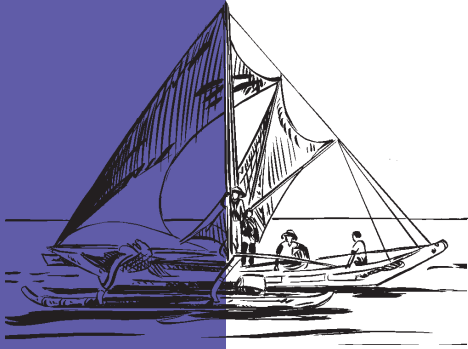


FISHERIES

Newsletter



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A net repair workshop was organised in Futuna by the
Community Fisheries Section in May.



SPC ACTIVITIES

■ CAPTURE SECTION

Masterfisherman Peter Watt continued his project in Samoa, working with the Fisheries Department on board their vessel *F/V Tautai Matapalapala*. Initial work with this project saw the hydraulic system for the mainline reel needing to be rebuilt as well as other changes made to the vessel to allow for a smooth fishing operation.

During April, Peter undertook two fishing trips where he used time-depth-temperature recording equipment to monitor the fishing gear. Catches were poor and the recording equipment revealed that the gear was not fishing as deep as one would expect.

In fact, the sensors in the centre of the catenary curve between floatlines were registering shallower depths to the sensors closer to the floatlines. Interesting what currents can do to the gear without fishermen knowing!

The Samoa project was put on hold in early May, when Peter resigned from SPC to take up a position in Samoa as part of another project. Peter and his work with the Capture Section of SPC as a Masterfisherman will be greatly missed, and we wish him well with his new position.

The Fisheries Development Adviser, Lindsay Chapman, attended a gear and technology working group meeting of the Inter-American Tropical Tuna Commission (IATTC) in April.

The working group explored ways to reduce bycatch, mainly associated with purse-seine log-sets (drifting fish aggregating devices—FADs), such as using hydroacoustic equipment to try and identify the species composition and size of fish in a school that was to be set on; gear modifications to release unwanted bycatch species once they were in the net; deck modifications to release unwanted bycatch alive

from the deck; and better utilisation of bycatch once it was caught and dead.

Masterfisherman Steve Beverly spent one month during April and May in Kiribati working with the Fisheries Division and Betiraoi Boatbuilding to progress work on the 12 m wood outrigger canoe, *F/V Tekokona II* (*Fisheries Newsletter* nos 86, 87, and 88). Sea trials and fishing trials were to have commenced during the Steve's visit.

Unfortunately, little progress had been made on the vessel in the interim since the last visit by Steve, and work could not be completed while he was in Kiribati as some parts and equipment were not available.

Steve did, however, assist Betiraoi Boatbuilding in installing the Fiji-made (Seamech) aluminium longline reel (Figure 1), hydraulic tank, and keel cooler; and the echo-sounder transducer



Figure 1: Seamech tuna longline reel mounted on *F/V Tekokona II*

on F/V *Tekokona II*. Plans to complete the installation of other necessary pieces of equipment had to be put on hold.

A good lesson was learned by all in making sure that overseas orders are done correctly, especially in a remote place like Kiribati. Whether goods are shipped by surface or airfreight, there are often delays with suppliers, agents, freight forwarders, customs departments, and shipping companies and airlines.

Some of the materials ordered from Fiji for the hydraulic system on F/V *Tekokona II* were bumped off the flight going from Nadi to Tarawa as other airfreight had priority.

This type of delay in a project can be very frustrating as Steve, the Fisheries Division, and Betiraoi Boatbuilding found out. At the end of one month in Kiribati, Steve was recalled to SPC headquarters as he had other duties to complete.

In May, Lindsay headed to Tokelau as part of an SPC mission, which included the Director-General, Bob Dun. The mission visited all three atolls (Fakaofu, Atafu and Nukunonu) to assess likely projects SPC can assist with.

In the fisheries area, Lindsay looked at the tuna longlining operations being established using 12 m alia-type catamarans (Figure 2) from Samoa. The vessels set around 300 hooks per set using a hand-crank reel, and have small insulated ice holds for storing the catch which should predominantly be albacore tuna (*Thunnus alalunga*).

The second stage of this project is to set up shore freezer facilities on each of the atolls so that the catch can be frozen and stored for shipment to the canneries in American Samoa.

Three vessels are currently in operation, one at each atoll, with another three vessels



under construction. The project should be fully operational around the end of 1999, and SPC technical assistance may be provided early in the year 2000 in the areas of tuna longlining and onboard handling of the catch.

Other areas of assistance identified during Lindsay's meetings with the Council of Elders on each atoll and the Fisheries Department staff included: assessment work on inshore



Figure 2: 12 m alia-type catamaran longliner used in Tokelau

resources; base-line studies on the roles of men and women in community fisheries; several areas of training at both the national and regional level; FAD technical assistance and the provision of information on new FAD designs; post-harvest activities using tuna and other species associated with tuna longlining; maritime issues; and information pamphlets and general information.

During the months of June and July, Steve assisted SPC's Training Section with tutoring students in the 1999 Nelson Practical Fishing Module (16 June to 2 July 1999). [Ed: see also p. 9]

Every year participants in the SPC-Nelson Polytechnic Pacific Islands Fisheries Officers Course spend the last five weeks of their studies in the Pacific Islands learning fishing techniques. This part of the course is called the Practical Fishing Module. During 1999, as in the previous two years, the fishing

module was held in Noumea, New Caledonia. Part of the fishing module took place on board *Marine Marchande's* training vessel, F/V *Dar Mad*, and involved five or six students at a time along with the vessel's captain and crew, Lucky and Velio.

Steve assisted with fishing techniques and strategies. As there was no FAD available in New Caledonian waters at the time, no FAD fishing techniques were carried out (vertical longlining, mid-water handlining, and trolling near FADs).

Bottom longline fishing, drop-line fishing, pelagic longline fishing for tuna and for swordfish, and trolling techniques were demonstrated and carried out with student participation (Figures 3 & 4). During all of the fishing trials a total of 24 fish weighing about 100 kg were landed.

During the first week of fishing, F/V *Dar Mad* fished just outside

of *Passe de Dumbéa*, which is near Noumea. During the second week of fishing F/V *Dar Mad* went north to *Baie de Saint Vincent* and *Ile Puen*. At night the boat was left at anchor near *Ile Puen* while the students stayed ashore in weekend cabins.

Starting early each morning, F/V *Dar Mad* left for *Passe de Saint Vincent*. On the first day out the crew of F/V *Dar Mad* and the students deployed an Indian Ocean style FAD that they had rigged the previous week. The FAD was observed later in the week resting nicely in 1,500 m of water about 8 km west of the pass. It should be a good fishing spot ready for next year's group of Nelson students. The remainder of the time was spent fishing near *Passe de Saint Vincent*.

In late May, Lindsay travelled to Canberra for meetings with AusAID regarding funding for the Coastal Fisheries Programme for a three-year period, 2000 to



Figure 3: Hauling bottom longlining gear from F/V *Dar Mad*

2002. Although the weather was cold, the meetings were warm and positive. The draft funding proposal was well received with constructive feedback from AusAID.

The final decision on funding will not be made though until official consultations are held in late 1999. Also in late May, the recruitment process for a new Masterfisherman to replace Peter was begun.

In Noumea, Project Assistant Marie-Ange Roberts finalised the layout of several reports ready to go to printing. In addition, the long-awaited 'Deep-bottom fishing techniques for the Pacific Islands—a manual for fishermen' has now been printed and distributed.



Figure 4: Coiling a branchline during the haul of the tuna longline



■ COMMUNITY FISHERIES SECTION

From April to June 1999, the Section's activities focussed on the areas of information and training.

Information

Women in Fisheries Information Bulletin

Issue #4 of the Bulletin was produced and distributed in English in March 1999 and in French in May 1999. Articles in Issue #4 cover the work of the Section in Palau, Tuvalu, Niue and elsewhere, news from around the region (Tonga, Fiji, Samoa, Solomon Islands, Kiribati, Nauru, Palau, Guam, Hawaii, New Zealand and Australia, news outside the region (Asia, India and Africa), and publications.



The Bulletin is now available on the world wide web. It can be found under Newsletters at <http://www.spc.org.nc/coast-fish/>.

Training manuals

The French version of the manual, "Practical Methods for Preserving Seafoods" was completed and distributed in June 1999. The manual on setting up a business has been translated into French and should be out by September 1999.

Seafood Nutrition and Recipe Booklet – Work began on this booklet in late March 1999. The

booklet aims to improve the nutritional value of local diets by promoting greater consumption of seafood. Produced in collaboration with the SPC Nutrition Programme, the booklet provides both fisheries and nutritional information on a variety of marine resources, and features recipes from around the region. Learning how to make new seafood dishes is very popular with women who attend seafood-processing workshops. As such, this booklet will be provided as resource material in the workshops. The booklet targets workshop participants, trainers, and fisheries extension officers

Community Fisheries Manual – Work began on this new manual in April 1999. The manual aims to provide both fisheries resource users and managers information on how to effectively work together in managing fisheries on a community basis.

The manual targets national fisheries workers, non-govern-

ment organisations and those involved in community development. The manual will feature background information on subsistence and artisanal fisheries, sustainable resource development, and advice on how to involve communities in fisheries management. The manual will outline the roles of both men and women in fish-

eries, and stress the importance of considering both in an effective management programme.

National assessments

Work on National Assessments for Niue, Palau, Tuvalu continued, and a preliminary baseline study for Wallis and Futuna was undertaken.



Training

New Zealand – The Regional Course on Seafood Business Operations and Management for Pacific Island Women was held for 4 weeks from the 12 April to 7 May 1999.

Organised by the SPC Fisheries Training Section in collaboration with the Nelson Polytechnic's School of Fisheries, the aim of the course was to improve the skills of Pacific Island women in the seafood industry.

Lyn Lambeth, Community Fisheries Officer, went along to the course for the first 2 weeks, as a participant, and to provide administrative support.

It was an ideal opportunity for her to become familiar with the facilities at the Nelson School of Fisheries, meet with national representatives, and familiarise herself with the organisation of a regional workshop. (Ed: More about this course can be found under the Training Section's activities)

Futuna – The Futuna Net Repair workshop was held from the 17–19 May 1999.

Women returning from fishing in Futuna

Lyn Lambeth, the Community Fisheries Officer, taught the 3-day workshop, providing practical instruction on making net needles, repairing nets, and making a complete net from start to finish.

Equipment (nylon, needles) were funded from the workshop budget, with funding and organisational support being shared between the SPC Pacific Women's Resource Bureau and the Community Fisheries Section.

SPC Community Education Training Centre Fisheries Module – Patricia Tuara, the Community Fisheries Adviser, visited Fiji from 25 April to 10 May 1999 to work on the development of the CETC fisheries module.

Working in collaboration with Tony Chamberlain, the Post-harvest Lecturer from the University of the South Pacific, Patricia met with trainees from CETC to obtain feedback on the module design. A 2-week "Introduction to Fisheries module" was designed to include general





Net mending in Futuna

fisheries information, harvesting and gear technology, processing, making processing equipment, marketing and the development of a community

fisheries programme. In addition, work has begun on the production of a training manual that will be a course handbook for the trainees.

The handbook will be useful to trainees when they return to their communities. The module will be taught from 20 September to 1 October 1999.



Other national activities

New Caledonia – There has been greater media coverage depicting New Caledonian women harvesting, processing and marketing seafood.

The Section was happy to meet one of the woman featured on local television. Mme Dremon, a commercial fisherwoman from

Yaté visited SPC on 23 June to discuss with Patricia Tuara ways in which to develop ties with women in the Yaté fishing community. A visit to Yaté is being planned later this year.

As a result of a press release covering the net mending workshop in Wallis and Futuna, the

Community Fisheries Section was approached by a Wallisan woman living in New Caledonia.

The Community Fisheries Officer was able to provide notes and diagrams on net repair for the woman.



TRAINING SECTION

Pacific Island women tackle fisheries business in New Zealand

Nelson, New Zealand saw an increase in its Pacific Island community in April, with 13 women from around the Pacific attending the New Zealand School of Fisheries for 4 weeks.

The first SPC regional course for Pacific Island women on seafood business operations and management was held in Nelson from 12 April to 7 May 1999.

The course was part of the SPC Fisheries Training Section's regional training programme on the management of fisheries enterprises and was funded by the governments of Australia and France.

This was the first course to specifically target women, in recognition of the fact that women are playing an increasing role in the development of the seafood industry in the Pacific. A lack of expertise in seafood business operation and management and a lack of opportunity for training often hamper women involved in commercial fisheries enterprises.

The course received a large number of applicants, about 75, of which one third appeared suitable.

Of those, 13 were selected from PNG, Solomon Islands, FSM,

Nauru, Palau, Fiji, Tonga, Tahiti, Tokelau, Kiribati and Tuvalu.

Many of the women attending came from private enterprises and were well qualified in terms of experience. However, most of the women had never been given an opportunity for training before, and were therefore keen to upgrade their technical skills and learn new strategies to enhance their businesses.

The course was developed in collaboration with the New Zealand School of Fisheries and the New Zealand seafood industry to meet the regulatory and quality control requirements of international seafood markets.

Subjects covered included seafood production systems (HACCP, handling, quality, value adding, marketing); business management practices (commercial ethic, personnel management and development, problem solving), and business planning and accounting (spreadsheets and computers for accounting, interpretation of financial information, business plans). Classroom lectures were interspersed with practical sessions and site visits around Nelson.

So why have a course just for women? Women do play a large

role in the seafood industry in the Pacific, especially the processing and marketing side, but are often overlooked when it comes to training. Unless the course application specifically asks for women, it is likely that most of the applicants will be men.

Two previous courses have been held at Nelson for Pacific Island fisheries enterprise managers. The first, in 1997, had three women out of the 13 participants while the second had one woman out of 12.

Being in such a minority, the few women tended to be overshadowed by the men on these courses. In the latest course the women were very comfortable with each other and related well



together—all had children being cared for by extended family and most had been occasionally placed into positions of responsibility in their companies with no training and little support.

The Pacific community in Nelson made the women welcome, hosting a Pacific night at the School of Fisheries. Other extra-curricular activities included a visit to a green-lip mussel farm; white-water rafting, and sampling the sashimi and sushi at a local Japanese restaurant.

The thirteen participants left Nelson with a wide range of new skills and personal con-

tacts. All recognised the value of the course and recommended that SPC should seek funding to repeat this training programme in future years. Some women asked SPC representatives if assistance could be given to organise an in-country follow-up to the Nelson training.

Consequently, one course tutor will go to Fiji in July to review Ocean Trader's HACCP plan and production systems. In August, Silika Ngahe, one of the two Tongan participants, will run some workshops on seafood processing and business management, for the women of Ha'apai and Va'vau.

A request to fund similar workshops in Honiara was also received from the Solomon Island participant, Delker Lulumani.

The enthusiasm shown by participants in Nelson was rewarding for course organisers. Even more encouraging was subsequent feedback by some women, saying they were already applying in their business some of the concepts and strategies learnt in Nelson. The Community Fisheries and Training Sections are keen to continue with this training programme and, in July, a funding proposal for three consecutive courses was submitted to NZODA.



'Hands-on practice in Noumea for the Nelson students

The practical fishing module of the 20th SPC-Nelson Polytechnic Pacific Islands Fisheries Officers Course was completed in July 1999 in Noumea for its third consecutive year. The course, consisting of two mod-

ules, runs 18 weeks in Nelson, New Zealand, followed by a five-week practical fishing module in Noumea.

This year, eleven participants from eight different Pacific

Island countries were selected. The purpose of the course is to give selected students, who are working as fisheries officers, relevant technical skills at a very practical level which they will use in the day-to-day oper-



Ricky Starr (Nauru) and Francis Katupa (French Polynesia) hold the catch of the day, a 37 kg wahoo.



**Sione Mailau (Tonga), David Eongen (Nauru) and Ms Erema Ebaurei (Kiribati)
rigging a FAD to be deployed about 5 miles from *Passe de St Vincent***

ation of their work and which they may pass on to their colleagues and local communities.

This year's practical module in Noumea, New Caledonia, was run by Teriihauroa Luciani, Steve Beverly and Michel Blanc of SPC and supported by Brian Fosset of Nelson Polytechnic.

Every attempt was made to keep the practical fishing module as 'hands on' as possible in order to give the participants a realistic impression, through experience, of the hardships their own fishermen face on a day-to-day basis.

This included fishing trips on the open sea facing all the elements (sun, wind, swells, rain, wind, more rain, bigger swells, wind and more rain and rain and rain) and the disheartening reality of a 'no-catch' day, as well as the excitement of 'a big catch'.

All with the intention to create a deeper sensitivity in the participants to better serve the fishermen when they return to their fisheries posts in their own country.

The participants' 'hands-on' experience covered various technical fishing methods which included trolling with lures, fresh bait trolling, deep bottom fishing with hand reels and pelagic longline fishing for tuna and swordfish.

During fishing operations students were asked to fill out the SPC vessel logbook and to analyse the finances of each fishing trip. This year, students also participated in the construction and deployment of a light Indian Ocean style FAD.

As local expertise was available, the course also included subjects such as how to catch aquarium fish, post-harvest and

HACCP principles, prawn farming techniques, as well as reef and mangrove ecology and environment.

In Noumea the New Caledonia School of Fisheries *École des Métiers de la Mer* (EMM), the *Service Territorial de la Marine Marchande*, the *Aquarium de Nouméa*, the local aquaculture research station of Saint-Vincent (IFREMER) and the Environment Unit *Centre d'Initiation à l'Environnement* (CIE) as well as various SPC fisheries sections have all worked together to make this course a success.

With all these modern and specialised facilities available and willing to help, Noumea is truly the ideal location in which to run the practical module. We look forward to another successful course next year.



■ REEF FISHERY ASSESSMENT AND MANAGEMENT SECTION

In Thailand

Pierre Labrosse, Reef Fisheries Management Adviser, was invited to participate in the Joint APEC-NACA-NICA Workshop on Grouper Research and Development in Hat Yai on 7, 8 and 9 April 1999. This workshop followed the meeting held on 7–8 April 1998, where the following needs were highlighted:

- pursue further research on the principal critical points and constraints linked to grouper aquaculture technology; and
- set up a co-operative network for grouper aquaculture research in the Asia-Pacific region.

This second workshop allowed participants to define and launch the co-operative network on grouper research and development. This initiative will make it possible to:

- determine the conditions needed for the sustainable development of grouper aquaculture, with significant export potential;

In Philippines

In June, Tim Adams and Pierre Labrosse from SPC, Andrew Smith from The Nature Conservancy (TNC) and Vaughan Pratt from the International Marine-life Alliance (IMA) met representatives of the Asian Bank for Development (ADB) in Manila

In Solomon Islands

With awareness of the negative impacts of an uncontrolled live reef fish trade growing, especially where destructive methods are used and spawning

- propose income and employment alternatives to individuals involved in dangerous and/or illegal grouper fishing activities; and
- participate in the protection of reefs threatened by excessive grouper fishing pressure.

A series of presentations provided an update on the current situation regarding grouper aquaculture research and development in APEC countries in the very broadest sense, including, in particular, post-harvest issues concerning markets, mainly concerning the live fish market.

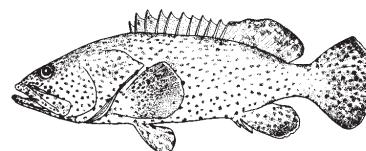
Three working groups dealt with the followings topics:

- Group 1: Production technology: research and industry development.
- Group 2: Food safety: chemical residues, handling/storage, transportation, trade issues (certification, quality labels, quality testing, marketing).

- Group 3: Social and environmental aspects, including technology transfer, coastal community livelihoods.

Each group evaluated the situation in the areas under consideration, identified those priority issues that should be the subject of research, development and information activities, and then formulated proposals.

These proposals were assembled into a project proposal and funding request that was presented to APEC immediately after the workshop. All the proposals were formulated in such a way as to respond to the priority issues identified by APEC, to implement co-operative activities and to promote grouper aquaculture development in the Pacific region.



While in Manila, Tim Adams and Pierre Labrosse attended the FishBase Steering Committee meeting. It was a good opportunity to discuss ways of activating the FishBase Pacific node for which training coordinators are based at SPC.

On 17–20 May 1999, Being Yeeting, Integrated Fisheries Management Associate, was invited to give technical advice and especially to provide a

regional perspective of the trade in a consultative workshop organised by the Solomon Islands' Fisheries Division with assistance from The Nature Conservancy.

The primary purpose of the workshop was to bring together the government (national and provincial), industry and reef owners to discuss and express their views relating to the development and management of the live reef food fish trade in the Solomon Islands. The goals of the workshop were:

- to identify the requirements for an economically and environmentally sustainable fishery from the reef-owner's and industry perspective;
- to review the Solomon Islands' draft interim national live reef food fish trade management strategy; and
- to provide specific recommendations to the Government of the Solomon Islands on the sustainable development and management of the live reef food fish trade.

An interim management plan is expected to come out from the workshop that will be used until the necessary biological, social and economical information (through the ACIAR project starting in mid-1999) becomes available for a further revision and finalisation of the main management plan.

The Nature Conservancy is preparing the interim management plan for review by The Solomon Islands' Fisheries Advisory Council before approval and implementation.



In Kiribati

A 24-day visit from 8 June to 1 July was made by Being Yeeting, at the request of the Kiribati Fisheries Division. The purpose of the visit was to:

- assist the Fisheries Division in assessing the potential of Abaiang Atoll for the Live Reef Food Fish trade,
- formulate guidelines for a National Live Reef Food Fish development and management policy; and
- make recommendations for an appropriate management system including necessary regulations that could be implemented and enforced under the current Fisheries Act.

In response to the requests, two main lines of activities were conducted. These include:

- field sampling using underwater visual census (UVC) in the sub-intertidal zone and lagoon area on Abaiang Atoll (one of the outer islands); and
- series of meetings with Government (central and rural), industry and local fishermen on Abaiang and Tarawa

Atoll (the Government station) to collect relevant information about the trade.

For the field sampling, a total of 42 stations in 8 different habitat types were surveyed. The habitat types included western reef sites (ocean and lagoon sides), northwest reef sites, passages (mouths and insides), lagoon sites (north and south) and the windward reef area.

Estimates of fish length of the potential live reef fish species were obtained, and of bottom type. These data would be used to get an idea of the density and distribution of the LRFF species surveyed.

Ultimately the information would enable the calculation of the size distribution and the biomasses of potential live reef food fish (LRFF) species. In addition, samples of algae (*Halimeda* being the most common) were collected at sampling stations to check for the presence (density and distribution) of *Gambierdiscus toxicus*, the dinoflagellate responsible for ciguatera fish poisoning.

For the information gathering part of the work, a total of 43

people from different sectors were consulted. Nine were from the national government, two from the local government, four from the industry, twenty-six were local fishermen, one from a research institute and one from the Development Bank.

The information gathered would be used to define the major issues and concerns of the different sectors and to develop options for an appropriate management and development system that could be implemented within the current legal framework and administrative structure.



The results of the field surveys and the findings from the meetings will be analysed and described in detail in the technical report to be published in September this year. This report will also include guidelines for a national LRFF management policy for Kiribati, a proposed management system with regu-

lations and a monitoring programme for the trade.

In addition to the formal work conducted, the opportunity was taken to train the staff of the Fisheries Division's Resource Assessment Section in the underwater visual census method that was used. This should enable

them to extend the assessment part of the work to other islands in Kiribati in the future to evaluate their potential for the trade. This should also allow them to become familiar with the method before using it extensively for assessing other fish resources in general.



■ OCEANIC FISHERIES PROGRAMME

Record participation at the 12th meeting of the Standing Committee on Tuna and Billfish

The 12th meeting of the Standing Committee on Tuna and Billfish (SCTB) was held from 16 to 23 June in Tahiti, French Polynesia, at the invitation of the French Polynesian Government.

The aims of the SCTB are to provide a forum for scientists and others with an interest in the tuna stocks of the western and central Pacific region to meet and discuss scientific issues related to data, research and stock assessment.

The SCTB coordinates fisheries data collection, compilation and dissemination; reviews research on the biology, ecology, environment and fisheries of tuna and associated species; identifies research needs and provides a mean of coordination to meet those needs.

Participation in the SCTB is open to scientists and others with an interest in the tuna fisheries of the western and central Pacific. Scientists of coastal states and territories of the region, from countries whose vessels fish in the region, and from international tuna fisheries management organisations are particularly encouraged to attend.

The SPC Oceanic Fisheries Programme (OFP) served as Secretariat for the meeting. The

Service des Ressources Marines (SRM), French Polynesia, kindly hosted the meeting, and their staff, under the logistical direction of Mr Stephen Yen, certainly added to the well-deserved reputation of Polynesian hospitality. The French *Institut de la Recherche pour le Développement (IRD, ex-ORSTOM)* also assisted greatly with the logistics and organisation of the meeting.

Financial assistance for the organisation of the meeting was kindly provided by the Governments of French Polynesia and France, and skillfully coordinated by H el ene Courte, Technical Adviser to the President of French Polynesia.

Some of the participants, who had been present at early SCTB meetings, were nostalgically recalling the days when only 12 to 20 people were seated around the table . . . this year's number climbed to well over eighty. Some of the reasons for this exceptional attendance were probably that:

- Tuna catches in the Western and Central Pacific Ocean (WCPO) now represent more than half of the world's tuna catches, and the SCTB's role as a regional scientific advisory body has grown in parallel with this huge fishery;

- This SCTB meeting may be the last one before the Multilateral High Level Consultation (MHLC) process, which should develop an arrangement for the conservation and management of highly migratory fish stocks in the WCPO, scheduled for completion in June 2000. SCTB is expected to form the basis of a possible scientific advisory body to that arrangement.

- Lastly, ten days in a beautiful hotel facing the ocean in Tahiti, is an invitation hard to refuse.

The meeting was attended by participants from American Samoa, Australia, Canada, Cook Islands, Federated States of Micronesia, French Polynesia, Japan, Kiribati, Nauru, New Caledonia, New Zealand, Niue, Northern Marianas, Palau, Papua New Guinea, Philippines, Republic of Korea, Samoa, Taiwan, Tonga, Tuvalu, United States of America, Vanuatu, and Wallis and Futuna.

Two regional organisations were also represented: the Inter-American Tropical Tuna Commission (IATTC) and the Forum Fisheries Agency (FFA), as were various organisations and agencies at national level.

The meeting opened with an address by the Minister of Marine Resources of French Polynesia, M. Llewellyn Tematahotoa, followed by an address by Mr Jean Aribaud, the High Commissioner of the French Republic in French Polynesia. Dr Ziro Suzuki, from the National Research Institute of Far Seas Fisheries (NRIFSF), Japan, chaired the meeting.

After an overview of WCPO tuna fisheries, the presentation of national tuna fishery reports, and a session allowing organisations to report on their activities, the meeting convened as six working groups: the Statistics Working Group (SWG), the Skipjack Research Group (SRG), the Albacore Research Group (ARG), the Yellowfin Research Group (YRG), the Bigeye Research Group (BRG), and the Billfish and Bycatch Research Group (BBRG).

Normally, time allocated for deliberations is equally shared

between each group, but this year, the Bigeye RG and Billfish and Bycatch RG were accorded slight priority, given existing resource uncertainties.

The meeting ended with a session allowing discussion on the MHLC process and the usual 'Other Business' session. You will find below, a brief summary of outcomes from these different sessions, including summary statements for the five Research Groups, extracted from Dr Tony Lewis' 'Prompt Report' that was hastily prepared for all participants on the last day of the meeting.

Brief summary of sessions

Initial overview of Western and Central Pacific Ocean (WCPO) tuna fisheries

The initial overview of Western and Central Pacific Ocean (WCPO)

tuna fisheries noted that the estimated total catch for 1998 for the four main tuna species was the highest on record (1,773,000 t), with a record catch of skipjack, particularly that taken by purse seine, making up 66% of this total. The yellowfin and bigeye catches were the second highest on record (407,000 and 97,600 t respectively), and the South Pacific albacore catch (41,100 t) the highest this decade. National fishery reports provide further details of these catches.

Reports by organisations

Reports on relevant activities of other organisations were received from the Inter-American Tropical Tuna Commission (IATTC), the Food and Agricultural Organization of the United Nations (FAO), the Pelagic Fisheries Research Program (PFRP) and the Interim Scientific Committee on Tuna and Tuna-like Species in the North Pacific Ocean (ISC).



Some of the Pacific Islands delegates: Sione Leolahi from Niue, Samuelu Telii from Tuvalu and Iliapi Tuwai from Fiji

Statistics Working Group (SWG)

The objectives of the SCTB Statistics Working Group (SWG) are to coordinate the collection, compilation and dissemination of tuna fisheries data. In regard to the coordination of data collection, the SWG held a session prior to the main SCTB meeting to establish minimum standards for catch and effort logsheets and to review, as an example, the logsheets used in New Zealand and Australia.

In the future, the SWG will review other logsheets used in the region, including those developed by the SPC/FFA Tuna Fishery Data Collection Forms Committee.

During the main SCTB meeting, the SWG Coordinator, Tim Lawson, reported on the status of data collection, compilation and dissemination. Data that are compiled by the OFP on behalf of the SCTB include annual catch estimates, catch and effort data, length data, and other types of data.

Progress in data compilation was achieved, although certain problems remain with some of the catch and effort data provided by Japan and Korea.

Concerning the provision of data by Japan, a participant from the National Research Institute of Far Seas Fisheries stated that while the Fisheries Agency has an agreement with SPC to provide catch and effort data, this agreement may not cover the provision of data compiled by the OFP on behalf of the SCTB.

It was also noted that there are two ex-Korean purse seiners and several ex-Taiwanese purse seiners flagged in Vanuatu, but the Vanuatu Department of Fisheries has not established

procedures for collecting catch and effort data from these vessels. Regarding the dissemination of data, it was reported that catch and effort public domain data, grouped by 5° latitude and 5° longitude strata and month, for all fishing nations combined, are now available on the SPC Website.

Other subjects discussed by the SWG included the statistical areas used for compiling annual catch estimates; the adjustment of bigeye and yellowfin catches by purse seiners for the misidentification/non-separation of bigeye and yellowfin in catch and effort logsheet data and landings data; and the development of a regional sampling design for port sampling programmes and observer programmes.

Skipjack Research Group (SRG) - Summary statement

Skipjack contribute two-thirds of the WCPO catch of the four main tuna species. The best available estimates indicate that the 1998 skipjack catch in the WCPO was the highest on record (1.17 million tonnes, just exceeding the 1991 catch), with purse-seine fleets providing both the majority of this catch (76%) and the catch increase observed during 1998.

Available indicators (purse-seine, pole-and-line) show variable catch rates over time in the fishery, but with no suggestion

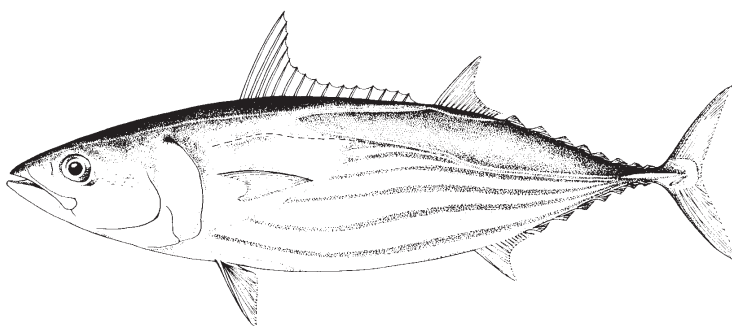
of a downward trend. Recent studies have begun to provide some understanding of environmental influences on fluctuations seen in skipjack availability and productivity of the stock in the WCPO.

Tag-based assessments from the early 1990s found regional exploitation levels to be low to moderate at catch levels similar to those in recent years; combined with the absence of clear trends in fishery indicators, this would suggest that the current catches are certainly sustainable.

However, given the importance of the skipjack fishery, there is a need to improve the statistical coverage of the fisheries, which remains poor in some areas (eg Indonesia, Philippines), to develop improved assessment models which would be amenable to reference-point-based management, to develop fishery indicators for use in stock assessments, and to continue to develop an understanding of processes affecting stock productivity and recruitment.

Albacore Research Group (ARG) - Summary statement

Albacore occurring in the South Pacific constitute a single stock. The best fishery estimates indicate that the 1998 albacore catch (41,000 tonnes) was the highest annual catch this decade. South Pacific albacore were mainly harvested by the longline fleet (88%) with a lesser amount con-





Terii Vallaux from SRM French Polynesia and François-Xavier Bard from IRD (ex-ORSTOM)

tributed by the troll fleet (12%). Longline catches have escalated in several domestic longline fisheries, especially Samoa, American Samoa and French Polynesia. In these three countries, the 1998 catch totalled 9,700 t or nearly 25% of the entire South Pacific catch.

The Taiwanese distant-water longline CPUE provides the best long-term indicator for the fishery, and catch rates in 1998 were high (>4 albacore per 100 hooks) compared to fishery performance earlier in the decade.

Trolling catch rates of the USA and New Zealand fleets are more variable than those of the longline fishery, possibly due to factors affecting availability rather than changes in stock abundance.

A length-based, age-structured stock assessment (MULTIFAN-CL) applied from 1962 to 1993 suggested that current levels of South Pacific albacore

catch are sustainable given moderate exploitation rates and recent increases in catch rates of domestic and distant-water longline fisheries.

In addition, there was some evidence of ENSO impacts on both catchability and recruitment. A recent production model analysis is also consistent with the good stock condition interpretation.

The MULTIFAN-CL assessment needs updating, and could be improved by updating Taiwanese longline statistics, re-structuring

the analysis to better incorporate recent fishery developments, consideration given to the likelihood of localising the model to smaller scales, incorporating assessment of precautionary reference points and better understanding how fleet behavior or albacore targeting may be related to economic factors.

Yellowfin Research Group (YRG) - Summary statement

The yellowfin tuna catch for the western and central Pacific Ocean (WCPO) has increased since the 1980s, when purse-seine fishing began to expand significantly in the WCPO.

Although expansion has slowed in recent years, the catch has reached record high levels. The best estimate of the 1998 catch is about 407,000 mt, which is among the highest on record. This is an increase for the purse-seine and other gear catches, and a decrease for the longline



and pole-and-line gear catches over 1997 catches.

This level of catch appears to be sustainable and is not adversely impacting the stock. Evidence for this conclusion is based on the time series of purse-seine CPUE, which is variable but with no particular trend, and the time series of standardised longline CPUE which is flat, or with a downward trend, depending on fishing area and type of analysis.

Other indicators (the MULTI-FAN-CL length-based age-structure model and tagging data) show exploitation at low to high levels depending on the yellowfin tuna statistical area, but on a whole and at the stock level, exploitation is at a low to moderate level.

In short, the WCPO yellowfin tuna stock appears to be in good condition and able to safely sustain the current level of catch.

Bigeye Research Group (BRG) - Summary statement

Although the catch of bigeye for the total Pacific Ocean accounts for a relatively small portion (8 % of total tuna catch in the Pacific Ocean), its economic value is substantial (approximately US\$ one billion annually). In 1998, the catch was 100,000 t and 70,000 t for the WCPO and EPO, respectively.

The catch increased gradually in the WCPO reflecting increases in longline and purse-seine catch-

es. On the other hand, the surface-fishery catch in the EPO increased markedly beginning in 1994 with decline in the longline fishery catch, and the total catch has stabilised between 70,000 and 90,000 mt.

The longline catch in the EPO declined from 83,000 t to about 35,000 t in 1998, and has been replaced by a large purse-seine catch since 1993. The purse-seine catch in the EPO increased from about 8,000 t in 1993 to over 50,000 t in 1996 and 1997. It declined to 34,000 t in 1998.

Because a comprehensive stock assessment for this species is hindered by the scarcity of data and the absence or poor quality of estimates for some key biological parameters, the current stock status is uncertain.

To overcome this situation, the application of the integrated (Multifan-CL) model, which utilises all available data and estimates all parameters simultaneously, is planned for the coming year.

The Group, however, noted that preliminary estimates of relative stock abundance from standardised longline CPUE indicate a decline in abundance since the late 1970s in the WCPO and since 1990 in the EPO. Although the estimates require further developments, the preliminary results raise concern of overfishing and decline in adult biomass.

Cohort analysis performed by the IATTC for the stock in the EPO also indicated a similar decline in the adult biomass. The Group therefore strongly recommends that directed research efforts supporting the appro-

priate stock assessment be urgently undertaken, for example, (i) determine better estimates of the bigeye catch by surface fisheries, (ii) determine estimates of mixing rates and movements of fish across the range of the stock, and (iii) determine estimates of biological parameters (growth and size-specific natural mortality rates).

Billfish and Bycatch Research Group (BBRG) - Summary statement

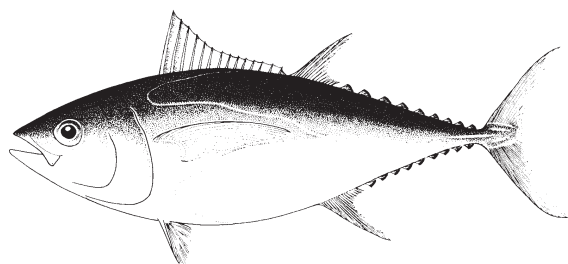
Some information is available on marlin stock structure and broad movement patterns. However, BBRG highlighted gaps in other information required for the development of quantitative stock assessments.

These are major gaps in information on age and growth, mixing rates and natural mortality. Historical catch and effort data are available for several commercial fleets, especially Japanese longliners. But catches of billfishes are often incidental to commercial fishing operations.

Consequently, there is uncertainty over the reporting of discarded catches, and catch rates need to be standardised if they are to be used as an index of stock abundance. Size data are also required. Useful catch, effort and size data might also be gathered from gamefishing operations that target billfishes.

BBRG does not yet have a history of stock assessment to draw on. BBRG did not attempt to develop a statement of stock status because of the information gaps mentioned above.

In the interim, BBRG's coordinator offered to develop a statement that subsequent meetings of BBRG can consider. Thus it will eventually create an agreed statement on stock status and add to this as results of dedicat-



ed research and assessment become available.

Update of the Mulilateral High Level Consultation (MHLC) process

The meeting was provided with an update of the ongoing MHLC process, to develop an arrangement for the conservation and management of highly migratory fish stocks in the WCPO, scheduled for completion in June 2000 (Convention and Commission).

The implications for SCTB in terms of the provision of scientific advice to the proposed Commission, as well as the proposed Convention area and species to be addressed by the Commission, were discussed at length by the group. Several

issues will be drawn to the attention of MHLC 5.

The meeting closed with the approval of the summary statements prepared by the Group Coordinators, and discussion of reporting procedures. As a result, a Prompt Report was prepared for the first time, to enable participants to return with a meeting summary, accompanied by a commitment from the Secretariat to post the draft report on the SPC website by the end of the month. (This was duly done on 29 June).

Following an invitation from the Kingdom of Tonga, SCTB 13 may be organised in another island paradise: Vava'u. (*These tuna people must have developed special skills to always get invited to the right places . . .*).

Showing the exceptional relationship that the French Polynesian Government has built with their local fishing industry, the farewell cocktail was jointly organised and sponsored by the two sectors. It created a good opportunity for the meeting participants to get to know some of the very enterprising Tahitian fishermen who have built an impressive local tuna longline industry in a few short years, and provided a fitting farewell for the 12th and largest SCTB.

A draft report from the 12th SCTB is available, in PDF format, on the SPC website at the following address:

*<http://www.spc.org.nc/oceanfish>
(click SCTB in the menu)*



Do it with a smile, part of the very efficient team that worked behind the scene: Babera Kaltongga from OFP, Christine de Floris and Frédéric Leproux from Service des Ressources Marines, French Polynesia

■ FSM FISHERIES MANAGEMENT AND DEVELOPMENT PROJECT

The Federated States of Micronesia (FSM) are about to undertake a major project to improve the economic returns it receives from its fisheries, especially those for tuna. The Fisheries Management and Development Project (FMDP) is financed by the Asian Development Bank under a Small-Scale Technical Assistance Grant. The project, which is being carried out by the consulting company of Gillett, Preston and Associates Inc., will commence in late July 1999 and will run for about 16 months.

The project is prompted in part by an increasingly urgent need for FSM to generate new sources of income to support its economy. For the past 15 years FSM's main foreign revenue source has been the funds received from the USA under the Compact of Free Association.

However, Compact payments have been progressively reduced every five years, and will terminate altogether in the year 2000, greatly reducing the funds available to Government, which is the country's major employer.

The Government is already tightening its belt in anticipation, by shedding staff and reducing the number of Government Departments.

However, alternative sources of income are needed to replace the revenue and employment previously provided under the Compact arrangements.

Other Micronesian countries have successfully developed tourism, but FSM's lack of facilities, as well as the difficulty and high cost of flying to and within the country, mean that this is unlikely to be an immediate prospect.

FSM has few exportable natural resources, and fisheries seems to be the country's only immediate candidate for rapid economic development. In the past, the focus has been on licensing foreign fishing vessels in order to generate revenue that has been used to finance the Government.

In the future, however, the Government will need to come up with ways of ensuring that the tuna fishery contributes more broadly to FSM's economy by providing direct opportunities for investment, employment, and participation by the domestic private sector.

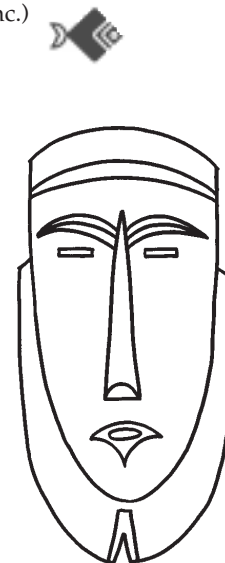
The FMDP has been designed to assist with this transition. Project activities will address a wide range of policy, economic and regulatory issues aimed at improving the overall benefits that FSM receives from its fisheries, and reducing the costs of managing them. Studies will be undertaken to assess the economic benefits (in terms of licence fees, employment, investment, taxes, resource rents, etc.) that will be produced by various mixes of foreign and domestic fleets, and of fishing vessel types.

Strategies will then be developed to enable FSM to move towards the optimum situation, and these will be formally incorporated into FSM's fishery management and development policies and regulations. At the same time, the fishery management roles and responsibilities of various federal and state agencies will be examined with a view to rationalisation of functions, in line with the Government downsizing exercise currently underway.

Rationalisation will be supported by an institutional strengthening programme aimed at improving the capacity and efficiency of public sector fishery management activities. In addition, options for the privatisation and improved management of FSM's various publicly-owned commercial fishing enterprises will be examined, and where possible mechanisms put in place so that these can be transferred to the private sector. These enterprises include purse-seine and longline fishing companies, wharves, slipway facilities, fish processing plants, and international fish air-freight operations.

Finally, the project will examine ways of transferring fishery management costs to the fishing industry, and assist FSM to move towards a user-pays management system. This will not only reduce the cost to Government, but will also provide increased security of access to resources for fishing industry members, and with it a greater motivation for sustainable resource use.

(Source: Gillett, Preston and Associates Inc.)



■ MARSHALL ISLANDS ARE EXPECTING A US\$ 3 MILLION GRANT FROM JAPAN

Japanese officials in Majuro have approved in principle a US\$ 3 million grant to aid establishment of a community-based commercial fishing operation in a remote atoll in the Marshall Islands.

The Marshall Islands Marine Resources Authority (MIMRA) is seeking to add a new atoll to the four that have already been developed with the aid of Japanese funding. The currently existing rural fish bases on these small islands market fish in the two main urban centers in the Marshall Islands.

The US\$ 3 million if, as expected, it is approved in Tokyo later this year, will enable the development of a fish handling facility on Jaluit's main island, Jabor, with cold storage, fish processing and marketing areas.

Other islands in Jaluit would be supplied with fishing boats, gear, other equipment and training opportunities to support development of a local commercial fishing industry, according to MIMRA's Deputy Director Danny Jack.

Japanese officials in Majuro indicated that the proposal was similar in nature to the pilot fisheries project that was launched on Arno Atoll with Japanese aid in the late 1980s, and then expanded in the mid 1990s to include three other outer atolls.

Danny Jack said that the aim of this project was to stimulate income earning opportunities among remote island communities by marketing fish caught in Jaluit within the atoll, as well as in nearby Kili — where the displaced Bikini Islanders live — and Majuro, the capital, which has nearly half the country's 65,000 residents.

Danny Jack added that to avoid population influx into urban centers, it was necessary to make life in the outer islands attractive and promote settlement of young people, thus decentralising the population.

Both MIMRA and Japan embassy officials indicated that the project, originally requested for the 2001 fiscal year, could start in 2000, if it is approved in Japan.

The Japanese embassy in Majuro has already approved it and is waiting for the response from the Japan International Cooperation Agency, which would be the funding agency.

Japan's Overseas Fisheries Cooperation Foundation, which already has an ongoing presence in the Marshall Islands, is expected to provide a range of technical assistance for carrying out the project, including training of staff for marketing, boat maintenance, handling of fish and promotion of sustainable fishing technologies, according to MIMRA.

(Source: *Marianas Variety News and Views*, 9 July 1999)



■ MILLIONS OF DOLLARS AVAILABLE FOR CORAL REEF PROTECTION

Million of U.S. dollars will be available to states and U.S territories to preserve and protect coral reefs under the Coral Reef Protection Act of 1999, according to U.S. Senator Daniel Inouye.

The Coral Reef Protection Act, according to Senator Inouye, would authorise appropriations totaling US\$ 100 million over a period of five years to preserve, sustain and restore the health of

U.S. coral reef ecosystems and assist in the conservation and protection of coral reefs by supporting conservation programmes.

This Act would leverage the federal dollars appropriated for these purposes by establishing a formal mechanism for collecting and allocating matching monetary donation from the private sector to be used for coral reef conservation projects, according

to Senator Inouye. He added that the Act would also authorise US\$ 15 million per year in grants to support coral reef and coral reef ecosystem conservation and restoration projects.

Any relevant state or territorial natural resource management authority or other government authority with jurisdiction over coral reefs ecosystems, or educational or non-governmental institutions with demonstrated

expertise in the conservation of coral reefs would be eligible to apply for these grants which would be administered by the Secretary of Commerce. Except for projects costing less than US\$ 25,000, or specific exemptions granted by the Secretary, these grants would be subject to a 25% non-federal matching requirement.

Additionally, the Act would authorise the Secretary of

Commerce to enter into an agreement to authorise a foundation to solicit, receive, hold and administer gifts and donations received to further the purposes of this Act. These funds could be combined with the federal grant funds in support of coral reef projects.

Furthermore, the Coral Reef Protection Act of 1999 would authorise US\$ 5 million per year to directly support federal con-

servation and restoration efforts. It would also authorise the Secretary to enter into joint projects with any federal, state, territorial, or local authority, or provide financial assistance to any person involved in coral reef conservation projects.

(Source: *Samoa News*, 6/7/99)



■ MODERN SPEARFISHING: A RISKY BUSINESS

Spearing for coral reef fishes is one of the oldest traditional fishing methods in the Pacific. In the past, the effects of spearfishing were minimal as fishers were limited to spearing from the surface or in relatively shallow waters accessible by free-diving.

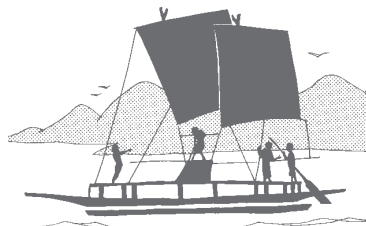
Over the past half century, however, spearfishing potential has been greatly enhanced by new technology, including scuba gear, powerful underwater flash lights, spear guns, "Hawaiian slings" (catapults to propel steel spears), and bang sticks (devices employing 12-gauge shotgun cartridges that can stop even sharks and large fish). Throughout the Pacific, the efficiency of modern spearfishing has created concern both for fish and for divers.

Dive fishing often occurs at night when many reef fish are the most vulnerable, sleeping or hiding under coral ledges and in holes. In Palau, for example, fishers using powerful underwater flashlights and spearguns have exploited large humphead parrotfish, which normally sleep in "dormitories" on the shallow reef. Faced with increasing fishing pressure, these, as well as other fish species that normally inhabit the plateau crest and upper slope of reefs, are driven to inhabit deeper waters further

down the reef slope. Similar reports have been documented in French Polynesia, Wallis and Pohnpei.

As the fish move to deeper waters, so do the spearfishers. Increasingly dependant on scuba gear to reach these greater depths, the spearfishers take greater risks.

In Guam commercial fishers use up to three cubic-foot scuba tanks per diver per night and venture as deep as 180 feet (55 m) on their first and second dives. Spearguns and bang sticks are used to maximise catches of popular humphead parrotfish and Napoleon wrasse. Spearfishers have experienced cases of the bends as well as a few emergency ascents due to regulator blowouts. The fishers must also combat strong currents and predatory tiger and reef sharks, which may steal their catches.



In Nauru, day and night scuba spearfishing grew in popularity in the 1970s and 1980s with up to 30 people regularly fishing the reef slope. Over time, divers noted that stocks of snapper and groupers were depleted in shallow water and spearfishers increasingly harvested smaller specimens. As in Guam, snappers and grouper populations had retreated into deeper water. Expansion of dive fishing activity into these depths by uncertified divers led to several severe cases of the bends and the acquisition of a hyperbaric chamber by the Nauru hospital.

The threat to reef fishes posed by scuba spearfishers, particularly on small islands with high demand for reef fish, have led some traditional chiefs and local governments to take or contemplate regulatory action to curb this method of fishing. On other islands, strong local support for spearfishing means that regulation is unlikely. Without regulation, however, large snappers, groupers, parrotfish, wrasses and other reef fish will continue to live below their normal depth range and spearfishers will likely take increasing risks to hunt their quarry.

(Source: *Pacific Islands Fishery News*, Spring 1999)



■ ECONOMIC VALUE OF “MARINE ECOTOURISM” IN THE MALDIVES

This article is based on a BSc thesis prepared by Ali Waheed, who is a scientist with the Marine Research Centre of the Ministry of Fisheries, Agriculture and Marine Resources, Republic of the Maldives

With over 1200 islands, the Maldives offers visitors an overwhelming variety of historical, cultural and natural attractions. Although the islands are small, the marine territory of this archipelago covers about 90,000 square kilometres. Tourists enjoy the rich biodiversity, the clear waters and the abundant, varied marine life.

Tourism began in 1972, with two resorts that offered visitors 280 beds. The industry has expanded rapidly over the past 20 years and is now the largest in the country. Within the tourism sector, scuba diving is the main attraction. In 1996, a total of 338,733 tourists visited the Maldives: some 56 per cent of them undertook scuba diving. Cost per dive averages about US\$ 33 including the boat cost. The cost varies between operators and depends largely on the type of holiday package the tourist divers are pursuing and the time of the year they visit.

The total revenue generated from tourism may help decisions on whether to aggressively pursue a policy of conservation or exploitation of wild resources. The reefs are rich in biodiversity and boast a variety of marine creatures and corals that are of interest to divers. The major marine life in the Maldives that attracts divers consists of sharks, manta rays and turtles.

Estimates of the number of dives made annually, as well as tourist survey results, show that the viewing value of shark is about US\$ 6 million per annum. The figure was derived simply by asking a hypothetical question about how much the divers were willing to pay to see more sharks. The same survey concluded that manta rays have a viewing value of US\$ 7 million per year, and turtles US\$ 4 million. This value is expected to increase as the tourism in the Maldives grows.

The survey also indicates that the viewing value of reef shark may be 10 times the entire export value of all sharks products. Thus it could be argued that non-extractive exploitation of the reef resource is economically more productive than extractive exploitation (tourism can earn more foreign exchange for the Maldives than fishing can).

Estimates show that the combined viewing value of marine wild animals exceeds US\$ 19 million. In addition, scuba diving alone generated in excess of US\$ 41 million in 1996. This represents average net earnings for each resort of approximately US\$ 0.56 million per year.

Ecotourism is the fastest growing segment of the world tourism industry and is dependant on the natural environment. Ecotourism,

on the other hand, can help to conserve biodiversity. If there is a decline in marine wildlife, the Maldives would attract far fewer ecotravellers.

The Maldives can be readily marketed as an excellent venue for ecotourists. A dynamic wildlife tourist industry can lead to relatively high returns, provided that the protected areas of the Maldives are properly managed and exploitation is not pursued indiscriminately.

The most significant threats to the protected areas of Maldives are illegal fishing and coral mining on or near the protected reefs. Ecotourism can generate adequate funds in the form of fee collection from divers.

It is estimated that about US\$ 0.9 million can be raised annually by introducing an environmental charge of one dollar per dive per day from each diver. These funds could also be used for community development of reserve areas and for carrying out biological and market research on alternative options for fishermen whose lives are affected by the protected areas.

(Source: *Bay of Bengal News*, December 1998)



■ LIVING MARINE RESOURCE PRODUCTION VARIATIONS IN THE EQUATORIAL PACIFIC UNDER THE INFLUENCE OF EL NIÑO

Every three to four years, the Equatorial Pacific experiences a major climatic disturbance, the well-known El Niño, which is one phase of a global climate fluctuation system: ENSO (El Niño-Southern Oscillation).

The main physical (atmospherical and oceanic) mechanisms responsible for this event are now quite well understood by scientists; little, however, is known about the geochemical variations affecting exchanges of carbon dioxide nitrate, etc.) and the biological variations (primary, secondary and tertiary production) associated with ENSO.

By coupling two oceanic simulation modules, IRD (Institute of Research for Development, formally ORSTOM) scientists have just achieved a breakthrough in the understanding of interactions between the physical and biogeochemical processes at work in the Western Equatorial Pacific during a low-amplitude El Niño episode.

When applied to variations in primary and secondary (phyto- and zooplankton) production, these models make it possible, in short, to better understand tuna movements in this oceanic region.

Known to scientists as the "warm pool", the Western Equatorial Pacific is an oceanic region with exceptionally warm surface water (28.5°C mean temp.), of low salinity and oligotrophic (nutrient-poor). At the Equator, the eastern boundary of this pool is in contact with colder water (24°C mean temp.), which is highly saline and nutrient-rich (especially in nitrate) due to the mineral-rich Equator-

ial upwelling. The contact area between these two water bodies is clearly demarcated by a front which is biologically rich in zooplankton and fish (especially tunas).

During a warm episode (El Niño), under the influence of frequent, strong westerly winds in the Equatorial Pacific and the currents they generate, the mass of warm water grows in size. Over a space of a few months, its eastern edge moves two to three thousand kilometres eastwards along the Equator.

Conversely, during a cold episode (La Niña), the mass of hot water is pushed westwards from its mean position. These dynamics, peculiar to the Pacific Ocean, have been incorporated into a digital ocean circulation model developed by LODYC (Dynamic Oceanography and Climatology Laboratory of CNRS/IRD/Paris VI), which includes data gathered from the whole Pacific Basin by means of a network of buoys and satellites.

What then is the impact of these oceanic dynamics on biological production in the Equatorial Pacific? To answer this question, modelling is needed, because data on biogeochemical production over this ocean as a whole are scarce. IRD scientists therefore use a biogeochemical model making it possible to simulate nitrate consumption by phytoplankton in surface oceanic waters with ample light.

Nitrate was chosen because it is a component of the vegetable biomass and because, in its absence, primary production tends to disappear. Biological production can be estimated

from the quantity of nitrate available. This model was coupled with the oceanic circulation model developed by LODYC. When applied to an El Niño-type event (1994), the coupled model made it possible to represent interactions between oceanic dynamics (winds, currents) and biological flows.

This research has shown that, when the eastern boundary of the warm and oligotrophic pool moves several thousand kilometers eastwards under the influence of El Niño and the cold-water area shrinks to a similar extent, the nitrate-rich and productive waters situated to the east of the basin also tend to shrink in size.

Simulations of the variations in nitrate contents and in biological flows that this model yields were confirmed by data recorded in the same part of the Pacific during French (FLUPAC and OLIPAC) and American (EqPac) oceanographic cruises carried out between 1992 (La Niña period) and 1994 (El Niño period).

On the basis of the primary production fluctuations determined as above, this modelling was used to estimate the variations in secondary production related to the oceanic dynamics generated by ENSO.

More specifically, it emerged that this nutrient-rich region (zooplankton and micronekton) for tuna is located in the vicinity of the front between the warm pool and the cold water area (Equatorial upwelling) and moves eastwards in phase with El Niño events. This would explain why Equatorial Pacific tunas (mostly skipjacks) move

eastwards, accompanying this front, during a warm ENSO episode. These results, obtained with modelling, have been corroborated by data from tuna fisheries. These indicate that, during El Niño years, maximum catches are located 2,500 kilometres further east than during "normal" periods.

IRD scientists are further developing this coupled model by associating it with a third module simulating the carbonate-carbon dioxide system in the ocean for the purpose of gaining a better understanding of how carbon dioxide (CO₂) exchanges between the atmosphere and the ocean might change during climate warming events, of which El Niño episodes are examples.

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To obtain the illustrations from these works, please contact: Indigo Base, Banque d'images de l'IRD, Claire Lissalde. Tel.: +33 (0)1 48037899; E-mail: lissalde@paris.ird.fr

(Source: *Fiche d'actualité scientifique*, IRD, No.86, March 1999)



■ NEW SPECIES OF COELACANTH DISCOVERED IN INDONESIA

Since the discovery of the first coelacanth (*Latimeria chalumnae*) in 1938, all the evidence implied that it was unique in its genus and that it formed a small population living almost exclusively in the Comoros island group.

The recent capture of a coelacanth in Indonesia cast doubt on this theory, especially as the morphological and genetic analysis carried out on this specimen by scientists from IRD and Indonesian scientific institutes (LIPI, CRIFI-RIFF) has just shown that it belongs to a new species (*Latimeria menadoensis*). This discovery, first reported in the *Comptes Rendus de l'Académie des Sciences*, sheds new light on the coelacanth's evolutionary history.

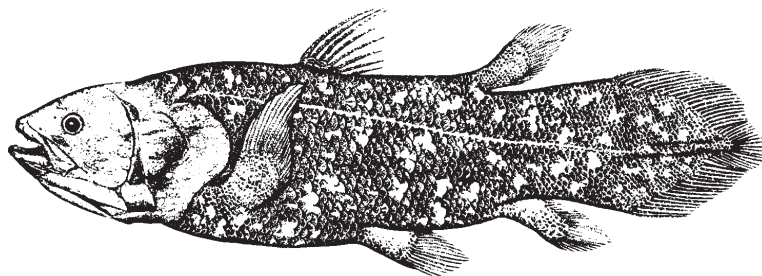
In 1938, the first live coelacanth (*Latimeria chalumnae*) was captured off the eastern coast of South Africa. This major discovery revealed the existence of a 'living fossil' which was thought

to have disappeared some 70 million years ago and which, morphologically, had evolved very little since its appearance in the Devonian, more than 400 million years ago.

The approximately 200 other coelacanth specimens recorded since the end of the 1930s were, for the most part, discovered in the Comoros. Previous scientific research on some specimens had suggested that *Latimeria chalumnae* was a population whose habitat was limited to the Mozambique Channel or even to only certain Comoros islands (Grand Comoros and Anjouan).

Mark Erdmann's discovery, in July 1998, of a coelacanth at a location more than 9,000 kilometres away, i.e. near the island of Menadotua in the Sulawesi island group (Indonesia) contradicted this theory and raised many questions.

In order to determine whether the Indonesian coelacanth belongs to a different population from the Comoros one, a team of scientists from the IRD (Institute of Research for Development, formerly ORSTOM), LIPI (Division of Zoology Research and Development Centre for Biology, Indonesia) and CRIFI-RIFF



Latimeria chalumnae

(Central Research Institute for Fisheries, Indonesia) carried out a genetic and morphological study of the new specimen.

These scientists then respectively analysed two parts of the genome (mitochondrial DNA) and described the main morphological characteristics of the Indonesian coelacanth. They then compared their results to available data on the Comoros species.

The results obtained revealed significant genetic and morphological differences between the Indonesian species and the Comoros coelacanth population, which shows a surprising lack of polymorphism.

The genetic differences observed were such as are generally found for close but distinct species. The researchers therefore concluded that the specimen discovered in the Sulawesi island group seemed to belong to a new species, which they named *Latimeria menadoensis*, in reference to its place of capture.

The molecular clocks (speed of evolution of a gene as expressed by the accumulation of mutations over time), which are known for the two genes studied, showed that *Latimeria menadoensis* and *Latimeria chalumnae* differentiated about 1.5 million years ago, a relatively recent event given the coelacanth's evolutionary history, which began some 400 million years ago.

The Indonesian coelacanth was caught on the reef slopes of a geologically recent volcanic island, i.e. in surroundings similar to those where the Comoros species lives, thereby confirming the fish's preference for this type of environment. The crevices which form when lava flows into the sea provide shelters in which the coelacanth can take refuge during the daytime.

While recent studies have shown that coelacanths can travel from one cave to another one several dozen kilometres away, this semi-sedentary fish does not swim at great depths or in open water. It would therefore seem very unlikely that the Comoros species was able to travel almost 10,000 kilometres across very deep oceanic trenches against the currents to reach Indonesian shores or vice-versa. The genetic differentiation observed between the two species can therefore be explained by significant geographic isolation.

Latimeria menadoensis' distribution area may not be limited to northern Sulawesi. Recent investigations have, in fact, shown that other coelacanths may have been observed elsewhere in the Indonesian archipelago. The analysis of additional specimens would certainly make it possible to further refine the important results just obtained, in particular to elucidate coelacanth movements over the last million years.

Without a doubt, this extraordinary fish is still full of surprises. The fact is that we had to wait for the Comoros coelacanth's jubilee to witness the arrival of an unexpected guest, who, nevertheless, is also a close relative.

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VOICES FROM THE VILLAGE: A COMPARATIVE STUDY OF COASTAL RESOURCE MANAGEMENT IN THE PACIFIC ISLANDS

Coastal resources are of fundamental importance in the Pacific Islands. Much of the region's nutrition, welfare, culture, employment, and recreation are based on the living resources in the zone between the shoreline and the outer reefs of the region. The continuation of current lifestyles, the opportunities for future development, and food security are all highly dependent on coastal resources.

For many centuries there has been a recognition by Pacific Islanders that some form of resource management is necessary to assure sustainability of these resources. In former times traditional management of coastal resources was undertaken by many coastal or resource-owning communities and appears to have been reasonably successful.

In recent years, however, serious problems in the management of coastal resources have arisen. There is the dual problem that the authority of local traditional leaders has been eroded, while the threats to the resources (over-harvesting, destructive fishing, pollution and a wide range of land-based threats) have increased.

In the Pacific Islands there is widespread recognition of the

by *Bob Gillett**

importance of coastal resources, of the requirement for some form of resource management, and of the present problems of current management schemes. What is less certain are what forms of management would be appropriate in the present conditions.

Governments and various groups interested in promoting effective coastal resource management have carried out many initiatives over the last several decades, but the success has been mixed. The reasons for any management success are not always clear and, the lessons learned from either successful or unsuccessful interventions are not readily available to coastal resource managers.

In this current situation, there appears to be a need to carefully examine the successes in coastal management and focus on identifying factors contributing to that success. What are the processes most likely to result in successful management? What should be the role of external stakeholders (governments, NGOs) in supporting these processes? When resources for management are scarce, where

should they be allocated to maximise the chances of success? And, very importantly, what are the key national policies that influence on-site management?

The Comparative Study of Coastal Resource Management in the Pacific Islands aims to help Pacific Island coastal resource managers gain a greater understanding of the factors contributing to the success or failure of coastal resource management arrangements.

The development of the study

The idea for a study of coastal resource management in the Pacific Island region evolved over a period of time. The Director of the Fiji Fisheries Division requested World Bank assistance in assessing the strengths and limitations of community-based management in coastal areas.

Subsequently, the concept of a multi-country study of the issue was developed during the course of several regional meetings in consultation with coastal resource management specialists and representatives of regional organisations and non-governmental organisations (NGOs).

During early 1998 the plans for the study were further articulated in the form of a concept paper which was peer-reviewed by the World Bank in late May. To finalise the methodology and to discuss implementation aspects, a workshop was held in Suva, Fiji in late June 1998 which was attended by 18 coastal resource management experts, most of whom were from the region. The survey questionnaire was

* This study was commissioned by the World Bank as part of its programme of assistance to the Pacific Island region. The study was carried out by a Pacific-based team in collaboration with a World Bank team. The findings, interpretations and conclusions expressed in this paper are entirely those of the author(s) and should not be attributed in any manner to the World Bank, to its affiliated organizations, or to members of its Board of Executive Directors or the countries they represent.

finalised in mid-July and fieldwork was carried out at 31 sites in 5 Pacific Island countries (Fiji, Palau, Samoa, Solomon Islands, and Tonga) between mid-July and mid-December. Data coding took place in December and analysis was undertaken January to April 1999.

Methodology

The study relied primarily on community perceptions of factors affecting coastal resource management at the village level.

There were two main reasons for this approach: first, there was no comprehensive ecological survey of coastal resource conditions in the Pacific that could be used to compare conditions between the sites. The costs and time involved in conducting such a survey would have been beyond the scope of this study.

Second, and perhaps most importantly, the majority of decisions regarding coastal resources are made by local communities based on their own perceptions. A better understanding of their perceptions is therefore essential to help Pacific Island governments and donors formulate appropriate national policies and coastal programmes. These insights could not be obtained through an ecological survey.

Several indicators could potentially be used for determining site management success, but many require intensive data gathering and quantification. The study used four relatively simple 'success' indicators which did not suffer from this limitation:

Trends in productivity of key resources used—*In the absence of other major factors influencing resource abundance, one of the first signs of successful man-*

agement of a resource that is already being harvested is an increase in productivity (catch per unit of effort or CPUE). The study obtained simple perceptions of CPUE trends for three key resources used by village groups over the period of a decade: a perceived improved trend, in the absence of external factors, would tend to indicate that management is effective. Similarly, a perceived declining trend may signal the absence or ineffectiveness of management.

Trends in habitat condition—*This measure consisted primarily of perceived changes in three local habitats, such as condition of live reef or extent of seagrass area, over a period of a decade.*

Trends in incidence of threats—*The study team obtained perceptions of the importance and urgency of key threats to the site, and the extent to which they have been contained, or increased.*

Compliance with management rules—*The study team obtained perceptions of villagers on their compliance with a selection of five local and national rules.*

A questionnaire was formulated for the collection of information at the village level on the success factors and on other aspects of coastal resource management.

Perceptions of success were collected from a total of 133 small focus groups, including elders, women and men resource users. In addition, the study collected information from various other community sources (such as village leaders, large village meetings, key respondents, village teachers, and shopkeepers) on the factors that may affect management success: external factors, such as natural disasters and degree of government support to the site; site characteris-

tics, such as the quality of local leadership and the extent of community dependence on coastal resources, and management processes, such as interaction with external partners (e.g. NGOs working at the site) and the involvement of villagers in decisions regarding resource use.

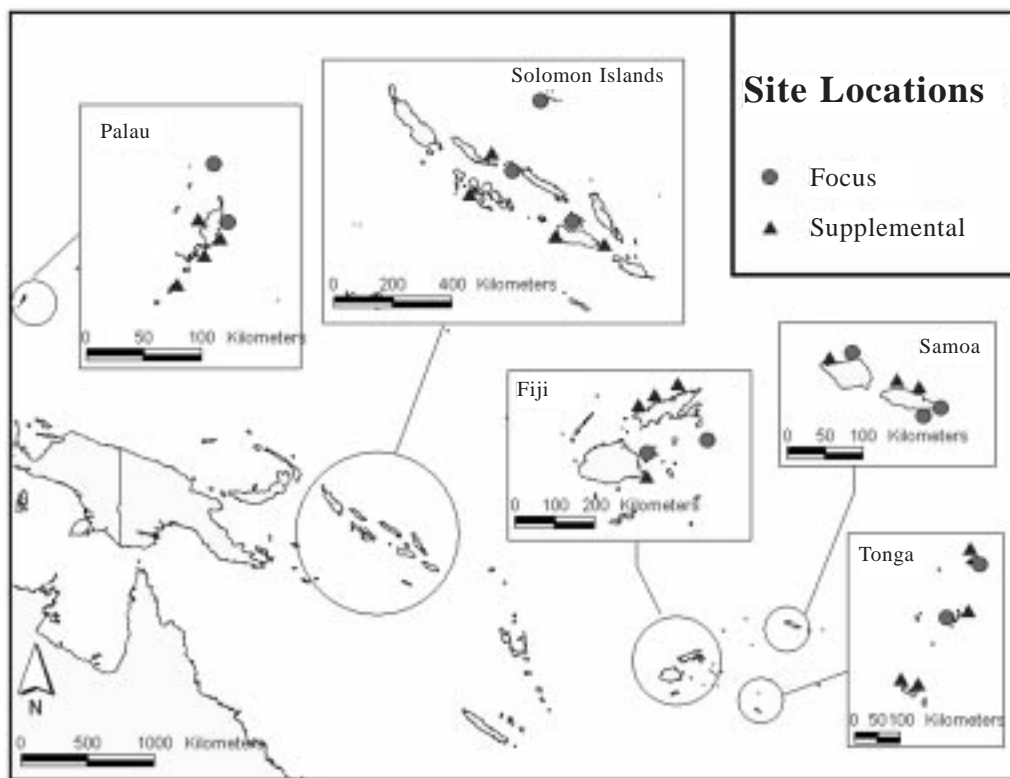
The answers from the community were complemented by study team observations of site conditions and interviews with representatives of government agencies and external partners. At focus sites, the survey carried out 16 interviews with different village groups.

The study sites

The study was carried out at 31 sites in the five countries (see map on page 28). There were 12 focus sites (four- to seven-day visits) and 19 supplementary sites (one- to three-day visits). The 31 sites ranged in size from 0.6 square kilometres in Papa (Samoa) to 2,360 square kilometres in Luaniua, Ontong Java (Solomon Islands).

The sample included two urban sites (Koror in Palau and Honiara Fishing Village in the Solomon Islands), five peri-urban sites and twenty-four rural sites. Several of the rural sites were very isolated and lacked regular transportation. Eight sites, including all sites in Tonga and in Cooks and Honiara Fishing Village in the Solomon Islands, lacked any form of customary marine user rights and were operated under open-access regimes. All of the remaining sites had some form of customary marine tenure.





The study sites

Key results of the study

Coastal resources are perceived to be declining . . . Community groups were generally pessimistic about resource trends. Only ten per cent of the responses said that catch per unit of effort had increased over the last 10 years, and only three per cent associated such an increase with management interventions.

Perceptions about habitat conditions and threats to coastal resources were more optimistic, with about half of the responses seeing negative trends. Several of the communities where resources were perceived to be declining were villages with low population densities, suggesting that even in remote areas, the impact of a few efficient commercial fishers on the exploitation of fragile coastal resources should not be overlooked. The political will, management tools, and social con-

text at the 31 sites did not appear capable of supporting objectives that revolved around optimal harvesting yields.

The goals of local management tended to be more basic, such as preventing further decline or collapse of important species, and preventing habitat degradation through control of destructive practices such as poison fishing. Overall, the study results indicate a much greater need for attention to coastal resource management throughout the region.

. . . and the nature of the threats to coastal resources appears to be changing. Communities perceived pollution as the fastest rising threat to coastal resources, while destructive fishing threats were perceived to be declining the most.

Threats caused by overfishing, siltation and mining fell between these two extremes.

Overfishing and destructive practices, however, were commonly identified as among the most important threats to coastal resources.

The outlook for coastal resources is perceived to be bleak . . . Respondents at 21 of the 31 sites believed coastal resources would continue to decline in the future. In village after village, people whose livelihood depends on the health of coastal resources argued for stricter enforcement of existing regulations and additional restrictions on commercial harvesting.

There were also some notes of optimism: in Samoa, respondents at five of the six sites believed that resources would improve in the future because of recent community management efforts. And in Luaniua (Ontong Java, Solomon Islands), the community adopted an extended ban on their own fishing for

trochus and beche-de-mer despite depending on coastal resources for 70 per cent of their income. This suggests that communities are willing to make sacrifices to gain long-term benefits if they are aware of the potential benefit and are guided by strong local leadership.

Simple management rules work best . . . The study found that at 13 of the sites (42 per cent) respondents were not familiar with many of the national rules designed to manage coastal resources. In general, those interviewed believed that the following types of rules obtained the most compliance:

- national regulations which were seen to be relevant to the community and which were subsequently adopted by village leaders as local community rules;
- national rules enforced by buyers or exporters, such as the national ban on trade in crocodiles in the Solomon Islands; and
- marine sanctuaries, closed seasons for specific fisheries, and rules restricting destructive fishing practices (e.g. a ban on night diving).

In general, the results of the study indicate that the simpler the national rules, the better they were understood and followed by coastal communities.

. . . while open access constrains community action. Eight of the villages lacked any mechanisms to exclude outsiders from using their coastal site. With one possible exception, none of these open-access sites had developed community rules for managing coastal resources.

By contrast, all of the restricted-access sites had adopted local

management rules, indicating that the authority to restrict access by outsiders is a powerful incentive for community-based management. Compared with restricted-access sites, open-access communities perceived threats to coastal resources to be increasing faster and felt less capable of dealing with local threats. Open-access communities also tended to be less aware of the benefits of coastal resource management.

Communities need help . . . Community-based management was found to be insufficient in five major areas: first, the villagers felt that some form of outside assistance was needed to handle coastal pollution, mining operations, commercial overfishing, and other threats such as dredging, construction of causeways and drilling for oil.

Second, nearly 40 per cent of the villages lacked mechanisms to control their own fishing effort. Where such mechanisms existed, external partners had acted as catalysts for community action, or the village benefited from strong local leadership and from a high dependence on coastal resources.

Third, communities had difficulty in enforcing local rules when it was unclear whether the rules conflicted with national laws (this was particularly true in Fiji and the Solomon Islands).

Fourth, communities may need access to expert advice on the technical aspects of managing resources.

Fifth, several respondents at villages reported that external commercial operators had circumvented local management rules by forming alliances with local leaders. Many sites seemed to lack ways to prevent their leaders from engaging in pri-

vate business interests that may conflict with their responsibilities towards the community.

. . . yet coastal resource management seems to be receiving low priority. In general, the study found a need for greater government attention to coastal resource management. Only about one fourth of the staff time of national fisheries agencies is spent on coastal management matters.

Given the low priority accorded to coastal management, it is not surprising that only about 40 per cent of the villages had been visited by a government official to discuss coastal resource management issues during the previous ten years.

Half of the sites visited were receiving funding support from donors, indicating that donor assistance may be used in some cases as a replacement for much-needed government support.

Further collaborative efforts are needed, but perhaps of a different kind than presently provided . . . Overfishing was the most frequent cause cited for catch declines and one of the most important threats found at the study sites, yet in many cases it cannot be addressed adequately by current regulations.

Programmes may be needed to strengthen the communities' ability and awareness of the need to restrict their own fishing effort, and to restrict the issuance of commercial licenses.

Many of the threats that, in the view of respondents, require some form of external assistance — for example, coastal pollution, mining, coastal infrastructure construction — cannot be controlled only by the institutions that traditionally have been given responsibility for dealing with coastal resource

Key site characteristics

Country	Site name	General location	Type	Conservation site	External partners	Site size (km ²)	Population density (people/site area)	Urban/peri-urban	High/low island systems	Village develop.	Ease of marketing perishable products #	% income from fisheries/tourism	Strength of marine tenure #	Sanctuaries present	Alternative income generations (AIGs) introduced	
Fiji	Dromona	SE Viti Levu, near Rewa river delta	Suppl.	No	No	130	0.8	Yes	High	Medium	Easy	84	Medium	No	Yes	
	Ucunivanua	Verata (SE Viti Levu, SW Ovalau)	Focus	Yes*	Yes	1,300	0.2	No	High	Medium	Easy	60	Strong	Yes	No	
	Susui	Northern Lau group, off Vanua Balavu	Focus	Yes**	No	6.5	13.9	No	High	Low	Medium	60	Strongest	Yes	No	
		Galoa Is., off NW Vanua Levu	Suppl.	No	No	1,655	0.2	No	Low	Low	Easy	80	Medium	No	No	
		N Central Vanua Levu	Suppl.	No	No	71	3.6	No	High	Medium	Easy	50	Weak	No	No	
		Mali Is., off N Central Vanua Levu	Suppl.	No	Yes	220	0.6	Yes	Low	High	Easy	80	Strong	No	No	
		Lifuka Island, Ha'apai Cons. Area	Suppl.	Yes*	No	12	18.8	Yes	High	High	Easy	35	Open access	No	Yes	
		Lo'anga Island, Ha'apai Cons. Area	Focus	Yes*	No	20	6	No	Low	Low	Medium	40	Open access	No	Yes	
		Falevai	SW Kapa Island, Ha'apai Group	Focus	Yes**	Yes	5	28.2	Yes	High	High	Easy	35	Open access	Yes	Yes
		Tu'anekevale	Eastern Vava'u	Suppl.	No	No	2	181	No	High	High	Easy	10	Open access	No	No
Tonga	Nukuhetulu	N Central Tongatapu Is.	Suppl.	Yes*	Yes	3	12.17	Yes	High	High	Easy	10	Open access	No	No	
	Ha'atafu	Ha'atafu Marine Reserve, NW Tongatapu	Suppl.	Yes*	Yes	4	61.8	No	High	High	Easy	40	Open access	No	No	
		Safata, S Central Coast of Upolu	Focus	Yes**	Yes	4.5	177.8	No	High	High	Easy	20	Weak	Yes	Yes	
		Aleipata, Eastern End of Upolu	Focus	Yes**	Yes	1.5	400	No	High	High	Easy	25	Strong	Yes	Yes	
		Manase	N Central Savaii	Focus	No	1.3	132.3	No	High	High	Easy	50	Strongest	No	Yes	
		Papa	Western end of Savaii	Suppl.	No	0.6	1,246.7	No	High	Low	Medium	5	Strongest	No	No	
		Solosolo	N Central Upolu, east of Apia	Suppl.	Yes**	Yes	1.2	2,500	No	High	High	Easy	5	Strongest	Yes	Yes
		Lealaalii	N Central Upolu, west of Apia	Suppl.	No	No	1	1,700	No	High	High	Easy	0	Strongest	No	No
		Fishing Village	Honiara	Focus	No	No	22	36.4	Yes	High	High	Easy	75	Open access	No	Yes
		Luanua	Ontong Java Atoll	Focus	Yes**	No	2,360	0.7	No	Low	Low	Difficult	70	Strong	No	Yes
Solomons	Kia	Amavon Marine Cons. Area, NW Isabel	Focus	Yes*	Yes	1,204	1.3	No	High	Low	Medium	81	Strong	Yes	Yes	
		Cooksin	Amavon Marine Cons., Wagina Island	Suppl.	Yes*	Yes	112	5.4	No	High	Low	Medium	70	Open access	Yes	Yes
		Naro	Western end of Guadalcanal	Suppl.	Yes**	No	10	32.2	No	High	Medium	30	Strongest	Yes	No	
		Niu	Niu Is., Marau Sound, E Guadalcanal	Suppl.	No	25	2.7	No	Low	Low	Medium	30	Strong	No	Yes	
		Onne	Marovo Lagoon, Western Province	Suppl.	Yes*	Yes	48	1.7	No	High	Low	Medium	43	Strong	Yes	Yes
		Ngival	Central E Babeldao Island	Focus	Yes*	Yes	9.5	25.3	No	High	Medium	17	Strongest	Yes	Yes	
		Kayangel	Kayangel Atoll, off N Babeldao	Focus	Yes*	Yes	105	1.7	No	Low	Medium	35	Strongest	Yes	Yes	
		Peleliu	Peleliu Is., SE Koror	Suppl.	No	No	71	8.1	No	High	Medium	Easy	43	Strongest	No	No
		Koror	Near Ngerukewid/Ngerumekaol/Ngemelis area, Koror	Suppl.	Yes*	Yes	665	25.5	Yes	High	High	Easy	35	Strongest	Yes	Yes
		Melekeok	Central E Babeldao, S Ngrwal	Suppl.	Yes**	No	11	23.7	No	High	Medium	Easy	19	Strongest	No	Yes
	Ngraremngui	Ngreremduu, central W Babeldao	Suppl.	Yes*	Yes	26	10.8	No	High	High	Easy	27	Strongest	Yes	Yes	

Sites in:	12	Avg. site size: 262 km ²	High islands: 7	Ease of marketing:	Strength of tenure	Sites with AIGs: 19
Fiji	6		Low islands: 24	Easy	Strong	Sites w/o AIGs: 12
Tonga	6		Average no. of ecosystems: 7	Medium	Strong	
Samoa	6		Urban/Peri-Urban: 7	Difficult	Medium	
Solomons	7		Rural: 24		Open Access	
Palau	6		Sites w/ partners: 15			
Total	31		Sites w/o partners: 16			

Average % of income from fisheries/tourism: 41%

Sites with sanctuaries: 14
Sites w/o sanctuaries: 17

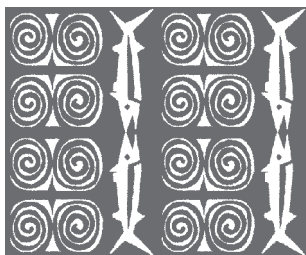
* Site Listed in Regional Action Plan for Nature Conservation for the Pacific Islands.
 ** Site not listed in regional list but either (a) recognised by the country as a conservation area; or (b) where community is undertaking conservation activities.
 # Ease of marketing: Easy – Traders come to the site and/or village sellers can access markets for perishable products; Medium – Can be done but involves much planning/costs; Difficult – Very difficult/impossible. Note that integration into markets refers only to perishable products, since trade in non-perishable products is not hindered by distances.
 ## Strongest: village leaders have the power to exclude all except non-villagers; Strong: village leaders have the power to exclude all except non-customary users; Medium: leaders outside the village have the power to exclude outsiders; Weak: not possible to exclude outsiders; Open Access – Traditional user rights in-existent or eroded.

management (the fisheries and environmental agencies).

Mechanisms are needed to coordinate government assistance across multiple sectors, a major institutional difficulty in many Pacific Islands where inter-ministerial cooperation remains weak. The study also indicates that the type of research that coastal communities most need may not involve complex stock assessment, but instead a better understanding of the socio-economic incentives that affect coastal resource use, and the development of simple technical solutions to assist them in the management of coastal resources.

. . . most alternative income generation programmes do not appear to have been successful in reducing pressure on coastal resources. . . . A common strategy to reduce pressure on coastal resources has been to introduce alternative ways to earn income, such as aquaculture, offshore tuna fishing and deep slope fishing.

Community perceptions at the study sites are that these programmes have generally not been successful in reducing pressure on coastal resources. Commercial aquaculture operations were seen to be facing marketing difficulties. Tuna fishing did, in some cases, provide by-catch at the village level, but there was a perception that tuna boat crews were often not coastal fishers.



At several sites, villagers said that ice plants introduced to support offshore fishing had actually helped opened up new markets for fresh coastal products and therefore increased overexploitation.

This suggests a need to explore income generation opportunities outside the fisheries sector, should they exist.

. . . and some of the most valued partners play primarily an advisory role to the communities. Fifteen study sites (48 per cent) were being assisted by external partners in managing their coastal resources. In general, communities perceived the benefits of partnerships to outweigh their shortfalls, but communities and external partners tended to have different perceptions about the benefits of the partnership. Local communities tended to focus on short-term, tangible benefits, while external partners were more interested in process-oriented results (e.g. strengthening local management institutions).

Communities perceived unkept promises, inadequate consultation, and slowness in achieving benefits as the main flaws of the partnerships, while the external partner focused on the failure of villagers to fulfil their commitments. The study also found that while external partners felt that they had made strong efforts to provide information to the communities, there was often little evidence that villagers had absorbed the information provided.

In general, partnerships fell into two categories: those which were largely initiated by the external partner (Category A), and those where the community itself requested the assistance (Category B). Category-A partnerships tended to be located at sites internationally recognised

as important for biodiversity importance, and often involved the introduction of new processes at the village level. Although the time needed for these new processes to be absorbed was much longer than for Category B partnerships, the donors supporting Category-A partnerships tended to have a shorter funding horizon than national agencies and local NGOs that were typically involved in Category-B partnerships.

Mechanisms to ensure longer-term involvement for Category-A partners should be considered. Community satisfaction with Category-B partnerships seems to be pronounced, in that external partners fulfilled the role of honest broker, providing quick and sound advice to the communities. Often, these partnerships relied on little more than technical support and awareness raising, and were effective at relatively low levels of funding.

Sanctuaries seem to act as catalysts for community awareness of the benefits of coastal resource management. . . . Marine sanctuaries were found at 14 of the study sites. In general, communities adjacent to the sanctuaries had favourable impressions of their impact.

Compliance was perceived to be good, and key species were thought to be increasing in abundance. The communities also felt, in general, that the sanctuaries would be sustained into the future. Perhaps as relevant as their management role, sanctuaries seem to act as catalysts for enlarging community awareness of the benefits of coastal resource management.

The study team found, however, that greater attention needs to be paid to ensuring that the results of ecological monitoring are available to villagers, that

no-take rules inside sanctuaries are strictly enforced, that sanctuaries are properly located and sized, and that villagers clearly understand the sanctuaries' objectives and benefits. While sanctuaries were generally perceived to provide benefits, they do not eliminate the need for other management interventions.

Which factors affect perceived success at the site level? The relatively small number of sites, along with data constraints, made it difficult to distinguish the effects of multiple factors on perceived indicators of successful resource management.

However, some general conclusions can be drawn. Among factors external to the site, natural disasters (e.g., cyclones) were significantly associated with the perception that fish catches were recovering and habitats had improved following a major event.

The study provided indications of the national policies that may be needed to support community-based management of coastal resources: simple and clear national regulations, a framework which facilitates the adoption and enforcement of local rules, awareness programmes aimed at local leaders, assistance with technical aspects of resource management, and

inter-sectoral collaboration to address land-based threats to coastal habitats.

Communities with good local leadership and sites of complex ecosystems had significantly lower perceptions of threats to resources.

Communities which shared the benefits or losses of management equally among their members perceived trends of higher catches and lower threats. Water pollution at a village site caused a perception that habitat trends were worsening. Population growth rates and density did not appear to have a negative impact on the perceptions of successful management of coastal resources.

However, the presence nearby settlements resulted in perceptions of worsening habitats and increasing threats. The presence of modern fishing technology led generally to perceptions of increased catches, reflecting improved access to distant fishing grounds.

More educated villagers tended to perceive worse habitat trends, presumably due to higher awareness of human impact on coastal habitats. High local awareness and effective local enforcement were also seen as important factors in management success.

Are stated perceptions true perceptions? Perceptions of resource trends were found to be remarkably consistent at any particular site. With the exception of habitat trends, the study found no statistically significant differences between the perceptions of different focus groups. Perceptions of compliance with management rules appeared to be the only indicator where there might be a clear incentive to underreport the incidence of violations, but the indicator is nonetheless useful to compare the relative perceptions of compliance with different management rules.

Voices from the village: The value of perceptions of coastal communities

This study departed from conventional methods by relying heavily on the perceptions of coastal communities. This resulted in some useful insights as well as some surprising findings that are relevant to the management of coastal resources in the Pacific. The experience indicates that in future work, careful attention should be given to the views of coastal communities.



The full text of the report "Voices from the Village: A Comparative Study of Coastal Resource Management in the Pacific Islands" is available from: Mr. David Colbert, Papua New Guinea and Pacific Islands Country Management Unit, East Asia and Pacific Region, The World Bank, 1818 H Street, NW, Washington DC, U.S.A. 20433, Fax (1) 202-522-3393 e-mail: Dcolbert1@worldbank.org.

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