A report on the current status of exploited reef fish aggregations in the Solomon Islands and Papua New Guinea – Choiseul, Ysabel, Bougainville and Manus Provinces

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1.0 Introduction

In 2003 Richard Hamilton was commissioned by SCRFA to compile a preliminary database on reef fish spawning aggregations in the Solomon Islands and Papua New Guinea (PNG). It was intended that the data collected would contribute towards the compilation of a detailed and comprehensive global database on the current status, location, and exploitation history of all known fish spawning aggregations. "Such a database can be used to summarize, in a standardized way, our current knowledge on reef fish aggregations, identify gaps in information, and provide a strong foundation on which support for aggregation management and protection can be based" (Preliminary report on the SCRFA global database, December 2002). Aside for compiling a preliminary database on spawning aggregations in each country, the in country visits also served as a valuable means of establishing contact with national and provincial fisheries officials, provincial officials, local community leaders, community based fishers and NGO's. It also provided an opportunity to hold public meetings in many of the rural communities visited, where the issues surrounding spawning aggregations were discussed.

Due to the dearth of scientific knowledge on reef fish spawning aggregations in both of these countries, the vast majority of the information documented in the SCRFA aggregation database and in this report was obtained through interviews with a wide range of stakeholders. Government officials, fisheries officers and local fishers were interviewed on their knowledge of spawning aggregations and associated issues, with published and unpublished literature being reviewed where available. The success of this project hinged on drawing on Indigenous Ecological Knowledge (IEK) pertaining specifically to spawning aggregations. Consequently, the main priority of this research was visiting remote fishing communities in each country, making contact and clearly explaining SCRFAS short and long term aims with these communities, and then establishing what (if any) species where known to form spawning aggregations within fishers traditional fishing grounds. When possible spawning aggregations were identified and fishers who were willing to participate were interviewed on a wide range of topics regarding these aggregations in accordance of the SCRFA questionnaire. When possible aggregation sites were also visited and precise locations marked.

The short time frame available for this work (6 weeks) meant that only several provinces in each country could be visited, and none of these provinces were covered in full. In the Solomon Islands Choiseul and Ysabel Province were visited, and in PNG Buka Island (Bougainville Province) and Manus Province were visited. All of these regions are maritime provinces that have extensive reef systems which are in relatively good health, a reflection of low population bases and communities leading a predominantly subsistence based lifestyle. These provinces were chosen in each country for the following reasons:

- There is little or no published work on reef fish aggregations in any of these provinces

- Interest in commencing LRFFT operations in Choiseul and Ysabel has been expressed

- LRFFT operations have occurred in Bougainville and Manus in the past, and there is interest in restarting operations in these provinces

- Local communities in each of these provinces have relied heavily on marine resources for generations, and consequently, it was envisaged that IEK on exploited spawning aggregations was likely to exist and be highly detailed.

It must be stressed that the data accumulated during this fieldwork surely represents only a tiny fraction of the IEK on spawning aggregations that are held by local fishing communities in each country. I begin below by providing an overview of IEK and CMT systems. Both need to be understood in order to appreciate how they may be utilised and incorporated into contemporary research and management of spawning aggregations in these countries. Following this overview I report on my findings from the Solomon's and PNG. I deal with the Solomon Islands first, and start by reviewing the history of the LRFFT within this country and its current status. A review of the LRFFT is important when one considers that the LRFFT is one of the major threats to coral reef fish spawning aggregations worldwide (Sadovy & Vincent, 2002). I then provide a specific report for Choiseul and Ysabel Province, over viewing the areas visited and the procedures followed, the status of IEK bases in each area, current forms of marine management under existing CMT systems, and future options for research and management of spawning aggregations in each area. A similar framework is then followed for PNG.

1.1 Indigenous Ecological Knowledge

Indigenous ecological knowledge (IEK) is an important component of the intellectual and cultural property of many indigenous societies, and it plays an integral part in a wide range of social and cosmological dimensions of these communities lives (Carrier, 1987; Foale, 1998a). From a rationalist viewpoint, indigenous knowledge bases also hold a great deal of information that is valuable to conservation and science. Indigenous ecological knowledge contains baseline information on local ecologies including information on what is present in the local ecosystems, and its temporal and spatial patterning (Hamilton & Walter, 1999). "Fishers can provide critical information on such things as interannual, seasonal, lunar, diel, tide-related and habitat related differences in behaviour and abundance of target species, and on how these influence fishing strategies" (Johannes *et al.*, 2000; 257). Fishers often know much more than biologists about the location of critical habitats such as spawning grounds (Johannes, 1981; 1988; Johannes & Hviding, 2001: Hamilton, nd), feeding areas (Hamilton, 1999), nursery areas (Johannes & Ogburn, 1999; Aswani & Hamilton, nd) and sea bird aggregation sites (Nakashima, 1993). IEK can also be critical in providing a perspective on the historical state of reef fish communities (Hamilton, In Press).

The potential values of indigenous knowledge bases are becoming increasingly well recognized, and a large body of literature advocating its documentation and integration with more quantitative types of research now exists (Lalonde & Akhtar, 1994; Stevenson, 1996; Christie & White, 1997; Johannes & Hviding, 2001). In South Pacific countries, quantitative baseline studies of coastal resources are rarely available for marine biologists to utilise, but rich bodies of indigenous ecological knowledge frequently exist, and if accessed correctly can provide detailed insights

into the past abundances, size structure and spatial distribution of a fish stock in question. In instances where large-scale ecological changes have occurred within the lifespan of fishers, then the knowledge of such changes can be extremely detailed. "Where long-term data sets are unavailable, older fishers are also often the only source of information on historical changes in local marine stocks and in marine environmental conditions" (Johannes *et al.*, 2000, p 257).

Although indigenous marine knowledge can be enormously rich, there are several common problems associated with utilising it.

1. IEK and other types of indigenous knowledge exists as inseparable parts of complex cultural systems, and it requires a detailed understanding of the cognitive framework of the indigenous culture, and the use of anthropological methodologies such as interviewing and participant observation to accurately document this material. Obstacles such as language barriers frequently face foreign scientists wishing to work with IEK, where the time needed for a scientist to gain fluency in the local language often exceeding the time limits of the entire project (Foale, 1998a).

2. IEK is often stratified by gender, age and geographical location (Hviding, 1996; Christie & White, 1997) and specific knowledge pertaining to specific families of fish is often restricted to expert fishers who specialise in targeting those species (Hamilton, 1999; Johannes *et al.*, 2000).

3. Most indigenous knowledge of marine ecologies is ultimately directed towards identifying patterns that maximise capture success. Thus some details of fish biology that are important to a marine biologists studying reef fish ecology may well be irrelevant to a local knowledge base, since these biological parameters have no influence on subsistence practice (Hamilton & Walter, 1999).

4. Whereas indigenous knowledge of fish behaviour will often be very accurate, local explanations for the mechanisms underlying these behaviours may not be compatible with scientific paradigms. "In some places declining yields may be attributed to sorcery or a failure to propitiate the gods" (Ruddle *et al.*, 1992:262).

5. Fishers' knowledge, like scientists, is fallible, and thus cultural information needs to be gathered systematically and treated with the same critical scrutiny that is applied by scientists to any other data set (Hamilton & Walter, 1999; Johannes *et al.*, 2000).

1.2 Customary Marine Tenure (CMT)

Customary marine tenure is a situation in which identifiable groups of people have informal or formal rights to coastal areas, and in which their rights to use and access resources are, in principle, excludable, transferable, and enforceable (Ruddle 1996), either on a conditional or permanent basis (Aswani & Hamilton, nd). All Solomon Islands and PNG coral reef fisheries (subsistence, artisanal and commercial) operate within well developed CMT systems, where ownership of and hence access to coastal

areas depends on a range of culturally defined variables, including descent line. Many anthropologists have documented the intricacies of CMT systems within the Solomon Islands and PNG (e.g. Carrier & Carrier, 1983; Hviding, 1996; Aswani, 1998) and various authors have promoted the idea that CMT systems could be used as an effective basis for achieving sustainable development and management of inshore fisheries in the Pacific Islands (Ruddle *et al.*, 1992; Foster & Poggie, 1993; Johannes *et al.*, 1993; Christie & White, 1997; Johannes, 1998; Thomas 2001).

Contemporary inshore fisheries management under existing CMT systems has had success in some areas of the Pacific in recent years (Johannes, 1998; Fa'asili, & Kelekolo, l999; Aswani & Hamilton, nd). However, it has become apparent that CMT systems alone will not conserve marine resources in many countries, especially when the economic incentives to harvest these resources are high and tenure disputes among differing parties are unresolved (Foale 1998a; 1998b; Aswani, 1998; Hamilton, 1999). It has been argued that CMT systems throughout the South Pacific and Asia were developed primarily for 'gain not restrain' (Carrier & Carrier, 1983; Polunin, 1984; Ruttan, 1998) and this issue has been the point of some controversy among academics (Hviding, 1996; Aswani, 1998). Regardless of the mechanisms behind the development of CMT systems, their obvious and undisputed management benefits are:

1. They provide an existing culturally recognised ownership structure around which management incentives can be based (Johannes *et al.*, 1993)

2. CMT systems effectively restrict outsiders access to traditional fishing grounds (Johannes, 1981; Hviding, 1996) hereby eliminating some of the problems associated with common property that are prevalent in many of the worlds inshore fisheries (Hardin, 1968).

CMT systems vary markedly between different regions, and the intricacies of these systems, their robustness and appropriateness to management or conservation initiatives need to carefully evaluated for each region in question.

2.0 The Solomon Islands

The Solomon Islands are a double-chained archipelago lying east of Papua New Guinea that extends over 1700 kilometres across the South West Pacific.
Over 900 islands make up the Solomon Island archipelago, most of which are volcanic in origin. The population of the Solomon Islands is approximately 500 000 and around 85% of Solomon Islanders live in rural villages where their livelihoods depend on subsistence production. The Solomon Islands has the lowest gross national product per capita in the South Pacific region with the predominant artisanal fishing craft being the dugout canoe (Adams & Dalzell, 1994). The national economy is heavily dependent on foreign aid and this situation has worsened in recent years with the cessation of most export commodities due to ongoing civil unrest in this country. Around 90 Austronesian and Non-Austronesian languages are spoken in the Solomon Islands with Pidjin English being the most widespread and frequently spoken language.

2.1 A brief history of the Live Reef Food fish Trade (LRFFT) in the Solomon Islands

LRFFT operations began in Vella La Vella Lagoon in the Western Province of the Solomon Islands in 1994 (Johannes & Lam, 1999), later spreading to Roviana and Marovo lagoons in the Western Province in the mid 1990s, with the most recent ventures starting up in the remote northern atoll of Ontong Java in 1999 (Donnelly *et al.*, 2000). Historical LRFFT operations in the Solomon Islands have predominantly been pulse fishing events that target seasonal spawning aggregations of serranids, and there is concern among local fishers and fisheries biologists over the social and biological impacts that the LRFFT has had in this country (Johannes & Lam, 1999; Kilé *et al.*, 2000; Johannes & Kile, 2000; Donnelly *et al.*, 2000; Samoilys & Donnelly, 2001). Concern over LRFFT operations in the Solomon Islands were brought to a head in 1999 where a licensed LRFFT company vessel that was surveying potential fishing grounds in Ysabel was discovered to be carrying equipment consistent with that found on board cyanide fishing vessels in Indonesia and Philippines (Donnelly *et al.*, 2000). The Solomon Island government subsequently imposed a moratorium on all new LRFFT licences in February 1999, which was lifted in late 2000 following considerable political unrest and the ensuing finical crisis that continues to affect the Solomon Islands.

In mid 2001 LRFFT companies again began to seek out new unexploited fishing grounds around the Western Province of the Solomon Islands (Personal observations, Roviana Lagoon, June 2001), and in the same year a management plan for the LRFFT drafted in Honiara (Donnelly, 2001). This draft management plan sought to totally protect the spawning aggregations of the three main target species of the LRFFT (*Plectropomus areolatus*, *Epinephelus fuscoguttatus* and *E. polyphekadion*) by placing a ban on aggregation fishing for five days either side of the new moon during the three months of the year when aggregations of these groupers are known to form (Donnelly, 2001). A recent article by Samoilys (2002) in the SPC Live Reef Fish Information Bulletin stated that the draft management plan was yet to be implemented, however many of the main recommendations of the draft plan were in fact incorporated into a 2002 revised version of the LRFFT interim licence conditions (Eddie Oreihaka, personal communications January, 2003; See also attached copy of the licence). Specific changes were;

Article 14. The vessel/carrier shall be equipped with an approved Automatic Location Communicator (ACL), duly registered with the FFA Vessel Monitoring System. The Master shall ensure that the ACL is operational at all times when the vessel is in Solomon Islands waters. When entering Solomon Islands waters, the Master shall ensure that the ALC is operating continuously from at least 24 hours prior to entry.

Article 22. Fishing is of spawning aggregations is not permitted under this licence. (The period is 5 days before and 5 days after new moon).

Nb: Specific months are not specified in the licence, as aggregations seasons vary between regions and are in many cases, unknown.

Article 24. Fishing for Live Reef Fish Food is restricted to Solomon Islands citizens only.

These new requirements of the LRFFT licence coupled with price disputes have effectively halted all LRFFT operations in the Solomon's Islands. Although several licences were purchased in 2002, no operations took place in that year, and no licences had been renewed for 2003 (Nelson Kile, personal communication, January 2003). The main reasons for this appears to be price disputes among local fishers (many of whom are now well aware of retail prices in Hong Kong) and company officials claiming that operations will not be economically viable if they cannot fish themselves, stating that the on off nature of local fishers will provide inadequate supplies of fish (George Diau, personal communication, March 2003).

In the Solomon Islands, LRFFT operations have significantly increased fishing pressure on known grouper aggregation sites (Hamilton, 1999; Kile *et al.*, 2000), and in the Western Province, local fishers have been hired by company representatives to seek out and experiment fish at known but little fished grouper aggregation sites (personal observations, 2001).

2.2 Choiseul Province

2.2.1 Preface

Prior to travelling up to Choiseul Province I had a meeting with Nelson Kile, (Minister, Ministry of Fisheries and Marine Resources) and Eddie Oreihaha (Director, Ministry of Fisheries and Marine Resources) at the National Fisheries headquarters in Honiara on the 23rd of January 2003. In this meeting I outlined the goals of SCRFA and my intended field work in both Choiseul and Ysabel Province. Both Nelson Kile and Eddie Oreihaha where very supportive of the proposed fieldwork, and a letter of support was written for me by Eddie Oreihaha, which introduced me to the fisheries officers in Choiseul, and requested that they assist me in my fieldwork (See attached letter). On the 24th of January I arrived in Taro, Choiseul and met up with provincial fisheries officers Nelson Kere and Francis Taniveke, and together we planned a field trip around southern and northern parts of Choiseul. Francis Taniveke, who is from Panarui village in South Choiseul agreed to accompany me on the trip, and on the same day we organised hiring a boat for transportation. Between the 25th of January and the 3rd of February Francis Taniveke and I visited Lologhae, Panarui, Sanggighae, Kuku, Levaleva, Popoporo, Polo, Vuranggo, Chivoko and Liuliu villages in south and north Choiseul. Community meetings were held in all villages visited. The trips was extended longer than originally anticipated, as travel from South Choiseul to the north was slowed as a result of rough weather caused by Cyclone Ben.

The boat that was used throughout the field work in Choiseul

2.2.2 Background information

Choiseul is a remote province that has a population that is almost entirely subsistence based. In South west Choiseul the predominant fishing method is drop line fishing from a dugout canoe, with fishers mainly concentrating on submerged reefs of moderate depth (20-50m) that extent up to seven kilometres off shore. Fishers mark the locations of specific fishing grounds on submerged reefs by memorising reference points on the mainland. In the North western part of Choiseul expansive outer barrier reefs and reef flats occur, allowing for a more diverse range of fishing techniques including, spearfishing, droplining, netting and the use of traditional plant poisons (Derris roots). Grouper form a very important component of local catches in Choiseul, particularly in the south where droplining is the dominat fishing method.

Aside from some royalties from logging, communities in Choiseul depend almost entirely on the sea as a source of income with Beche-de-mer, shark fin and trochus being the main means of generating cash. Dependence on the sea as a source of income has risen sharply in recent years with the collapse of copra and coco operations (at a provincial and national level) and the bankruptcy of national and provincial governments, which has resulted in national and provincial government employees often being unpaid for months. Furthermore, the economic crisis that the Solomon Islands is experiencing means that there is now little money coming into remote regions such as Choiseul in the way of remissions from family members working in Honiara. Virtually no markets for fish existed in any of the regions visited, and the ice machine at the provincial fisheries centre in Taro had broken down at the time of my visit, with the province having insufficient funds to repair it (Francis Taniveke, personal communication, January 2003). Even when the fisheries centre at Taro was operational, its distance from most of the areas we visited means that it is impractical for

these communities to sell their fish catches here. Compelling this problem of distance is that remote villages have no access to ice, and thus no means of storing fish. Consequently, virtually all fishing activities occurs for "kiakai no mo" (for food only), and fishers report extremely high catch rates of fish, often saying that they only need to fish for an hour or so to meet food requirements.

LRFFT operations have never commenced in Choiseul, although a LRFFT company representative did contact the Provincial Government in 2000 regarding fishing in Choiseul waters, and in the same year a fisheries officer from Taro took a LRFFT representative around several communities in North-west Choiseul, a region his company was interested in operating in. However the company representative had poor English and Pidjin, so he was unable to communicate effectively with local community leaders and left discouraged several days latter (Francis Taniveke, personal communication, January 2003).

2.2.3 Community meetings and interviewing procedures

Upon arriving at a village we would ask to talk to the Chief, and then outline to him our intentions and request to hold a community meeting that day, often also requesting to stay the night in any available community accommodation. Often we would hold meetings at night in community halls or meeting houses, as at this time everyone had returned to the village from their daily activities. The largest meetings were held on Sundays after church.

A typical community house in Chiviko village where we spent a night.

Community meetings went as follows: Francis Taniveke would ask the local minister to open the meeting with a prayer and then thank everyone for coming and thank the chiefs for giving us permission to talk (This was done in either the Babatana language or Pidjin). I would then

introduce myself, and explain my association with SCRFA and its short and long term goals. Following this I would give a talk on the biology of species targeted in the LRFFT, concentrating in detail on life history characteristics that make many of the primary target species of the LRFFT vulnerable to rapid overexploitation. (i.e. aggregating behaviour at set sites during predicable spawning periods, slow growth and protogyny). Spawning behaviour and the pelagic larval stage of fishes was also described.

After this I overviewed the LRFFT operations, the target species of the LRFFT, the impacts that the LRFFT has had in other regions of the world, the history of the LRFFT in the Solomon Islands, past prices paid for these fish in the Solomon Islands and the retail prices paid for various targets of the LRFFT in Hong Kong. I used the "Identification guide to fishes in the live seafood trade of the Asia-Pacific region" (Lau & Li, 2000) as a visual aid throughout the talk.

In concluding, I reiterated the lifehistory characteristics that makes many spawning aggregations vulnerable to heavy levels of exploitation, the reasons why the LRFFT would be interested in unexploited areas such as Choiseul in the future, and restated that SCRFA was potentially interested in assisting and working with local communities and provincial fisheries in the future to ensure the long term sustainability of their fisheries. The community was then asked if they had any questions regarding any of the topics covered in the talk. Numerous questions came out of these talks, with fishers being particularly interested in:

- Sex change in fish
- Actual spawning in fish- although some fishers had witnessed this, none understood it to be spawning.
- The larval stage of fishes
- The disparities between prices paid for fish and prices obtained at retail outlets.
- The specific operations of the LRRFT
- How could they prevent the LRFFT from either coming altogether, or if it came, how could they ensure that long-term sustainability of their resources.
- Where there any less destructive alternatives to the LRFFT
- Could we tell them the spawning periods of their fish, so that they could control fishing at these times

Both Francis and I answered these questions, with Francis sometimes translating questions in Babatana into Pidjin for me. We had an overwhelmingly positive response from all of the communities we visited, with all communities very interested in our work and recognising the potential benefits of properly managing spawning aggregations. A common request from communities was their desire for SCRFA to return and determine through research when spawning seasons of the various fish in their waters occur, so that this information could be used as a basis for future community and provincial based management.

Community meeting in progress in Chivoko

Once all questions had been answered, we asked fishers at the meeting some general questions about local fishing techniques, types of fish captured and knowledge of spawning aggregations that occurred on their reefs. Following this, the chief would close the meeting with a speech and a prayer, and ask interested fishers to stay behind and discuss in detail their IEK of spawning aggregations. (Sometimes, the chief would pick out specific people to talk to us whom he knew to be particularly good fishers).

Often fishers would come back to our accommodation after the meeting, where discussions would continue well into the night. It is noteworthy that while community meetings were a great way of sharing information and gaining general views and attitudes, small interviews (1-5 fishers) were the only way in which I could cover all the question in the SCRFA questionnaire, and have sufficient time to begin to comprehend local IEK that was being shared. Trying to interview a large group of people (sometimes well over 100) in detail was simply impossible. Furthermore, many Melanesians are shy, and often one needs to win a degree of acceptance and trust, before useful information is divulged. Consequently, the best information was invariably gained when several fishers and myself were sitting in a kitchen, drinking tea, smoking and chewing Beatle nut while flicking through fish books and exchanging knowledge and ideas. Often, when specific spawning aggregations were identified by fishers, I would ask fishers if they would take me to the sites, and the following day we would visit these aggregation sites, take GPS readings and snorkel at sites, (depth permitting), in order to gain a good appreciation of habitat type.

2.2.4 IEK of spawning aggregations

In all areas visited fishers had detailed knowledge pertaining to the way in which the lunar stage, tidal state and currents influence catches. For example, in the most western part of

Choiseul currents can be extremely strong, so dropline fishing is restricted to three days around the first and second quarter when currents are at their minimum, a period known as Mata Suka Veka (when the moon is split in half). In all other areas visited currents are much less extreme, and all fishers reported remarkably consistent days when fishing is the best, that being a three day period around the new moon and the full moon and several days after it. In South Choiseul dropline fishers have detailed knowledge on the whereabouts of fish aggregating areas, many of which would appear to represent spawning sites, possibly for multiple species. These aggregations generally occur on the slopes of submerged reefs, often within highly localised areas with coral trout (and in particular *Plectropomus leopardus*) being the main fish captured at these sites (see SCRFA aggregation data sheet). In South Choiseul the locations of these sites is kept secret.

In North Choiseul, observations on spawning aggregations of *Plectropomus areolatus* were recorded from spear fishers, and aggregations of spawning *Ctenochaetus striatus* and mixed aggregations of *Epinephelus* spp. were described in detail (see SCRFA aggregation data sheet). Throughout Choiseul however, limited information on the seasonal timing of spawning aggregations was documented, with aggregations around Chiviko being the exception. In South Choiseul for example, it was not possible to determine the seasonality of aggregation formations, as all fishers interviewed stated that they do not mark specific season, using only the lunar cycle to identify the best times to target known aggregation sites. It may be that such sites represent spawning aggregation areas for many species of fish that spawn at different periods throughout the year, if this is the case, it would have the effect of keeping catch rates at such sites high much of the time, thus, there would be little need to mark specific seasons of individuals species. Furthermore, the lightly exploited expansive areas of reef in Choiseul coupled with a subsistence lifestyle of local communities may mean that fishers can catch adequate supplies of fish at any time, thus, there is little need for fishers to mark specific periods of exceptional fishing opportunities. Indeed, several large 100 kg eskies of top-level carnivores (serranids and lutjanids) can be filled in a single night by a few fishers (Francis Taniveke, personal communication, January 2003), indicating that levels of exploitation are very low. Also feasible is that some fishers had knowledge on the seasonal nature of aggregation formations, but were not prepared to divulge this information.

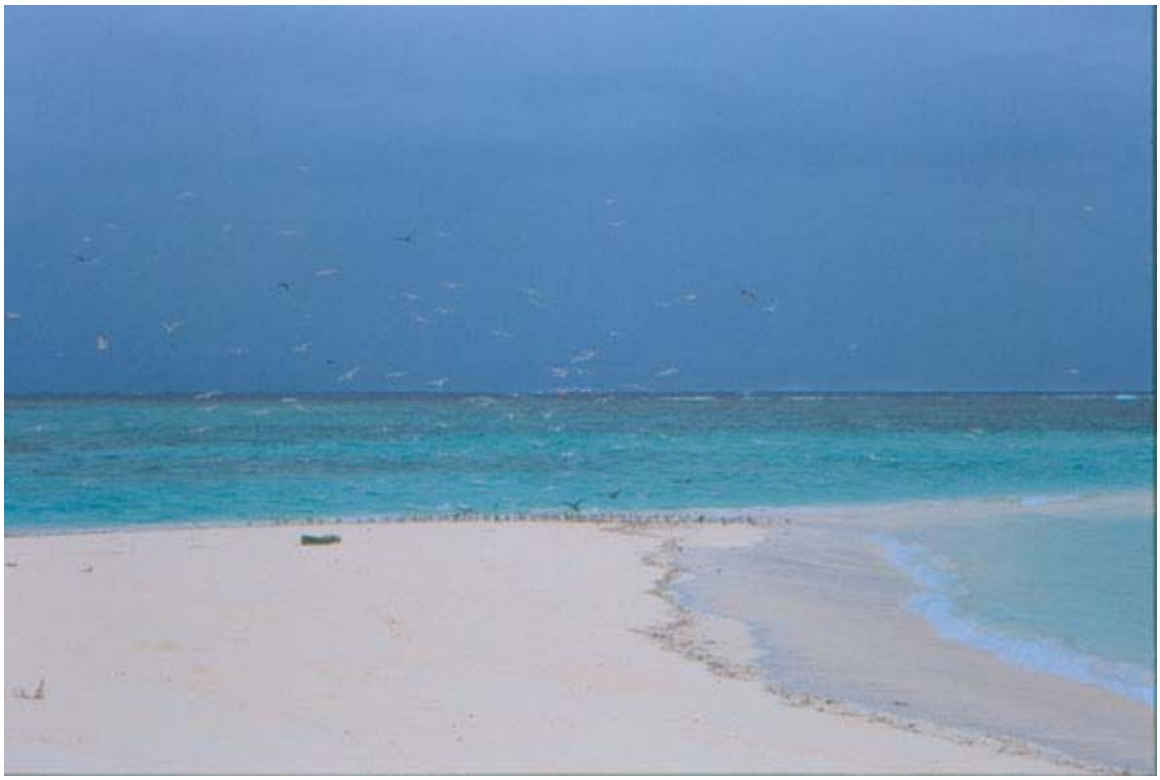
It is also apparent that many spawning aggregations sites of reef fishes around Choiseul remain unknown to local fishers, as is indicative of the recent and ongoing discovery of spawning sites around the island (See SCRFA aggregation data sheet). Interviews with fishers also reveals that historical fishing pressure on reef fish resources in Choiseul has been very light. The only declines in catches of reef fishes reported was for near inshore areas very close to populated regions, with older fishers stating that fishers now ventured further from shore than they had to in the past. Even catch rates from heavily harvested and well known mixed aggregations of *Epinephelus* spp. in Zaruna Passage, Chiviko (See SCRFA aggregation data sheet) are said not to have declined notably in fisher's lifetimes (Egan Velokaeqo, Chivoko, personal communication, January 2003).

2.2.5 Existing marine management under local CMT systems

In Choiseul the most common form of customary management is when communities close reefs to trochus and Beche-de-mer fishing for periods of 6 months-2 years. These closures only occur around reefs that have some sort of visible structure above sea level, such as reefs that are partially dry at high tide or have a small island on a portion of the reef. For example, the Lologhae community closed the Nggiloe reef in South Choiseul to all trochus fishing in

1998 (Antony Naqukana, personal communication, January 2003) and at Polo village in North Choiseul, the harvesting of trochus and Beche-de-mer from the reefs surrounding Manu Island is currently banned for all of 2003 (Peter Pataja, personal communication, January 2003). Closures are implemented through the chiefs and the church, with a church leader praying over the reef at the time of closure. Reefs are then considered Tambu (sacred) until opened, and fishers adhere to closures, believing that the closed reefs are now cursed and it would be bad luck to break the Tambu. The reefs surrounding Manu Island are known to have an enormous black Tambu custom shark that protects the island, and fishers who break Tambu's implemented by the chiefs will be eaten by the Kustom shark. The belief in this custom is very strong, and was reinforced in the 1970's when a large shark killed a man from a different province who was diving on the Manu reefs for holothurians during a closed season (Peter Pataja, personal communication, January 2003).

It is important to note that in most cases these closures more accurately represent stockpiling of valuable community resources as apposed to the western concept of conservation-based management. For example, the Nggiloe reef in South Choiseul was opened after a one-year closure and many village members harvested trochus over a one week period, with all proceeds contributing towards the construction of a new church building. The disparities between western conservation based management ideals and current forms of local community management in Choiseul were also vividly apparent at Manu Island. While trochus and Beche-de-mer are frequently protected on the reefs surrounding this island, Leatherback turtles, hawksbill turtles and seabirds that all use this island to lay eggs between November –January are exploited, and never protected under local CMT systems (Peter Pataja, personal communication, January 2003).



Nesting sea birds on Manu Island

Having said this, one of the areas we visited were actively implementing community based management measures for the sole purpose of ensuring the sustainability of marine stocks. Chiefs from the village of Liuliu at the western tip of Choiseul were preparing to place a two year ban on various forms of fishing (spearfishing, gill nets and traditional fish poisons) over a large area of reef (approximately 8 linear kilometres). These closures were to come into force in March 2003, and had come about from perceived declines in catches over the last twenty years as a result of a growing population and a move towards more modern fishing technologies. Liuliu was the only area in Choiseul where I observed management measures being implemented for anything other than trochus and Beche-de-mer.

2.2.6 Future options for research on spawning aggregations

As a result of the community meetings held in each village visited, there were plenty of opportunities to discuss possibilities for future research and gain communities responses. All communities that were visited in Choiseul invited SCRFA to return in the future and carry out research on spawning aggregations. Communities also stated that they would be prepared to assist in this work, by recording catches they made, and GSI data etc. Given the pristine nature of Choiseul reefs, the high catch rates and the willingness of local communities to participate in research, it would be possible to establish the spawning seasons of a wide range of important commercial species in Choiseul through a one or two-year survey of local catches. Such surveys would also provide numerous opportunities to collect substantial amounts of demographic data for latter laboratory analysis. The possibility of such research was discussed in detail with Francis Taniveke who is very interested in being involved in such a project. Some of the steps that such a project would require are listed below:

- Formalising provincial and national approval
- Design the research and establish where to collect such information
- Run workshops in the designated communities detailing what information to collect, how to collect it etc. Equipment such as scales, tape measures and field guides to various fish species would need to be provided at this stage as well.
- Overseeing the areas where work was being conducted. A provincial fisheries officer could possibly carry out such work with short field trips made by an outside researcher, who could at these times collect demographic data, etc.

Any future researchers wanting to work for SCRFA in Choiseul should approach not only national and provincial government staff, but also the Lauru Land Conference of Tribal Community (LLCTC). The LLCTC is made up of chiefs from all regions of Choiseul, and is an organization that has a strong influence in Choiseul politics. In the past, independent outside researchers have been removed from Choiseul by the LLCTC, with LLCTC stating that these researchers were stealing the intellectual property of Lauru (Jerry Pitisopa, personal communication, January 2003). Nevertheless, LLCTC is keen to form partnerships with outside organizations with expertises in environmental issues, and William Atu at TNC office in Honiara has a strong working relationship with LLCTC. In February 2003 a memorandum of understanding was signed between TNC and the LLCTC at a LLCTC conference in Wagina Island (see attached draft of the MOU). At the same conference

William Atu gave the secretary of the LLCTC a letter I had written on behalf of SCRFA explaining SCRFA's fieldwork in Choiseul (See attached copy of this letter).

2.2.7 Future options for management

The status of reef fish around Choiseul appear to be very healthy and levels of exploitation are very low, so it is unlikely that they currently need management. However population growth is rapid in the Solomon Islands, and commercial ventures such as the LRFFT may come to this province in the near future. The most effective precautionary way of protecting spawning aggregations of high value species in Choiseul would be implement seasonal closures during the months of spawning. Such closures will require research and would be most effective if passed through provincial law and endorsed by the Lauru Land council. Site based management of individual aggregations would be impractical for most areas, given that numerous aggregation sites appear to remain undiscovered, the seasonality of many aggregations is unknown, and the majority of aggregations occur in remote locations. However in areas where aggregations where in close proximity to local communities, site based management could be implemented through existing CMT systems if local communities wanted to implement such controls.

2.2.8 Potential for eco tourism

It is extremely unlikely that eco tourism ventures based around diving at spawning aggregation sites in Choiseul could be established in the near future as Choiseul has very little infrastructure to support tourism. There is little accommodation for tourists in Choiseul, no where to rent diving equipment or fill tanks, domestic flights to Choiseul are infrequent and irregular and even the simplest services that tourist come to expect such as banking, telephones and basic medical assistance are unavailable for the vast majority of this province.

2.3 Ysabel Province

2.3.1 Preface

Initially I had decided to focus my time in Ysabel around the South eastern end of the province, in order to cover locations not visited by Johannes & Kile (2000). However, when it was brought to my attention that The Nature Conservancy (TNC) was investigating the possibility of monitoring spawning aggregation sites around Kia, it was decided to collect further information on the exact locations of aggregation sites in this area, data that would potentially be of use for any future research conducted here. William Atu from the TNC office in Honiara accompanied me on this brief field trip. William Atu has worked extensively with the Kai community who co manage the TNC run Anavon Marine Park and he coordinates the Solomon Islands TNC programmes relating to the conservation of spawning aggregations. William accompanied me in order to:

- Inform chiefs and village elder at Kia of TNCs interest in monitoring spawning aggregations in around Kia in the future.

- Gain experience in the type of information required by SCRFA

- Develop a wider understanding of the biology of fishes targeted by the LRFFT by participating in community awareness talks

Richard Hamilton and William Atu interviewed fishers from Kia, Baola, Sisiga, Ghoveo and Buala, between the 26th of February and the 2nd of March (refer to maps). A significant amount of time was spent travelling to and from Kia from the provincial headquarters of Buala by fibreglass boat, as the airport of Suavanao, which is close proximity to Kia, was closed due to disputes between local communities and Solomon Airlines. We spent two nights in Kia on the 26th and 27th of February, and we interviewed eight fishers (spearfishermen and older fishers) on their IEK of spawning aggregations around Kia, visited a *P. areolatus* spawning aggregation site, interviewed fisheries staff, examined fisheries purchase records from the Bahana Fisheries Centre in Kia and held a meeting with members of the Kia community on the night of the 27th of February. We then travelled back to Buala, stopping and holding community meetings and interviewing fishers at several villages along the way.

2.3.2 Background information

Ysabel is far more accessible than Choiseul, given the closer proximity of the island to Honiara. Five flights a week service the two ends of this province, fibreglass boats travel between Honiara and the eastern end of Ysabel, and coastal ships visit the main villages in Ysabel approximatly once a week. Like Choiseul, Ysabel Province has extensive reef systems that are lightly exploited (Johannes & Kile, 2000). Communities in Ysabel depend heavily on the sea as a source of income with Beche-de-mer, shark fin and trochus being important sources of revenue. Fish is also an important source of income in Ysabel, with many fishing activities being artisanal. Fishers can sell their catches at the government run Buala Fisheries centre and at the Bahana Fisheries centre in Kia. Eskies of frozen fish are also sent to Honiara via plane or boat from private operators, and several small privately owned fisheries centres operate out of Buala, with fish sold out to local markets. Communities located a long way from these main centres can sell fish to buyers on coastal shipping boats that travel around Ysabel weekly.

Spearfishing and dropline fishing are the main fishing methods used in the areas visited in Ysabel, and serranids make up a significant proportion of catches. Grouper are taken by a wide range of age and gender groups and harvested predominantly through drop lining, throw away line and spearfishing. The importance of grouper to local fisheries is reflected through commercial purchases. A fisheries officer at Buala estimated that serranids made up approximatly 20-25% of yearly purchases at the Buala Fisheries centre (Michael, Fisheries officer, Buala, personal communication March 2003) and in Kia serranids made up 23.5 % of the total catches in the months prior to this centre purchasing Bumphead Parrotfish. LRFFT operations have never commenced in Ysabel, although there were plans to establish LRFFT operations here in the past, and local communities in several regions of Ysabel had agreed to host LRFFT operations (Moffat Aloha, personal communication, February 2003).

2.3.3 Community meetings and interviewing procedures

The community meetings and interviewing procedure undertaken in Ysabel were identical to that followed in Choiseul. However the presence of William Atu meant that he was able to

answer in detail many questions regarding the Anavon Marine Park, turtle ecology, and long-term goals of TNC. Community meeting were held in Kia, Baola, Sisiga and Buala.

2.3.4 IEK of spawning aggregations

In December 2000 Bob Johannes & Nelson Kile interviewed fishers from around the Northwest portion of Ysabel (including Kia) and on Wagina Islands (off the eastern tip of Choiseul) about spawning aggregations that occur in their waters (Johannes & Kile, 2000). Johannes & Kile interviewed 17 fishermen (or groups of fishermen) during their study and focused on species that are prime targets of the LRFFT. Their main finding related to *P. areolatus*, with fishers informing them of eight known spawning aggregation sites for *P. areolatus*. However Johannes & Kile provided no indication in their report of either the general or specific locations of theses sites. Thus, it was not possible to determine if the two *P. areolatus* sites I documented from Ysabel where two of the same *P. areolatus* aggregation sites earlier reported by Johannes & Kile (2000). Johannes & Kile also reported that spawning aggregations of *P. areolatus* (and *P. leopardus*) were said to peak between June and July each year, and they also made the observations that due to a low population base and extensive reef systems, Ysabel was still very lightly fished, and that it was likely that many aggregations were yet to be discovered.

In February 2003 Kia fishers that I interviewed stated that Soghuma (*P. areolatus*) was the most important serranid in their fisheries (identical statements to this effect were documented for this area by Johannes & Kile 2000) and informed me of two sites where *P. areolatus* where known to aggregate. Fishers took me to the aggregation site that was closest to Kia, and the exact location of this site was marked on GPS and habitat was noted via snorkelling. However none of the fishers interviewed were able (or perhaps willing) to identify the specific seasonal or lunar periodicity with which aggregations formed, indeed, several older fishers stated that "we do not yet have a problem catching fish, so why bother marking the seasons of fish" (Gad Rotubele, personal communication, February 2003). Interestingly, examination of purchases made at the Banana Fisheries Centre in Kia between June 2001 –December 2002 showed that unusually large catches of coral trout were only ever recorded in June and August 2001, possibly indicating fishing on a spawning aggregations of *P. areolatus* at this time. (NB: no such peaks were observed in the 2002 data, although very little fish were purchased between June-August 2002. It was not possible to confirm if these large catches of coral trout in June and August 2001 represent *P. areolatus*, as all *Plectropomus* species purchased are simply recorded as coral trout.

Detailed information on several shallow water aggregations of small *Epinephelus* spp. was also collected from fishers at Baola village (see SCRFA aggregation data sheet). In all areas visited fishers reported no declines or only slight declines in catch rates over the past decades, indicating light fishing pressure in this area (see also Johannes and Kile, 2000). It is important to note that very little time was spent in any of the areas covered in this field trip, even at Kia we only managed to interview a very small faction of the fishing population. It is highly likely that a more extensive survey in this area would produce more information on spawning aggregations.

2.3.5 Existing marine management under local CMT systems

Although customary ownership of marine estates is apparent in Ysabel, I did not document any instances where community based management measures were or had been in place. Several fishers stated that while chiefs could in theory implement such controls, in practice, many fishers would be unlikely to adhere to their requests. Indeed, there was limited appreciation or concern for conservation issues in all areas visited, as was demonstrated through a conversation with Chief Billy Gedi from Ghoveo village regarding turtle harvesting. Chief Billy Gedi told me that the numbers of turtles harvested in this region were considerably higher than in the past, due to fishers abandoning traditional technologies (scoop nets) and now targeting resting turtles at night with the aid of underwater flashlights, spearguns and hooks. However, despite noticing a rapid increase in the numbers of turtles harvested, he was unaware and/or unconcerned of the potential long-term implications of these practices.

Ghoveo fishermen slaughtering green and hawksbill turtles that were captured the previous night.

The issues of conservation were repeatedly raised at community meetings in regards to the Anavon Marine Park, with few community members comprehending the link between protected areas and sustainable fisheries. Indeed several fishers stated that they hated the word conservation, associating it with a loss of resources and questioning the economic benefits of the Anavon Marine area to Ysabel. A lack of concern for conservation issues was amply demonstrated at Anavon in 2000, when following the break down of law and order in the Solomon Islands, several communities blatantly poached from the reserves waters. When confronted by TNC officers who were based at Anavon Island they told them that they were unconcerned of any retribution due to a lack of law and order (William Atu, personal communications, March 2003).

Having said this, community leaders at Kia did express their desire to work with TNC/SCRFA in the future regarding the monitoring and management of spawning aggregations. In Ysabel, as is the case in many areas in the South Pacific, an educational campaign clearly outlining the need for management and conservation measures would be a critical part of achieving any long term conservation goals.

2.3.6 Future options for research on spawning aggregations

Continuous yearly monitoring of the reproductive states of reef fishes purchased at the Buala and Babatana Fisheries centres would provide a wealth of information on the spawning seasons of fishes captured in Ysabel waters. This information, although time consuming, could be collected relatively easily, since trained fisheries officers operate both centres. The main requirement would be the collection of species-specific GSI data throughout the year. Carrying out this research at both ends of Ysabel would provide a spatial comparison of spawning seasonality and collections of demographic data during spawning seasons would complement this database and confirm spawning. At the Babatana Fisheries Centre, much relevant data is already collected, however the lumping of large families of fish under general English common names greatly reduces the value of this data (Refer to a copy of the EU fisheries datasheet from the Babatana fisheries Centre). One suggestion would be to limit sampling to species of interest that are frequently taken in local fisheries, and utilise local folk taxonomy in the species-specific identification of catches. It is ironic that while local fishers officers at Kia could quickly provide a species specific local name for all important reef fishes purchased, they admitted at times being confused over which English common name should be assigned to the variety of serranids purchased. A sensible and simple procedure would be to provide posters of the fishes of interest along with the scientific and local names of these fish.

Site-specific research at known aggregation sites would be possible but difficult in most instances; given the remoteness of many of these sites and lack of logistical support (I.e. there is nowhere in Ysabel where dive equipment could be hired or tanks filled).

2.3.7 Future options for management

I agree with earlier research by Johannes and Kile (2000) in that the most effective and practical means of protecting spawning aggregations in Ysabel would be seasonal closures around spawning periods. Establishing species-specific spawning periods would ideally involve quantitative research. Seasonal closures as a management measures would be especially relevant in the advent that commercial ventures such as the LRFFT establish within Ysabel waters. Seasonal closures would also protect aggregation sites that are as yet undiscovered and as Johannes and Kile (2000) point out, this approach does not risk the dissemination of information on the locations of spawning aggregations, information that could lead to their eventual overexploitation. Site based management would only be a practical option in relatively few instances where aggregations occurred in close proximity to communities whom were willing to implement controls through existing CMT systems.

2.3.8 Potential for eco tourism

Ysabel, like Choiseul currently has little infrastructure to support eco tourism. However unlike Choiseul flights to this province are reasonably frequent, and the Anavon Marine Park, the first and only marine park in the Solomon Islands, has the potential to be a major

attraction for eco tourism if TNC choses to open this area up to tourists. If TNC does decided to work with Kia community on monitoring and protecting spawning aggregation sites, then there would potentially be possibilities of developing tourism ventures in this region that were in part based around utilising spawning aggregations as a draw card.

3.0 Papua New Guinea

Papua New Guinea (PNG) encompasses the eastern half of the island of New Guinea, the Admiralty and Bismarck archipelagos and the northern islands of the Solomon Islands archipelago. The total population of PNG is approaching 5 million, with most of this population living in small rural settlements. Three quarters of the population live inland, with the expansive coastal areas accounting for only 13% of the total population (Hunnam *et al.*, 2001). Over 80% of the population live in the subsistence economy, and traditional landowners have customary rights over virtually all land and inshore coastal resources (Hunnam *et al.*, 2001). PNG boasts approximatly 12,000 km2 of coral reefs, most of which are in good condition and recognised as being among the most biologically diverse in the world (International Marinelife Alliance website, 2003). PNG also displays remarkable cultural diversity, with over 800 distinct languages spoken. Tok Pidgin is the most widely spoken language in PNG.

3.1 A brief history of the Live reef Food Fish Trade (LRFFT) in PNG

The LRFFT began in PNG in 1990 at the Hermit Islands, Manus Province (Gisawa & Lokani, 2001). It 1992 this operation was stopped by the Provincial Government due to a variety of social and environmental concerns that the operation raised. Since then LRFFT operations have operated in Milne Bay, Bougainville, New Ireland and East New Britain Provinces (Gisawa & Lokani, 2001). In 1998 a large cyanide-based LRFFT operation in Miline Bay was exposed. The PNG government subsequently closed down this operation, and a national moratorium on the trade was imposed (International Marinelife Alliance website, 2003). Realising that there was much interest in the LRFFT and that there was opportunities for local communities to benefit from it, the National Fisheries Authority (NFA) approved two trail LRFFT licences in late 2000 (Gisawa & Lokani, 2001). One trail licence was issued for operations at the Tingwon Islands in New Ireland Province and the other was approved to operate at M'Buke Islands in Manus Province (Gisawa & Lokani, 2001).

A study commissioned by TNC on the feasibility of the M'Buke Islands supporting a LRFFT operation concluded that the M'burke Island fishery could not supply the quantity of fish required to make a LRFFT operation successful (Squire, 2001). On the basis of this report NFA revoked the trial licence, and operations never went ahead (Stephen Nakilai, personal communication, February 2003). The trail fishery at Tingwon Islands in New Ireland Province did proceed as planned, however, the size of the operation was down sized considerably by NFA after research conducted by TNC staff (Paul Lokani *et al.*) during 2002 revealed that traps used were causing significant damage to the coral reefs, and spawning aggregations were forming in low numbers (John Kasu, personal communication, February 2003). At the time of this fieldwork only the LRFFT trial at Bangatang was still operational.

As is the case elsewhere throughout the western pacific, the commencement of LRFFT operations have significantly increased the fishing pressure on known aggregation sites in PNG (John Kasu, personal communication, February 2003), and have also led fishers to target aggregations of groupers that were previously little known of and relatively unfished (Sam Puty, personal communication, February, 2003).

3.2 Buka Island, Bougainville Province.

3.2.1 Preface.

The National Research Institute advised the Bougainville Provincial Government of my intended up coming visit in 2002, and they gave approval for this research and informed fisheries officers of my upcoming trip. Consequently, upon arrival in Buka in early February I made contact with Jinro Boisen, a provincial fisheries officer at Buka. Jinro Boisen, who is from Matsunga Island, agreed to accompany me on the trip, and we organised hiring a boat for transportation. Jinro Boisen informed me that fishers from the small outer islands that lie adjacent to Buka island were completely dependent of the sea, and thus likely to have more detailed IEK bases on spawning aggregations that fishers on the main island of Buka. Consequently, between the 9-14th of February Jinro Boisen and I visited communities on Taiof Island, Pororan Island, Petats Island and Matsunga Island (refer to map).

3.2.2 Background information

Buka Island lies just off the northern tip of the much larger Bougainville Island. Buka, like the rest of Bougainville Province is recovering from over a decade of civil war that was sparked in 1989 when local landowners claims for 11 billion kina (at the time approximatly 11 billion US dollars) as compensation for environmental damage caused by the Australian operated Bougainville copper mine (BCL) at Panguna fell on deaf ears. The signs of the peace process are evident, with the Peace Monitoring Force an active presence in Bougainville and numerous aid agencies have established themselves in Buka. At the time of this fieldwork workshops on the proposed move towards an autonomous government were being held in several of the villages that we visited.

The town centre of Buka, although relatively small by PNG standards is much larger than centres at Choiseul or Ysabel. Buka has a well-serviced airstrip with regular flights to other provinces, a hospital, power station, large market, numerous food outlets and small stores and a variety of accommodation. The population on the main island of Buka is predominantly subsistence based, depending on the sea and land for survival and as a means of generating a source of income. Copra, coco and small-scale timber production provide the main sources of income to communities on the Buka Island, with marine resources such as Beche-de-mer, trochus and fish providing a less important source of cash. The communities that we visited on small islands to the west of Buka Island are completely dependent on the sea for survival, and the standard of living is lower here since they do not have access to cash crops such as coco and copra (Jinro Boisen, personal communication, February 2003). These communities depend heavily on Beche-de-mer, trochus and fish as a means of generating income. Beche-de-mer is the most important resource, and is heavily utilised as a means of generating sufficient cash to pay school fees. Fish are predominantly smoked and then

transported and sold at the Buka market. A small amount of fish is also sold to local restaurants and fast food outlets. The provincial run fisheries centre in Buka did supply these communities with another outlet for their fish, but at the time of my visit this centre had not operated properly for almost a year, due to problems with electricity supply. (Jinro Boisen, personal communication, February 2003). The closest outer islands of Taiof, Matsungan and Petats supply Buka town with fish. At the most northern island of Pororan, the distance to Buka town makes travelling to the township to sell fish largely uneconomical. Traditional barter systems are still in place at Pororan, and on weekly basis individuals from the main island of Buka paddle across to Pororan Island and barter with Pororan fishers over the exchange of fruit and vegetables for fish. Grouper form an important component of local fish catches in Buka, being held in high esteem and actively sought after as a source of food and a means of generating income. The meat and eggs of aggregating groupers are actively sought out.

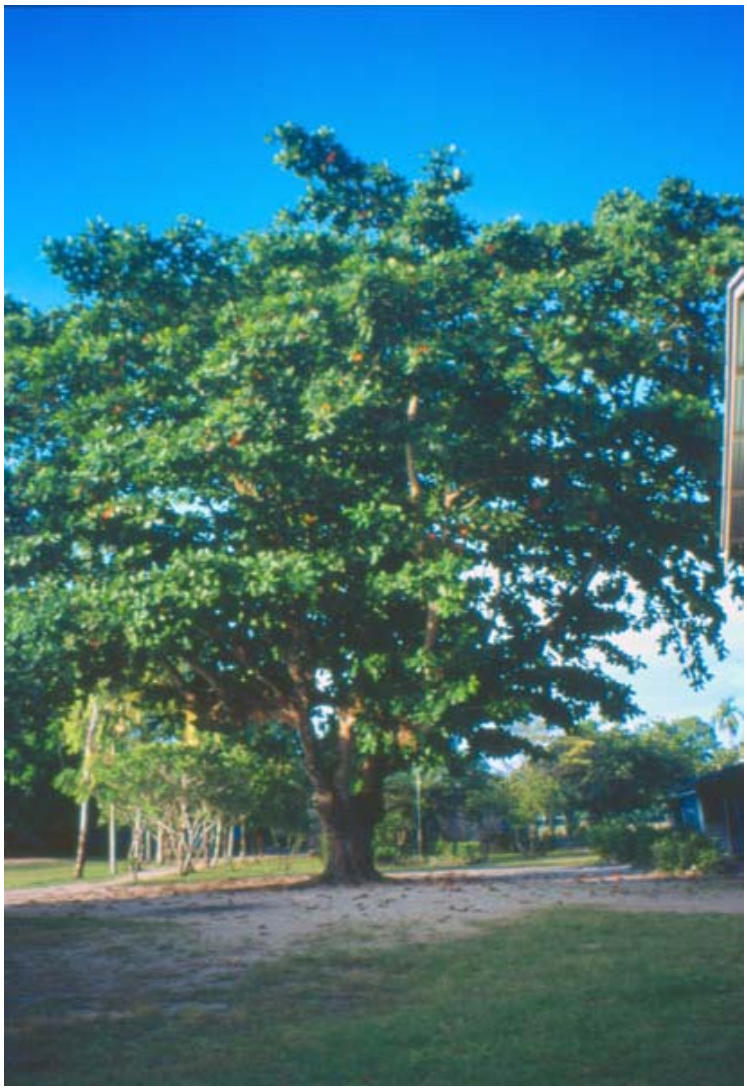
The Tasman Islands, Fead Islands, Nissan Islands, Mortlock Islands and Cateret Islands also come under Bougainville Province. A LRFFT operation operated at the Cateret Islands in 1993-1994, before local fishers removed them due to price disputes (Jinro Boisen, personal communication, February 2003). Spawning aggregations of serranids are known to occur at the Tasman, Fead and Cateret Islands (Paul Lokani, personal communication, December 2002), but none of these remote atolls could be visited in this trip due to time constraints and a lack of suitable transportation.

3.2.3 Community meetings and interviewing procedures

The community meetings and interviewing procedure undertaken in Buka was similar to that followed in Choiseul. Community meetings were held at Taiof Island and Pororan Island.

3.2.4 IEK of spawning aggregations

The majority of the fishers interviewed in Buka had detailed IEK on fish aggregations that occur within their waters. The most common and re accruing axiom regarding fish aggregations was fishers claims that when the leaves of the coastal Talise tree turned red, aggregations of serranids with ripe gonads could be harvested in large numbers from known aggregation sites. The linking of spawning seasons to the flowering or reddening of certain trees is not unique and has been documented in many pacific regions (e.g. Johannes, 1981: Hviding 1996). Perceivably, the same environmental cues that cause certain trees to flower or lose their leaves may also trigger spawning in certain species of fish.



A large Talise tree in Poroan village

In all areas, fishers were vague on the months in which the leaves of the Talise tree turned red, invariably stating that they followed the Talise tree not calendar months. Fishers were also unsure of the exact number of times that this Talise season occurred, although fishers predominantly stated that the Talise season occurred between 2-3 times a year. Clearly, a knowledge of the exact calendar months when aggregations form and a knowledge of the precise number of times a year that this occurs is irrelevant to these fishers. This provides an interesting example of where the IEK of aggregation formations is detailed, but so removed from a western framework that it does not aid in a scientific understanding of the months when aggregations form.

Further complicating a scientific synthesis of this information, was that although always detailed, IEK on the species that formed aggregations during the Talise season varied between communities visited, for example;

- In Taiof Island fishers described aggregations of *Plectropomus leopardus* and *Plectropomus maculatus* forming during the Talise season.

- At Matsungan Island fishers stated that *P. leopardus P. maculatus* & *P. oligacanthus* form during this period.

- At Petats village various species of *Cephalopholis* were said to aggregate at this period, which also coincided with the flowering of the Hihiki tree.

- Furthermore, at Petats Island fishers gave very specific detailed information on *P. leopardus* and *P. maculatus* aggregations that were reported to occur over several days in the second quarter every month of the year, with the lunar periodicity of aggregation formation pinpointed by both lunar stage and a monthly jellyfish phenomenon.

Give the close proximity of all the areas visited, is hard to explain how this Talise season could mark aggregations of *Plectropomus* in one area and aggregations of *Cephalopholis* in another. It also seems unlikely that the reported aggregations of *P. leopardus* and *P. maculatus* that occur every month of the year around Petats village always represent spawning aggregations, as these species do not spawn all year round in other tropical locations (i.e. Sadovy, 1996; Samoilys, 1997).

While it is possible that some of the IEK collected is epistemologically incommensurable with science, the fact that the Talise tree season was identified as a cue for aggregations of serranids in all areas implies that is has some biological basis, with *Plectropomus* the most likely family of fish to aggregate around this period. However, determining the exact species that aggregate at this time and their spawning season will require scientific investigation. Incidentally, the purchase records at the provincial fisheries centre in Buka provided no indications on the likely timing of *Plectropomus* spawning aggregations, as all reef fish species are purchased for a set price per kilo. In the majority of areas visited fishers reported declines in catch rates from aggregation sites over the past several decades (refer to SCRFA aggregation datasheet).

3.2.5 Existing marine management under local CMT systems

Well-defined customary ownership of marine estates occurs in Buka, however the power of community leaders to enforce closures within their respective communities appears to have declined considerably in recent years, and I did not learn of any instances where community based management measures were currently in place. Several of the fishers I interviewed stated that the civil war had undermined the village leaders power, with young members of the community who had grown up "strong with guns" being unlikely to listen to their elders requests (Samuel Boisen, personal communication, February 2003). One account of the breakdown of CMT systems around Buka was provided for the Sofina and Christmas Islands that are in close proximity to Taiof Island. Green and Hawksbill turtles are known to lay eggs on these uninhabited islands around December-January each year, and local fishers have harvested these eggs and turtles for generations. In the past, when numbers of turtles were perceived to be decreasing, village elders placed 2-4 year bans of the harvesting of these turtles. The last ban was implemented in the mid 1980's prior to the Bougainville crisis. The advent of the Bougainville crisis is said to have significantly eroded village elder's power, and consequently, no bans have been implanted since (Dominic Marai, personal communication, February, 2003).

3.2.6 Future options for research on spawning aggregations

The IEK relating to *Plectropomus* spawning aggregations that is presented here is spatially variable, however it does provide a template on the locations of some *Plectropomus* aggregation sites and the likely lunar periods when some aggregations occur. Such a template could be used as a basis for future research designs. In the areas where we held community talks, community members were supportive of possible future research. It would be interesting and of potential management value to quantify what specific species of fish aggregate around the Talise season, and indeed, why aggregations of *P. leopardus* and *P. maculatus* occur on a monthly basis and coincide with jellyfish aggregations around Petats Island.

3.2.7 Future options for management

Initially, it will be important to quantitatively determine what IEK on aggregations do represent spawning aggregations and when and for how long these spawning seasons occur. Most of the aggregations documented in Buka were in close proximity to populated areas, meaning that in theory site-based management of aggregation sites would be a possibility. However implementing such controls may prove difficult, as these aggregations represent important fishing periods for artisanal fishers who have limited alternative sources of income. Furthermore, implementing such controls through existing CMT systems may have limited success given that the power of village elders to enforce such controls appears to have eroded considerable in recent decades. Management of aggregation sites would need to be evaluated on an site by site basis through close consultation with local communities. It is noteworthy that any future LRFFT operations would most likely target the remoter, presumably less fished outer atoll regions such as the Fead Islands and the Cateret Islands before they moved to more exploited regions in close vicinity to Buka Island. Thus, these areas may be in greater need of management attention in the future.

3.2.8 Potential for eco tourism

Buka has much infrastructure that would support tourism, although it currently does not have any diving facilities. However a more accurate knowledge of spawning aggregation seasons would be required before the feasibility of utilising known aggregation sites as tourist attractions could be evaluated.

3.3 Manus Province.

3.3.1 Preface.

The National Research Institute advised the Manus Provincial Government of my intended up coming visit in 2002, and they in turn they gave approval for this research. Upon arrival in Manus I made contact with Wep Kanawi at the provincial government headquarters, whom Paul Lokani from TNC in Port Moresby had told me to contact upon arrival. Wep Kanawi introduced me to the fisheries officers in Manus, and after explaining my intended research to them we organised a field trip together. Two of the fisheries officers, Manuai Matawai and Pomat Powayai decided to accompany me on the field trip. After organising the hire of a boat, we visited Pere village, Loniu village, Andras Island and Chopa village between the 18-23rd of

February. In addition to this a fishermen from Hermit islands was interviewed at Lorehgau on spawning aggregations and past LRFFT operations at the Luf Islands, and I interviewed Pomat Powayai about *Epinephelus coioides* aggregations that occur in Kelaua Bay (see SCRFA aggregation sheet).

The company of these two fisheries officers proved invaluable. Both fisheries officers themselves possessed detailed knowledge of fish aggregations that occurred around Manus Island. Manuai Matawai who is the fisheries researcher officer at Manus is from Pere village, and he has a long standing interest in IEK relating to spawning aggregations. Consequently, Manuai Matawai had already complied considerable information on 10 species of fish that form aggregations in Pere waters. Thus, in our visit to Pere we simply re interviewed many of the fishers that Manuai Matawai had previously interviewed in order to cover aspects of the SCRFA aggregation questionaries that Manuai Matawai had not documented. (This included questions regarding changes in CPUE, traditional fishing methods, and signs of spawning). Re interviewing fishers also served as a means of cross checking information documented by Manuai Matawai, and we were able to make several more in depth additions to the original data collected. We then visited many of the aggregation sites by boat in order to collect GPS positions and snorkel at the sites and observe habitat. It is noteworthy that Manuai Matawai had recently worked with Lyle Squire as a research diver during Squires TNC sponsored consultancy in Manus on spawning aggregations (Squire, 2001), and it was Manuai Matawai who informed Lyle Squire of the *P. areolatus* and *Epinephelus fuscoguttatus* aggregation sites around Pere that are reported on here and in Squires (2001) report.

3.3.2 Background information

Manus Province is one of the smallest and most isolated provinces of Papua New Guinea, with Manus Island being the largest landmass of the province and home to the capital of Lorengau. The majority of the population are subsistence based, being part time fishers and farmers. Cash crops including cocoa, copra, timber, fish, Beche-de-mer, trochus and shark fin. Like Buka, populations on small islands and atolls in Manus are completely dependent on marine resources as a means of survival. Groupers form an important component of local fish catches in Manus, with the eggs of some groupers such as *P. areolatus* being considered a delicacy, and ripe females of this species (and several other groupers) are actively sought from known spawning aggregation sites. Manus Island is serviced by regular flights and the majority of modern consumer goods are available at Lorengau. The history of LRFFT operations in Manus has been reviewed in section 3.1 of this report.

Shark fin and Beche-de-mer being dried at Lorengau

3.3.3 Community meetings and interviewing procedures

The community meetings and interviewing procedure undertaken in Manus were similar to that followed in Choiseul. Community meetings were held at Loniu village and Andra Island. At other areas visited we concentrated solely on interviewing fishers.

3.3.4 IEK of spawning aggregations in Manus

There was a vast amount of well-preserved IEK on spawning aggregations in Manus, with information bases more detailed than in any other area of Melanesia that I have ever visited. The most detailed information was collected from Pere village, an area where fishers are renowned throughout Manus for their fishing expertises (Stephen Makilai, personal communication, February 2003). Detailed information on three well known *P. areolatus* and *Epinephelus fuscoguttatus* spawning aggregation sites in Pere waters were documented, and aspects of this IEK were verified by research conducted by Squire (2001). IEK on spawning aggregations and spawning behaviour of fish in Pere waters were also documented for *Siganus canilacattus*, *Epinephelus ongus*, *Symphorichthys spilurus*, *Lethrinus lentjan*, *Lutjanus argentimaculatus*, *Rastrelliger kanagurta*, *Sphyraena qenie*, and *Caranx tille* (refer to SCRFA aggregation sheet). At Loniu village detailed information was documented on mullet spawning migrations and spawning areas and a limited amount of information was documented on *P. areolatus* aggregations at Andra Island.

One of the interesting findings to come out of the research in Manus was IEK relating to *P. areolatus* spawning aggregations. At Pere spawning aggregations of *P. areolatus* are known to form between the months of March -August, with all aggregations showing a very specific lunar periodicity, building in the second quarter,

and having dispersed completely by the new moon. Very similar information on the seasonality and lunar periodicity of *P. areolatus* spawning aggregations has been documented and verified in Marovo Lagoon, Solomon Islands (Johannes, 1988) and more recently off the Munda Bar reefs in the Western Province, Solomon Islands (Hamilton, nd). Indeed, the lunar periodicity with which *P. areolatus* aggregations form is identical in all three geographical regions that are separated by 6 degrees of latitude, strongly implying that the seasonality and particularly the lunar periodicity of *P. areolatus* aggregations in Melanesia are relatively fixed. A fixed lunar periodicity during the second quarter in Melanesia contrasts with regions such as Pohnpei, where *P. areolatus* aggregations are known to form prior to the full moon (Pet & Muljadi, 2001).

In all areas visited in Manus fishers reported declines in catch rates from aggregation sites and for fisheries in general over the last four decades (refer to SCRFA aggregation datasheet).

3.3.5 Existing marine management under local CMT systems

As well as having highly detailed IEK bases, Manus communities were also actively involved in implementing management measures for valuable fish and invertebrate stocks through existing CMT systems. Furthermore, the majority of individuals interviewed in Manus had a strong awareness of their ability to overfish their fish stocks, with the predominant reasons for implementing management strategies being to ensure the future sustainability of their resources. At Pere village, dynamiting is prohibited under customary law (it is also prohibited at a national and provincial level), and night time spearfishing at a known *P. areolatus* spawning aggregation site is prohibited under customary law. The Pere community is also in the process of implementing the Pere Costal Zone management Plan (Matawai, 2000), a process that will involving codifying a variety of customary imposed management measure into provincial law. At Loniu village the community actively prevents outsiders from harvesting monthly pre spawning migrations of mullet that occur within their customary sea estates, while also imposing numerous restrictions on their own tribe as to where and when these migrations can be harvested, and what gears may be used to harvest these migrations.

While at Andras Island, marine management measures for both invertebrates and reef fish were in place. Closures on trochus and Beche-de-mer have been regularly implemented at Andra for generations, with a stick being placed on reefs within the Andra sea estates to inform everyone that the trochus and Beche-de-mer season is closed. In accordance with custom, the man who has the power to recommend that the closures be lifted is an expert fisherman whose fishing methods include spearing fish on the reef flats with a hand spear during the day. When this fisherman perceives that the stocks of Beche-de-mer and/or trochus have recovered, he informs the community leaders who then order the removal of the sticks and open up the fishery to the community for three days. Anyone form the Andra village can go fishing for tocus and Beche-de-mer during this open season, with the harvest they take belonging to them. After three days the season is closed again and the sticks are erected back on Andra reefs. At the time of my visit, the trochus fishery on Andra reefs had been closed for 6 years, with fishers stating that they were waiting for prices to rise before opening up the fishery. The Beche-de-mer fishery was also closed (Mark Vouih, personal communication, February 2003). In February 2003, community leaders at Andra also imposed indefinite bans on destructive fishing techniques within all their waters, namely,

they banned night time spearfishing with the aid of an underwater flashlight, dynamiting and the use of traditional Derris fish poisons (Mark Vouih, personal communication, February 2003).

The varied examples of traditional and contemporary forms of marine management under existing CMT systems in Manus reflect that;

- Fishers in Manus have an awareness that local subsistence and artisanal fishing practices can have large impacts on their own marine resources

- Many existing CMT systems in Manus are robust

- CMT systems in this region and the communities that operate within them have the ability to adapt to changing ecological and social circumstances.

3.3.6 Future options for research on spawning aggregations

The highly detailed IEK on fish aggregations and spawning migrations present in areas such as Pere and Loniu provide a ready made template of information, that could be used to formulate numerous hypotheses for scientific research designs. It would also be relatively easy to monitor the status of exploited aggregation sites around areas such as Pere, since detailed data on the species-specific locations and lunar and seasonal periodicity of when these aggregations form already exists. Local fishers and local fisheries staff from Pere have expressed their interest in being involved in such projects in the future, and the head of the provincial fisheries office in Manus is enthusiastic and supportive about such research (Stephen Makilai, personal communication, February 2003).

Other factors that would make Manus an ideal region to focus future research are;

- Areas such as Pere and Loniu are only 1-2 hour's boat ride away from the provincial centre

- Individuals such as Manuai Matawai are interested in being involved in future projects. Given that Manuai Matawai is an influential member of the Pere community, has a detailed understanding of spawning aggregations and the issues surrounding them and is a certified SCUBA diver, his contribution to future projects around Pere would be invaluable.

3.3.7 Future options for management

In many regions in Manus, communities have implemented management measure for their marine resources through existing CMT systems, and in some instance, communities are also looking to formalise these regulations through provincial law. It is apparent that in many instances local communities are doing a very good job on their own. They could benefit significantly however, from access to information, funding and expertise that SCRFA may be able to provide in the future.

In Manus there is real potential for SCRFA to work together with the Provincial Fisheries Department and local communities in establishing site by site based management of spawning aggregations. The two most critical components that an organization such as

SCRFA could bring to Manus are scientific expertise and funding. The need for external sources of funding are apparent when one considers that, excluding salaries, the total budget for the Fisheries Department in Manus in 2003 was only 20 000 kina (approximatly $US 5000), none of which was set aside for research (Stephen Makilai, personal communication, February 2003).

3.3.8 Potential for eco tourism

There are realistic opportunities for developing community based eco tourism ventures in Manus that utilise known spawning aggregations as an attraction. In particular, I discussed this option in detail with Manuai Matawai and several fishers in Pere. Everyone I talked with in Pere were in agreement that it would make sense to close these aggregations sites if they had an alternative tourist value. However, like all other provinces visited, Manus currently does not have any diving facilities, and this significant logistical constraint would have to be overcome. Furthermore, before any such venture could be developed, it would require open discussion and planning with surrounding villagers who also hold CMT claims on some of the aggregation sites around Pere.

3.3.9 Intellectual Property rights

In many areas of Manus, certain families or clans hold specific IEK relating to a specific species, and this IEK has been acquired over generations. The custodians of this knowledge justifiably take great pride in their IEK, both for its practical and cultural values. There are several conceivable problems with the widespread publication of such knowledge:

Firstly, this knowledge, although freely provided, is the cultural property of an entire clan. Thus, although SCRFA received consent to document this knowledge from individuals, not all the custodians of this knowledge consented to it. It may be that widespread dissemination and exposure of this cultural information will be poorly viewed in the communities from which it originated (Manuai Matawai, personal communication, February 2003).

Secondly, the widespread dissemination of IEK may result in heavier fishing pressure on certain spawning aggregations than is currently the case, and this does not simply relate to publication of the specific locations of known aggregation sites. For example, it was only at Pere village that fishers had detailed knowledge relating to when *P. areolatus* aggregations formed. If such knowledge becomes public, it will almost certainly lead to the more efficient exploitation of *P. areolatus* aggregations that occur around areas such as Andrea, where currently there is little IEK on aggregation formation other than a general knowledge of location (see SCRFA aggregation sheet). This point is also true for areas such as Ysabel and Choiseul, where aggregation sites of *P. areolatus* were known, but specific information on the timing of aggregation formation were not. It must be stressed that in all provinces visited I assured interviewees that SCRFA does not reveal information on its database to the public.

4.0 Other relevant ongoing research in the Solomon Islands and PNG and areas of high priority for future research

TNC in the Solomon Islands is planning to investigate spawning aggregations in the Kia region and the wider Anavon area in Ysabel. As I understand it none of this work in the Solomon's has proceeded yet. The best person to contact with regards to the ongoing status of this research in the Solomon Islands is William Atu. Dan Afzal from the WWF office in Gizo, Western Province, Solomon Islands is also planning to conduct research on spawning aggregations in the Gizo region (William Atu, personal communications, March 2003), although I am unaware of the status of this research. In PNG Paul Lokani from TNC has carried out some work in Kavieng on spawning aggregations and Squire (2001) conducted a survey for TNC on potential areas for the LRFFT in Manus.

Other areas of potential interest for research in the Solomon Islands would be a more extensive coverage of areas in the Western Province that have not yet been exposed to LRFFT operations (this would include the large populated islands of Rendova and Kolombangara) and many of the large eastern islands such as Makira, Malaita, Guadalcanal and Rennell Islands. In PNG studies in areas such as Miline Bay and around the outer islands off New Britain would be very valuable, both of these areas are regions where LRFFT operations have operated in the past.

5.0. General overview of community based management of marine resources in the areas visited.

The most widespread community based marine management measures seen throughout the Solomon's and PNG were closures on trochus and Beche-de-mer fisheries. The frequent occurrence of such measures appears to relate to the following factors:

- Both species have had a commercial value for a long time, with Beche-de-mer being harvested as a cash crop in both countries since the early 1800's (Hunnam *et al.*, 2001), hence the value of protecting (or stockpiling) these resources is well recognised.

- A long history of commercial exploitation has lead communities to become well aware of their ability to over harvest these resources.

- Both species are fairly sessile, so there is the perception that closures will have a direct benefit to the communities that implement closures – i.e. no fear that the community will simply be conserving the resource for someone else.

- Both species are unimportant food sources in Melanesia- thus; implementing management measures has little or no impact (in the case of Beche-de-mer) on local diets.

In brief, the high commercial value of these species, their low mobility and lack of importance in local diets means that there is much to be gained and little to be lost

from local communities that manage these resources within their sea estates. Community's widespread attempts to manage valuable marine invertebrates do not extend to reef fishes. Indeed, I documented very few examples where local communities managed fishing pressure on spawning aggregations or spawning runs. This relates to a combination of the following factors;

- Fish in many areas do not have a high (or any) cash value. Furthermore, in lightly fished areas (such as Choiseul and Ysabel) fish are still extremely plentiful, and fishing activity is yet to have a large negative effect on fish stocks. Thus, there is no practical reason (or incentives) for conserving these resources. This is particularly true in Choiseul where the response I had when I asked fishers if local chiefs had the power to conserve reef fish spawning aggregations was often: "Yes, the Chiefs have the power to do that, (close spawning aggregations sites) but they have no reason to implement such closures" (Frank Malasa, personal communication, January 2003).

- The higher mobility of reef fishes means that there is a general perception that management measures may simply conserve fish for someone else.

- These communities are very dependent on reef fish as a source of food, so there is awareness that banning fishing will have direct and immediate consequences for everyone.

Not surprisingly, it was areas such as Manus, where fishers perceived that their activities had caused local fish stocks to decline and where CMT systems were relativity intact, that communities were involved in implementing controls of fishing activities for reef fishes. Finally, in many cases the benefits to local communities of implementing spawning aggregation protection is not immediately obvious, and attempts at management will need to go hand in hand with education awareness campaigns which outline the need for protection and the potential benefits for the wider fisheries.

Additional report 12. Scientific, common and local names for fish species mentioned in this report and in the SCRFA aggregation data sheet.

Species name	Common English Name	Local name	Location of local name
Bolbometopon muricatum	Bumphead Parrotfish	Topa	Ysabel, Choiseul & W.P.
Caranx tille	Tille Trevally	Koi	Pere Village, Manus
Cephalopholis boenak	Chocolate Hind	Kaukau	Petats village, Buka.
Cephalopholis miniata	Coral Hind	Biau	Petats village, Buka
Cephalopholis sonnerati	Tomato Hind	Bok	Petats village, Buka.
Crenimugil crenilabis	Fringelip Mullet	Kanas	Loniu village, Manus
Ctenochaetus striatus	Lined Bristletooth	Kubae	Chivoko, Choiseul.
Epinephelus coioides	Orange-spotted Grouper	Kod	Kelaua Bay, Manus.
Epinephelus fuscoguttatus	Brown Marbled Grouper	Kali Mbuangeu	Pere Village, Manus
Epinephelus fuscoguttatus	Brown Marbled Grouper	Babanga	Kuku village.
Epinephelus merra	Honeycomb Grouper	Sabuka	Chivoko, Choiseul Province
Epinephelus ongus	White-streaked Grouper	Kalindreken	Pere Village, Manus
Epinephelus spilotoceps	Foursaddle Grouper	Sabuka	Chivoko, North Choiseul
Epinephelus spilotoceps	Foursaddle Grouper	Pele	Baolo village, Ysabel
Epinephelus tauvina	Greasy Grouper	Sabuka	Chivoko, Choiseul Province
Epinephelus trimaculatus	Threespot Grouper	Pele	Baolo village, Ysabel.
Lethrinus lentjan	Pink-Eared Emperor	Kolangindrou	Pere Village, Manus
Lutjanus argentimaculatus	Mangrove Jack	Mburor	Pere Village, Manus
Lutjanus bohar	Red Bass	Visaka	Polo village, North Choiseul
Lutjanus bohar	Red Bass	Toulu	Matsungan village, Buka
Lutjanus gibbus	Paddletail	Toulu	Matsungan village, Buka.
Lutjanus gibbus	Paddletail	Kukama	Polo village, North Choiseul
Lutjanus rivulatus	Maori Seaperch	Sina	Sisga village, Isabel
Lutjanus vitta	Brownstripe Seaperch	Liu	Polo village, North Choiseul
Plectropomus areolatus	Squaretail Grouper	Kekwa	Pere Village, Manus
Plectropomus areolatus	Squaretail Grouper	Kali Mbrulil	Andra village, Manus
Plectropomus areolatus	Squaretail Grouper	Saboka	South Choiseul
Plectropomus areolatus	Squaretail Grouper	Sondo & Varise	North Choiseul
Plectropomus areolatus	Squaretail Grouper	Soghuma (small)	Kia village, Ysabel
Plectropomus areolatus	Squaretail Grouper	Tulanagi (big)	Kia village, Ysabel
Plectropomus areolatus	Squaretail Grouper	Pajara (generic)	Marovo Lagoon, W.P.
Plectropomus areolatus	Squaretail Grouper	Pazara Haquma	Munda, Western Province
Plectropomus leopardus	Leopard Coralgrouper	Tutula	Petats village, Buka.
Plectropomus leopardus	Leopard Coralgrouper	Mesera	Lologahae, South Choiseul
Plectropomus leopardus	Leopard Coralgrouper	Veau	Tsupolo village, Buka
Plectropomus leopardus	Leopard Coralgrouper	Mesera	Kuku village, Choiseul
Plectropomus maculatus	Spotted Coralgrouper	Veau	Tsupolo village, Buka.
Plectropomus maculatus.	Spotted Coralgrouper	Tutula	Petats village, Buka
Pseudobalistes flavimarginatus	Yellowmargin Triggerfish	Makoto Liu	Roviana lagoon, W.P.
Rastrelliger kanagurta	Long-Jawed Mackerel	Lala	Pere Village, Manus
Selaroides leptolepis	Smooth-Tailed Trevally	Kazaro	Chivoko, Choiseul.
Siganus canilacattus	Spinefoot	Pachar kuapat	Pere Village, Manus
Sphyraena jello	Pickhandle Barracuda	Pipo	Roviana Lagoon, W.P.
Sphyraena putnamiae	Barracuda	Pipo	Roviana Lagoon, W.P.
Sphyraena qenie	Chevron Barracuda	Malisa	Pere Village, Manus
Sphyrana barracuda	Great Barracuda	Babulis	Matsungan village, Buka
Symphorichthys spilurus	Sailfin Snapper	Ndrang	Pere Village, Manus

7.0 Contact details of individuals interviewed

Note: When I was interviewing fishers about reef fish aggregations within a rural village setting, the vast majority of the time a small group of fishers that gathered around contributed to my understanding of the aggregations that are reported on in this report and the SCRFA aggregation data sheet. However it was impractical to record the contact details of every single fisher that contributed in some way. Thus, below I provide contact details for the individual(s) who provide the bulk of information documented. Furthermore, in some of the communities visited we did not document any relevant information, thus, the contact details of individuals interviewed were not recorded. I consider all of these listed interviewees as very reliable.

Solomon Islands

Hon. Nelson Kile
Minister of Fisheries
PO Box G13
Honiara
Solomon Islands
Ph (677) 30107
Fax (677) 30256

Private address:

Nelson Kile
PO Box 302
Honiara
Solomon Islands
Email: nelson.kile@ffa.int

Other personal details of interviewees: Interviewed in Honiara on the 23/1/03. Age, approx. 40.

Eddie Oreihaka
Director of Fisheries
Ministry of Fisheries and Marine Resources
PO Box G13
Honiara
Solomon Islands
Ph (677) 30107
Fax (677) 30256

Other personal details of interviewees: Interviewed in Honiara on the 23/1/03 and on the 4/3/03. Age, approx. 40.

George Diau
Fisheries Department
Ministry of Fisheries and Marine Resources
PO Box G13

Honiara
Solomon Islands
Ph (677) 30107
Fax (677) 30256

Other personal details of interviewees: Interviewed in Honiara on the 3/3/03 regarding the LRFFT. Age, approx. 35.

William Atu
Deputy Program Manager
The Nature Conservancy
Solomon Islands Field Office
P.O. Box 759
Honiara
Solomon Islands
Tel: 677 20940
Fax: 677 26814
Email: tncdpm@solomon.com.sb

Other personal details of interviewees: Age, approx. 35. I worked with William in Honiara and Ysabel.

Choiseul

Francis Taniveke
Fisheries Division
Taro Island
Choiseul Province
Solomon Islands

Other personal details of interviewee: Fisheries officer. Age, approx. 35. I worked with Francis while in Choiseul.

Antony Naqukana
Logogae village
South Choiseul
Solomon Islands

Other personal details of interviewee: Fisherman. Age, 63. Interviewed in Logogae village on the 25/1/03 regarding fish aggregations and customs relating to fishing in this area.

Movin Miavana
Logogae village
South Choiseul
Solomon Islands

Other personal details of interviewee: Fisherman. Age, 50. Interviewed in Logogae village on the 26/1/03 regarding fish aggregations, fishing techniques and customs relating to fishing in this area.

Mathew Pitakagi
Panarui village
South Choiseul
Solomon Islands

Other personal details of interviewee: Chief. Age, approx. 60. Interviewed in Panarui village on the 27/1/03 regarding *P. leopardus* aggregations in this area.

Frank Malasa & Dadley Poloso
Dara village
South Choiseul
Solomon Islands

Other personal details of interviewee: Fishermen. Age, approx. 40 & 45 respectively. Interviewed in Dara village on the 27/1/03 regarding fish aggregations, fishing techniques and customs relating to fishing in South Choiseul.

Enoch Vaqalo and Derrik Doropita
Dara village
South Choiseul
Solomon Islands

Other personal details of interviewee: Fishermen. Age, approx. 50 & 40 respectively. Interviewed in Dara village on the 27/1/03 regarding fish aggregations, fishing techniques and customs relating to fishing in South Choiseul.

Honourable James Alepio
C/- Vola P/A
North West Choiseul
Solomon Islands

Alternative address:
PO Box 34
Taro
Choiseul Province
Solomon Islands

Other personal details of interviewee: Politician. Age, approx. 40. Interviewed in Saqigae village on the 28/1/03 regarding *P. leopardus* aggregations in this area.

Luke Ripukana
United Church
Kuku village
South Choiseul
Solomon Islands

Other personal details of interviewee: Chief, Age, approx. 60. Interviewed in Kuku village on the 28/1/03 regarding grouper aggregations in this area.

Jerry Pitisopa
Farmers Institute
Sasamungga village
South Choiseul
Email: sasamuga@pipolfastaem.gov.sb

Other personal details of interviewee: Consultant. Age, approx. 40. Interviewed in Taro on the 3/2/03 regarding the Lauru Land Conference.

Peter Pataja and Jackson Gogoro
Polo community
Northwest Choiseul Province
C/- Taro Post Office
Choiseul
Solomon Islands

Other personal details of interviewee: Fishermen. Age, approx. 25 & 45 respectively. Interviewed in Polo on the 30/1/03 and the 31/1/03 regarding P. areolatus aggregations around Manu Island and *Lutjanus* aggregations around Polo.

Egan Velokaeqo
Chivoko United Church
Northwest Choiseul Province
C/- Taro Post Office
Choiseul
Solomon Islands

Other personal details of interviewee: Fisherman and retired teacher. Age, approx. 60. Interviewed in Chivoko on the 1/2/03 and the 2/2/03 regarding spawning aggregations in Zaruna Passage.

Ysabel

Holford Kokoe
Bahana Fisheries Centre
Kia village
Ysabel Province
Solomon Islands

Other personal details of interviewee: Fisheries officer at Kia. Age, approx. 40. Interviewed in Kia on the 27th and the 28th of February 2003 regarding history of the Bahana Fisheries Centre.

Moffat Aloha
Baolo village
Ysabel Province
Solomon Islands

Other personal details of interviewee: Fisherman. Age, approx. 38. Interviewed in Baolo on the 28th of February 2003 regarding *Epinephelus* aggregations in this area.

Luke Dikahehe
Sisiga village
Kokota Distract
Ysabel Province
Solomon Islands

Other personal details of interviewee: Fisherman. Age, approx. 38. Interviewed in Baolo on the 1/3/03 regarding *Lutjanus* aggregations in this area.

Gad Rotubele and Desmond Habu
Kia village
Ysabel Province
Solomon Islands

Other personal details of interviewees: Fishermen. Age, approx. 60 and 40 respectively. Interviewed in Kia on the 27/2/03 regarding *P. areolatus* aggregations in this area.

Chief Billy Gedi
Ghoveo village
Kokota
Ysabel Province
Solomon Islands
2.3.03

Other personal details of interviewee: Chief. Age, approx. 65. Interviewed in Ghoveo on the 2/3/03 regarding conservation and management issues in Ysabel.

Papua New Guinea

Paul Lokani
Acting PNG Program Director
The Nature Conservancy
PNG Field Office
P.O. Box 2750 Boroko,
NCD, Papua New Guinea
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Email Address: lok.tnc@global.net.pg

Other personal details of interviewee: email correspondence only.

John Kasu
Principal
National Fisheries College
PO Box 239
Kavieng
New Ireland Province
PNG
Ph. 675 984 2187/984 1249

Fax. 675 984 2343
Email: jkasu@fisheries.gov.pg
Or: jkasu@daltron.com.pg

Other personal details of interviewee: Principal. Age, approx. 45. Interviewed in Kavieng on the 16/2/03 regarding LRFFT trail operations that were undertaken in Kavieng.

Manus

Stephen Nakilai
Assistant Administrator
Division of Fisheries and Marine Resources
PO Box 37
Lorengau
Manus Province
PNG
Ph/fax: 675 4709269

Other personal details of interviewee: Head of the Fisheries Department in Manus. Age: approx. 45. Interviewed in Lorengau on the 17th and 21st of February regarding the LRFFT in Manus and the future goals of SCRFA etc.

Manuai Matawai
Provincial fisheries Research Officer
Division of Fisheries and Marine Resources
PO Box 37
Lorengau
Manus Province
PNG
Ph/fax: 675 4709269

Other personal details of interviewee: Fisheries officer. Age 32. I worked with Manuai while in Manus.

Pomat Powayai
Provincial Fisheries Officer
Division of Fisheries and Marine Resources
PO Box 37
Lorengau
Manus Province
PNG
Ph/fax: 675 4709269

Other personal details of interviewee: Fisheries officer. Age 30. I worked with Pomat Powayai while in Manus, and interviewed him in Lorengau about *Epinephelus coioides* aggregations that occur in Kelaua Bay (which is where Pomat is from).

Sam Puty
Luf Island
Hermit Islands
Nigohern
Manus Province
PNG

Other personal details of interviewee: Fisherman. Age approx. 42. I interviewed Sam Puty at Lorengau on the 18/2/03 regarding past LRFFT operations in the Luf Islands, and known spawning aggregations that occur in the passages around Luf Island.

Alex Kaluwin
Pere village
Manus Province
PNG

Other personal details of interviewee: Fisherman. Age 67. I interviewed Alex Kaluwin on the 18th and 19th of February 2003 at Pere, regarding numerous aggregations that are known to occur around Pere.

Jobe Manaui
Loniu village
Manus Island
Manus Province
PNG

Other personal details of interviewee: Fisherman. Age approx. 70. I interviewed Jobe Manaui on the 20/2/03 at Loniu village regarding IEK and custom and exploitation of mullet pre spawning migrations and spawning migrations that occur around Loniu village on a monthly basis.

Mark Vouih
Andra village
Andra Island
Manus Province
PNG

Alternative address;
C/- Pomoto Ndrehet Kurti Andra
Local level government
PO Box 37
Lorengau
Manus Province
PNG

Other personal details of interviewee: Politician. Age approx. 50. I interviewed Mark Vouih on the 21/2/03 at Andra Island regarding IEK of *P. areolatus* aggregations around Andra Island, and local management measures that exist here.

Chris Lopra
Chopa village
Manus Island
Manus Province
PNG

Other personal details of interviewee: Fisherman. Age approx. 74. I interviewed Chris Lopra in Chopa village on the 22/2/03 regarding IEK of mullet aggregations in Nran Tewi.

Buka

Jinro Boisen
Provincial Fisheries officer
DPI Fisheries
PO Box 96
Buka
Bougainville
PNG
Ph. 675 973 9920
Fax. 675 973 9164

Other personal details of interviewee: Fisheries officer. Age approx. 35. I worked with Jinro Boisen while in Buka.

Ignatius Maneo
Karavet village
Taiof Island
Buka
Bougainville
PNG

Other personal details of interviewee: Fisherman. Age approx. 50. I interviewed Ignatius Maneo on the 9/2/03 at Karavet village (Taiof Island) regarding IEK aggregations that from during the Talise season and recent changes in CMT.

Dominic Marai
Tsupolo village
Buka
Bougainville
PNG

Other personal details of interviewee: Fisherman. Age approx. 50. I interviewed on Dominic Marai the 10/2/03 at Tsupolo village (Taiof Island) regarding IEK of *P. leopardus* and *P. maculatus* aggregations that from near here during the Talise season.

John Lokani, Stephen Hatobu and Mathias Pagus
Pororan Island
PO Box 285
Buka

Bougainville
PNG

Other personal details of interviewees: Fishermen. Age approx. 32, 55 and 70 respectively. I interviewed these fishermen on the 12 and 13th of February 2003 at Pororan Island regarding spawning aggregations that occur around white Island and fishing practices.

William Tameits and Francis Haoping
Petats Island
Po Box 214
Buka
Bougainville
PNG

Other personal details of interviewees: Fishermen. Age approx. 50 and 45 respectively. I interviewed these fishermen on the 13/2/03 at Petats Island regarding spawning aggregations that occur around the Talise and Hihiki season, and around the lunar jellyfish season.

Timoti Peni and Samuel Boisen
Matsunga Island
Buka
Bougainville
PNG

Other personal details of interviewees: Fishermen. Age approx. 50 and 60 respectively. I interviewed these fishermen on the 14/2/03 at Matsunga Island regarding *Lutjanus bohar* & *Lutjanus gibbus*, *Plectropomus* spp. and *Sphyrana barracuda* aggregations that occur around Matsunga Island.

4.1 Address of people/communities who would like SCRFA materials

All of the people listed above would like any available SCRFA materials relating to aggregations and a copy of the final report. The following list is individuals not mentioned above whom I had discussions with regarding SCRFA's work. They too would also like any available SCRFA materials.

Chief Benjamin Papakera
Poroporo village
Choiseul Bay
Choiseul
Solomon Islands

Chief Leadley Pitasua
Vuraqo village
Northwest Choiseul Province
C/- Taro Post Office
Choiseul
Solomon Islands

Henry Marau
Secretary to Paramount Chief
Po Box 35
Buala
Ysabel Province
Solomon Islands

Father Doni Keli
Resource Management Trust
Po Box 1667
Honiara
Solomon Islands

Michelle Lam
Environmnetal concerns action network of Solomon Islands (ECANSI)
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