

# REEF FISHERIES MANAGEMENT IN THE PACIFIC

With the technical support of:



## SUCCESS STORIES

### VILLAGE-BASED CATCH SURVEY IN FIJI

#### 1. What was the problem or the challenge?

Evidence suggests that the inshore fisheries of Fiji are in decline. In response to this, many communities in Fiji have taken the bold step of establishing management plans including in most instances a no-take protected area. These communities are supported by a network of NGOs, academic institutes and most importantly Government together who form the Fiji Locally Managed Marine Area (FLMMA) network. In turn this network is part of the wider regional LMMA network (for a review of the work and status of LMMAs, see Govan *et al.* 2009<sup>1</sup>). As part of the adaptive management approach it is essential that the communities have some means to assess the effectiveness of the management they are undertaking. Historically this was done using Underwater Visual Census or fish count-based methods; though we found evidence of lack of robustness in this method in many instances where replicate numbers were low and variability was compounded by other factors. We therefore sought an alternative method to assess effectiveness; one that is robust, reliable and links directly to the management objectives of most of the communities implementing management.

#### 2. What was done?

Part funded by the CRISP programme, the Whitley Fund for Nature and core FLMMA funds from the MacArthur and Packard Foundation, the Institute of Applied Science of the University of the South Pacific working with FLMMA partner organisations designed a log book based Catch Per Unit Effort (CPUE) survey approach. This approach was rolled out to approximately 60 communities around Fiji across a geographic and social range. Within each village over 30% of households were supplied with the log books, rulers for measuring fish length and instructions on recording information on what was caught, where it was caught and how it was caught. We now have data from over 3000 fishing trips and 250,000 fish and invertebrate records.

#### 3. How successful was it?

The survey was and continues to be a great success. There are a number of key messages that came from the survey. Many of these were presented at the Conservation Science Forum held in Suva, Fiji in late 2009<sup>2</sup>. The key messages confirm the status of the inshore fishery in Fiji is threatened. Of the two most commonly caught fish families, 74% and 88% respectively of the individuals in the catch were below length at maturity. In addition it is clear from the results that the inshore village-based catch is becoming increasingly commercialised; 70% of fish and invertebrates in the survey were sold despite this contradicting fisheries legislation. Additional work building on the

village-based CPUE survey which included experimental fishing within no-take protected areas suggests that the no-takes support high proportions of mature brood stock adult fish (Clements *et al.* in prep<sup>3</sup>) and hence are of critical importance in stabilising the fisheries resource.

#### 4. Lessons learned and recommendations

One of the main drivers of the success of the CPUE survey was the direct involvement of communities in the work. Mechanisms were provided where initial analysis could be done by simply summing catch and effort within the community and that this information could be used to inform management decisions. An integrated database was also produced that provided quarterly reports in the vernacular, which were then passed back to the community for their use in management.

Overall FLMMA is currently re-evaluating how it encourages learning and monitoring within the network to be done. What is being proposed is tiered monitoring system based on community perception, standardised collection of data using methods including the CPUE survey currently ongoing and finally at the highest level of complexity, question driven scientific research. This re-evaluation was in response to the need to maximise benefit of monitoring and learning whilst operating within a constrained resource base. In the future this means that the CPUE survey

will likely be used in 15 villages around Fiji and will compile a long-term time series against which management effectiveness can be measured at the site and country level.

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<sup>2</sup> Institute of Applied Sciences (IAS). A nation-wide survey of village-based fishing pressure in Fiji, in proceedings of the Inaugural Fiji Islands Conservation Science Forum, Jenkins A.P., Prasad S.R., Bacchiochi J., Skelton P., and Yakub N., Eds., Wetlands International Oceania, Suva, Fiji, 2009.

<sup>3</sup> Clements L. *et al.* (In prep). Community-based Marine Protected Areas in Fiji offer measurable fisheries benefits.

#### 6. Contact for further information

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*"Household fish consumption is a very reliable tool for fisheries management..."*

Photo credit: James COMLEY



**SCRFA**  
SOCIETY FOR THE CONSERVATION  
OF REEF FISH AGGREGATIONS

## SPAWNING AGGREGATIONS IN PALAU

### 1. What was the problem or the challenge?

The challenge was to move towards sustainable use of reef fisheries and to ensure persistence of key biological phenomena in the Palau marine ecosystem, western Pacific, in the face of an absence of fishery monitoring or management as well as a situation of clear declines in fishery resources. Existing marine protected areas which are subjected to little effective enforcement and local traditional measures are not fully respected by the community resulting in considerable poaching.

### 2. What was done?

Given the poor documentation of the status of the local fishery, initially fisher interviews were conducted to determine the general understanding in the fishing community of the trends experienced in resources over the last several decades. We were also interested to understand the attitudes of fishers regarding possible causes of changes observed and the solutions that the fishing community proposed. The fisher interviews clearly and unambiguously identified (a) declines in catch rates and sizes of many species of food importance, including many that aggregate to spawn, (b) a general lack of awareness that their experiences were widely shared by others even within their own community, and (c) concern that more needs to be understood about the resources and action needs to be taken to reverse declines. Building on the outcomes of the interviews an aggregation site (Ebiil) was selected in a marine protected area for detailed study to provide a baseline for future comparisons to be able to objectively demonstrate any changes, to produce information for developing a management plan, and to establish a scientifically robust monitoring protocol specifically designed for the site for ease longterm monitoring. Presentations of the results of the aggregation survey and fisher interviews were given to community and political leaders and in the media. A short educational film for general public viewing was produced on Palauan coastal fisheries, their condition, the need for management and possible future steps. The film included a diagram to show how aggregations produce fish that enter the fishery.

### 3. How successful was it?

The monitoring of the protected aggregation site enabled training of personnel in monitoring, and produced a considerably better understanding of the condition of the site and species and numbers present, and a baseline for future use for adaptive management. Information collected is being used in a management plan currently being developed and fisheries have entered more obviously the work plans of local NGOs. Presentations of results to local politicians and community leaders produced many discussions on resource condition as well as possible solutions. The film has been aired on local TV. There was both newspaper and radio coverage of the study and related work. Considerable ownership was developed locally and Palau's experience was used as an example elsewhere in the region through presentation of the project by a Palauan NGO staff member on the project.



Photo credit: Yvonne Sadovy

*"Any fisherman is able to understand the long-term interest of protecting spawning aggregations..."*

### 4. Lessons learned and recommendations

Fish spawning aggregations are an excellent educational tool because it is so easy to understand the basic need for reproduction. How they produce fish and why they are important is necessary to understand if their protection is to be successful. Once this is understood it is easy to move on to fisheries in general and to discuss the need for maintaining sufficient spawning adults, the need to avoid taking too many juveniles and the implications of lack of management. We learned that it is possible for many people to have the same experience of a resource, such as general declines, but not to realize that this experience is widely shared within the community. Without such common knowledge and understanding, it is difficult to recognize the need for action. Interviews, workshops and documentaries are good ways of gathering/generalizing/disseminating such information. Commercial exports of reef fish resources can be a major factor in declines and may not be to the best advantage of countries that depend heavily on coastal resources but the fact that local catches tend not to be assigned a monetary value while exports

are, mean that the local value to the country is not widely appreciated. Decisions are needed regarding whether or not exports are in the best interest of coastal communities and local food security in the long term. Long-term monitoring of resources and their management are needed in many countries and considerably more expertise in fisheries science is necessary that will enable this to take place.

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Film: 25 minute film "Fish for the Future; respecting and managing Palau's spawning aggregations".

Palau Conservation Society. Enhanced monitoring of grouper spawning aggregation at Ebiil Channel. Final technical report, June 2010.

### 6. Contact for further information

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Photo credit: Scottie KIEFER

*Yvonne Sadovy and Asap Bukurrou with 'high tech' equipment (built by Pat Colin) used to house GPS for monitoring aggregation sites*



## SUPPORT TO MARINE AQUARIUM TRADE IN KIRITIMATI

### 1. What was the problem or the challenge?

Kiritimati Island is one of the atolls in the Line Islands of the Republic of Kiribati where the marine aquarium trade industry provides a very important source of income and employment for the local people. Being home to some endemic and rare species, and with its close proximity to Hawaii as the gateway to the very important US marine aquarium trade market, the operations in Kiritimati were quite profitable. Because of the success, the industry was allowed to expand without any control measures and in the last decade cowboy operations started entering the industry leading to irresponsible harvesting of the resources and poor industry practices. As a result, poor quality of live fish exports and high Deaths On Arrivals (DOAs) have been experienced giving less benefits from the resources for the local collectors and exporters than expected. Consequently this also increases the risk of overfishing the resources and unnecessary abuse and waste which not only threatens biodiversity but also the sustainability of the industry in Kiritimati Island over the long term.

### 2. What was done?

In the middle of 2010 at the request of the Kiribati Government, the Secretariat of the Pacific Community (SPC) commissioned a team of fisheries scientists and industry experts to visit the island to look into the matter. A training workshop for the industry, consisting of lectures and hands-on practical sessions, was conducted to both explain and provide information on the biological and technical aspects of the industry, including dive safety, and to demonstrate best collection and handling practices throughout the supply chain of the industry. Important areas, where handling practices can be critical for the quality of the fish to ensure good survival, were highlighted. The team was also able to assess the current collection and handling practices and visit the fish holding facilities, providing advice and recommendations instantly on ways of improvements where needed. In addition, four fisheries officers were also trained on how to conduct fisheries resource surveys. These officers later took part in a survey of the marine aquarium fish resources to assess the current status of the resources in Kiritimati. This was followed by an attachment training for one of the fisheries officers on data analysis, report writing and on the development of the management plan at the SPC headquarters.

### 3. How successful was it?

The mission has been successful in providing an understanding of the causes of high mortality rates of marine aquarium fish exported from Kiritimati Island, which has in turn allowed for the development and institution of effective solutions and responses. More importantly,

the industry stakeholders were provided with an understanding of why they were getting high mortality for their fish and shown how they can improve this. The success of the training will be easily evident if improvements in DOAs are seen in the future. The fisheries officers trained in the survey method were able to help in conducting the marine aquarium fish survey of Kiritimati. The new capacity to do the survey will allow the Fisheries Department to monitor the status of the resources or to conduct other resource appraisals for new areas of interests in the future. The result of the survey that was conducted has been described in a technical report providing the current status of the

marine aquarium fish resources stock in Kiritimati Island. The stock estimates provide a good baseline for future monitoring as well as the basis for setting annual species quotas as required in the management plan. The management plan also provides the legal basis for controlling and maintaining good industry practices, dive safety measures and a framework for the industry to play a more active role in the responsible management and monitoring of the industry. This is done through a Management Advisory Committee comprised of representatives from the private sector including the industry and relevant government departments, who will be responsible for coordinating management efforts under the management plan.

### 4. Lessons learned and recommendations

The bad practices of the industry found in Kiritimati Island were basically all unintentional and purely caused by the lack of proper training on industry practices, especially for new comers entering the industry. This was coupled with a poor understanding about the general biological aspects of the resource and the technical reasons behind the industry best practices. With this information being provided and shared, the collectors and the exporters were very willing to listen and to learn and to even change their ways of operation to improve the quality of their fish. It should be noted that unlike the

Asian countries, destructive fishing methods such as the use of cyanides and chemicals are never used which is a positive asset. The industry strongly supports the idea of managing and regulating the fishery to ensure its sustainability over the long term. The fisheries management authority therefore should work closely together with the industry for the successful implementation of the management plan and the monitoring program for a sustainable marine aquarium trade.

### 5. Contact for further information

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Photo credit: Eric OLUA

*"Improving the technical level of professional fishermen is a key-issue..."*



# ECONOMIC EFFICIENCY OF MMAs IN VANUATU

## 1. What was the problem or the challenge?

So far, the demonstrated effects of MMAs suggest an inside MMA biomass and density increase for fishery target fish and invertebrates, and an increase of average age and size for fish species (Roberts *et al.* 2000<sup>1</sup>). However, the effects of Marine Protected Areas (MPAs) on the fishery yields and productivity have been confirmed by few studies so far, and the catch stability is expected but not demonstrated (Caddy 2000<sup>2</sup>, Russ *et al.* 1996<sup>3</sup>, Castilla *et al.* 1989<sup>4</sup>, Francino *et al.* 2008<sup>5</sup>). Other direct effects on tourism are observed but also are rarely quantified (Brander *et al.* 2007<sup>6</sup>). The study conducted under the CRISP programme in Vanuatu by Nicolas Pascal focuses on those aspects to try and obtain clear results as for the positive socio-economic impact of MMA at a community scale over reef fisheries.

## 2. What was done?

After discussion and an agreement with local communities, five villages of North Efate, Emua Piliura, Unkap, Worasifu, Laonamoa were selected to conduct the study. Those sites have similar characteristics: fringing coral reefs as dominant ecosystem, they all include a MMA managed and enforced by communities for at least 5 years. MMAs selected are 0.1 to 0.2 km<sup>2</sup>, similar to most of MMAs in the Pacific region (Govan *et al.* 2009<sup>7</sup>). Two other villages, Nekapa and Saama, were identified as control sites to evaluate the fishery effects. The control sites chosen are similar to the sites with MMA regarding their ecological attributes, past and present fishing effort and their



Photo credit: Eric CLUA

*"An MMA can improve the village fisheries yield by 10 to 20%..."*

socio-economic context (proximity to market, reliability on monetary incomes, tourism facilities). Fishing activity is well spread amongst the population as it is estimated that more than 60% of the adult population is implicated in one form of fishing (HIES 2008<sup>8</sup>). The two major types of fishing in the villages are netfishing and spearfishing.

The assessment of the fishing effect of the MMA was conducted through the comparison between MMA sites and non-MMA sites (control). For netfishing, the study included a direct observation of fishing Catch Per Unit Effort (CPUE) in during a 5 months period, representing 120 replicates of experimental fishing trips. For spearfishing, log books were consistently filled out along a four months study (July to October 2009), with 170 hours of fishing activity recorded. Size data were collected at a species or family level to assess as precisely as possible any potential MMA effects. Data collected from the log books and fishing experiments have made possible the calculations of mean CPUEs in kg/h for both netfishing and spearfishing at every location. To

separate the MMA effects over fishery from other external environment effects, the study was completed by Underwater Visual Census (UVC) for fish diversity index and Medium-Scale Approach (MSA) for substrate identification in control and MMA sites.

## 3. How successful was it?

This study led to the conclusion that MMA lead to an increase in reef fishery CPUEs mainly depending on gear used. Average increase on CPUEs (kg/h) due to the existence of a MMA is estimated to be 22% (SD = +/- 13%). Even if increases in CPUEs do not compulsorily affect fishing yields, as the fishing effort may not be maximum, the effects of MMA on fisheries have been assessed, and represent a 5% increase of the monetary and non-monetary (subsistence) village needs. For information, when considering fishing yields, the commercial fishery covered 6% of monetary needs in 2009 with a potential (MSY = 5 t/km<sup>2</sup>) average of 17% (up to 27%). Reef-subsistence fishery represents 8% of village non-monetary needs. The MMA impacts on fisheries represented approximately 25% of the total economic benefits generated by MMAs (Tourism is 60% and social capital 15%).

For the funding agencies, the Return on Investment values range between 1.3 for the lowest to 5.2 for the most spectacular (5 years after creation, with a discount rate of 8%). In other words, the leverage effect of investment in small and community-based MMAs has widely been demonstrated: 1 Euro invested produced an average of 3 Euros.

## 4. Lessons learned and recommendations

- MMAs are influencing the village monetary balance, leading to a potential contribution of 15 to 30% of the total village monetary needs.
- Observed effects on reef fisheries are present but generally weak and difficult to perceive.
- The investment is mainly in human capital.
- Other studies are suitable for assessing the effects of MPA on maximum sustainable yield, as the methodology of this study did not allow it.

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- <sup>6</sup> Brander L.M., Beukering P.V., Cesar H. (2007). The recreational value of coral reefs: A meta-analysis. *Ecological Economics* 63 (1): 209–218.
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- <sup>8</sup> Vanuatu National Statistics Office (2008). Main report on Household Income and Expenditure Survey (HIES), 2006. Household Income and Expenditure Survey, Vanuatu National Statistics Office.

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