *Catch Per Unit Effort*

Particularly if used in combination with data on catch composition by gear type, catch per unit effort (CPUE) is an extremely useful type of data in any fishery management program, particularly one involving spatial closures of various kinds. It can tell both managers and community members what impact the closures are having on the performance of fisheries. The theory of spill over effects from spatial closures is convincing, even when weighed up against the many scientific uncertainties that remain (Russ 2002; Hilborn et al. 2004; Russ et al. 2004; Sale et al. 2005), but actual real world data to support the theory, particularly for larval spill over (or the ‘recruitment effect’), is much harder to come by, even after decades of successful compliance (e.g. Abesamis et al. 2006). While it does not yet provide quantitative evidence of the fishery benefits of larval spill over, more recent research in Kimbe Bay (Almany et al. 2007) does significantly improve our understanding of dispersal patterns of fish larvae. A well-designed long term CPUE monitoring program would provide much needed fishery data that would demonstrate the economic benefits of the spill over process that this ongoing biological research is describing.

Furthermore if Fish Aggregating Devices (FADs) are used (which I strongly support) as a means of absorbing some of the fishing effort that is displaced by MMA/MPA programs, then CPUE monitoring can also give some indication of how successful this strategy is in practice.

### *Outreach*

My interviews with people at all locations in the program indicated that rural people in particular are very hungry for reliable, detailed and accessible scientific information about the life history of economically important marine organisms, particularly larval biology and ecology, lifespan and growth rate. These are things that rural people are less able to observe than seasonal and lunar cycles of behaviour and movement of fish and invertebrates. While this sort of information mostly is not directly related to the implementation of the EAF to TNC’s work, it indirectly contributes inasmuch as it helps people to better understand impacts of overfishing on the stock-recruitment process for different species and at different scales, thereby potentially

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<sup>4</sup> Given the long period of time TNC and other NGOs have been working in Kimbe Bay, there is now some evidence that people are becoming aware of their own impacts on fisheries. Thus good quality survey data on this question would be very useful for future planning as well as risk assessment for current plans.

helping to motivate people to avoid the many destructive flow-on effects from overfishing, both ecological and social-ecological.

Involvement of local fishers in monitoring work is also a goal to continue to strive towards, as it is likely to reduce poaching from within the community. TNC is clearly doing a great deal of this already, particularly in Pere.

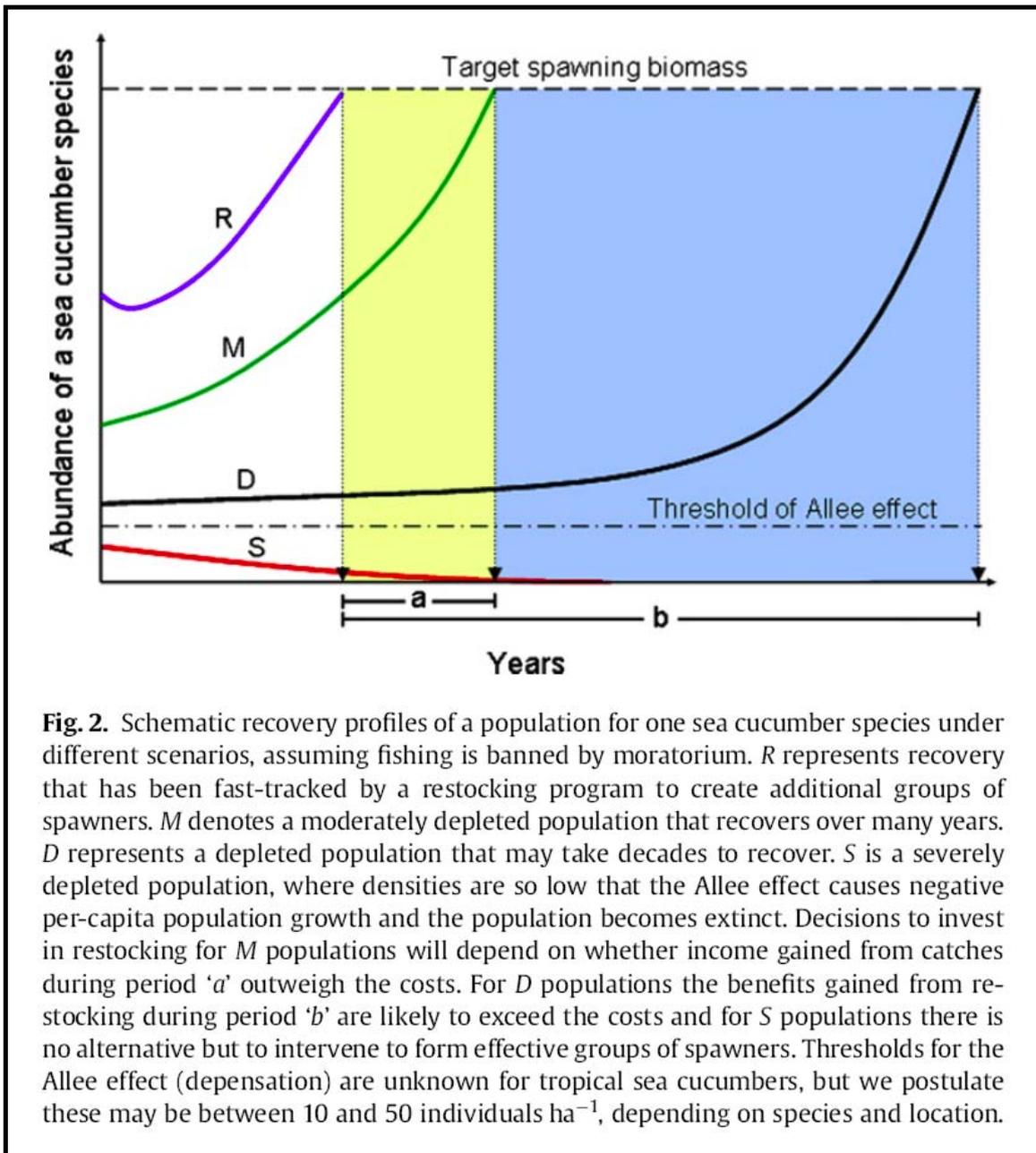
As discussed above, uncontrolled human population growth is a significant threat in both Pere Village and parts of Kimbe Bay in PNG, but avenues for addressing this issue in the short term are few, and may be expensive. If TNC is able to find ways of contributing to campaigns and funding to improve the level of female education, this will certainly help over the medium to long term. Collaboration with the relevant government departments may also help.

### *Pre-emptive Management of Mining Impacts*

Mining and prospecting activity continues to expand in both PNG and Solomon Islands at the time of writing this report. There are mining or mining prospecting operations close to TNC's sites in Manus and Choiseul, all with the potential to impact negatively on marine conservation outcomes. The mining legislation in PNG has been strengthened and improved considerably since the 1980s, largely in response to the environmental and social disasters generated by the Panguna and Ok Tedi mining operations. The Mining Act in Solomon Islands is nowhere near as strong, and consequently will provide less support for efforts to make mining companies accountable for environmental and social impacts. TNC may want to consider, perhaps in collaboration with other NGOs working in the region, conducting a review to examine the weaknesses of the Mining Act in Solomon Islands in relation to potential environmental impacts on catchments and adjacent marine ecosystems. Oxfam is one group which has shown an interest in this topic in the past.

### *Information Management and Training*

Village-based volunteers and employees in projects such as TNC's commonly express the desire for more training in whatever line of work they are hired to do. These people usually do not have access to the internet and are always hungry for information. The two volunteers at Pere (who perform biological and socio-economic monitoring respectively) both expressed a strong desire for both more training in their work and for more background material on fishery management and socio-economic research. They were particularly interested in any images of reproduction in marine organisms that they could use to communicate the concepts of larval dispersal, and stock-recruitment processes to other members of the community. While speaking at a community meeting at Pere Village, I drew the diagram in Figure 2 from Johann Bell et al.'s recent paper, 'Restoring small-scale fisheries for tropical sea-cucumbers' (Bell et al. 2008) on the blackboard (reproduced below). A number of Pere community members told me that this was information they found very useful.



**Fig. 2.** Schematic recovery profiles of a population for one sea cucumber species under different scenarios, assuming fishing is banned by moratorium. *R* represents recovery that has been fast-tracked by a restocking program to create additional groups of spawners. *M* denotes a moderately depleted population that recovers over many years. *D* represents a depleted population that may take decades to recover. *S* is a severely depleted population, where densities are so low that the Allee effect causes negative per-capita population growth and the population becomes extinct. Decisions to invest in restocking for *M* populations will depend on whether income gained from catches during period 'a' outweigh the costs. For *D* populations the benefits gained from restocking during period 'b' are likely to exceed the costs and for *S* populations there is no alternative but to intervene to form effective groups of spawners. Thresholds for the Allee effect (depensation) are unknown for tropical sea cucumbers, but we postulate these may be between 10 and 50 individuals  $ha^{-1}$ , depending on species and location.

(From Bell et al. 2008)

Larval durations – how long are larvae drifting in the currents before they can settle?



Most fish

3–10 weeks



Corals

3 weeks



Beche-de-mer

2 weeks



Clams

2-3 weeks



Trochus

3 days



Lobster

4-18 months

Above: A teaching slide that shows larval durations for various economically important species.

While there is a commendable level of collaboration and information flow between TNC and Mahonia Na Dari in Kimbe, there is some scope for an increased level of integration of work between the two groups. Mahonia has a great deal of experience communicating scientific concepts to school children and villagers, while TNC is directly involved in, or closely associated with exciting cutting edge fisheries research such as the work being done on larval dispersal and fish reproductive behaviour by Geoff Jones, Glenn Almany, Rick Hamilton and others. Continued communication of the results of this work to people in TNC's partner villages would no doubt be greatly appreciated. An exchange program between TNC and Mahonia, where staff members of each group spend time working with the other group, would help in the exchange of ideas about effective science communication at different levels. It is very important that scientific ideas are communicated carefully, consistently and without exaggeration. I have occasionally observed a tendency for some Western environmentalists to hype threats to marine ecosystems, and to exaggerate the extent to which MPA/MMA programs will deliver economic benefits. This sort of behaviour only damages an organisation's credibility. Involving local people in ongoing monitoring work, including both dive-based fish counts, and shore-based CPUE monitoring, is likely to greatly increase both interest in, and compliance with management programs.

TNC has already documented quite a bit of local knowledge about fish and other economically important marine organisms at several of its sites. Recording this information (where it isn't secret) and communicating it to younger generations, particularly where it complements the above-mentioned scientific concepts, can only strengthen the power of the scientific messages that underpin fishery management, including EAF principles. I would encourage continued efforts on this front, and where possible the involvement of local teachers in efforts to make fishery biology a component of school curricula.

# TRIP REPORT

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## KIMBE BAY

*26<sup>th</sup> Jan 09*

Transit Townsville to Kimbe Bay. Met by Leo Bualia at the airport, who gave me a suggested itinerary for the visit. Stayed at Walindi Plantation Resort. Met with Freda Paiva in the evening.

*27<sup>th</sup> Jan 09*

Met with Leo Bualia, and Walain Ulaiwi and was given a briefing of the project scope, funding arrangements and achievements to date. The Participatory Conservation Planning approach was outlined. Details of relationships between TNC and New Britain Palm Oil, as well as the Provincial Government were also discussed.

Met with Cain Lomai, manager of Mahonia Na Dari, in the evening.

*28<sup>th</sup> Jan 09*

Dived Susan's Reef, and another near it, with Walindi Plantation Resort dive operators.

Interviewed Bob Prior, former research scientist with NBPOL.

Travelled to Tarobi Village after lunch with Michael Tarbebe (driving), and Adolf Tovili ([atovili@tnc.org](mailto:atovili@tnc.org); Community Development Facilitator (CDF) for Tarobi) and George Ulae ([gulae@tnc.org](mailto:gulae@tnc.org); Coordinator of the CDFs).

Met with Tarobi Village Committee, including Chairman George Meinharthd-Litom, Chairman of Tarobi LMMA Site Committee. Over-nighted in Tarobi.

*29<sup>th</sup> Jan 09*

Returned to Kimbe.

Met with Cecilie Benjamin, Chair of the Board of Mahonia Na Dari.

Met with staff of Mahonia na Dari (Fidelma Takaili and Tansy Bliss).

Met with Ben Rich, Manager, Sustainability, NBPOL.

Met with Cosmas Makamet, Manager, FORCERT, in the same building as Mahonia Na Dari.

Dinner with Newell Sinaigawi, Fisheries Advisor, West New Britain Province, and Leo Bualia, Walain Ulaiwi and Michael Tarbebe..

## MANUS

*30<sup>th</sup> Jan 09*

Transit to Manus, via Moresby. Met by Manuai Matawai. Brief discussion with Manuai Matawai and Pere Village Councillor Chokal Polin in the evening. Over-nighted at the Lorengau Hotel.

*31<sup>st</sup> Jan 09*

Travelled to Pere Village. Met with various people involved in the management committee directly or indirectly. Stayed at the house of John Samol.

*1<sup>st</sup> Feb 09*

Visited the Kwichou Islands cultural sites and the permanent transect for spawning aggregation monitoring.

Interviewed Francis Tanou, an elder of the community, about the histories of each of the Titan tribes, and their origins in the Kwichou Islands.

Attended a community meeting in the community centre and took notes on various points that were made about the marine resource management process. Interviewed various individuals later in the day about what was discussed at the meeting.

*2<sup>nd</sup> Feb 09*

Spent the day talking to various members of the Pere community about aspects of culture, demography, local economy and social structure, as well as recording peoples' thoughts on the conservation program, and alternative livelihood options.

Snorkelled on the reef just in front of Pere Village.

*3<sup>rd</sup> Feb 09*

Travelled back to Lorengau, where I spoke with Paul Mangeu (Provincial Fisheries Officer) and Paso Pohei (Principal Fisheries Advisor) at the Provincial Fisheries Office.

Over-nighted at Manuai's house.

*4<sup>th</sup> Feb 09*

Transit back to Townsville, via Cairns.

## SOLOMON ISLANDS

*7<sup>th</sup> and 8<sup>th</sup> Feb 09*

Transit to Honiara, via an overnight in Brisbane.

*9<sup>th</sup> Feb 09*

Met with Rudie Susurua at TNC office in Rove and with Alex Carlos, John Leqata, Lionel Luda and a number of other fisheries officers at Ministry of Fisheries and Marine Resources at their new workspace in Ranadi.

*10<sup>th</sup> Feb 09*

Met with FSPI (Hugo Tafea and Silverio Wale) in New Chinatown. Attempted to meet with the Lauru Land Conference President, Bishop Leslie Boseto, but was informed he would be away till the 13<sup>th</sup>.

11<sup>th</sup> and 12<sup>th</sup> Feb 09

Held various discussions with Peter Ramohia, Willie Atu and Rick Hamilton at the TNC office at Ranadi. Had lunch and dinner with the TNC team, including the film makers Jordan and Kat, on the 12<sup>th</sup>.

13<sup>th</sup> Feb 09

Transit back to Townsville.

## ACKNOWLEDGEMENTS

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This Project was made possible through support provided by The Nature Conservancy and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety supports this project within the framework of the International Climate Initiative. The content and opinions expressed herein are those of the author(s) and do not necessarily reflect the position or policy of The Nature Conservancy or the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and no official endorsement should be inferred.

I would like to express my gratitude to all of the TNC staff with whom I spoke during this review. Everyone was helpful and friendly, and gave generously of their time to talk to me. I am particularly grateful to team leaders Leo Bualia (Kimbe), Manuai Matawai (Manus) and Willie Atu (Solomon Islands) for their logistical support, organizational assistance, and warm hospitality during my visits. I am also grateful to many people in the communities of Tarobi and Pere for their hospitality and openness in discussions about the marine resource management challenges they are facing, and the impressive successes they have achieved. Thanks also to all the TNC staff who provided constructive criticism of the first draft of this report.

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