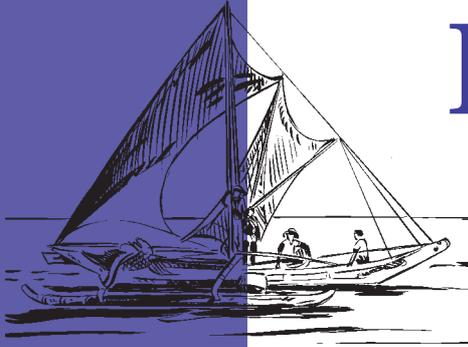


# FISHERIES

*Newsletter*



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**The participants at the seafood workshop, held in Niue from 2 to 7 October 1998, enjoyed making their own marinades in preparation for the smoking of fish.**



Secretariat of the Pacific Community  
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# SPC ACTIVITIES

## ■ SECOND PACIFIC COMMUNITY FISHERIES MANAGEMENT WORKSHOP

The SPC Marine Resources Division, with financial assistance from New Zealand ODA, held a workshop for the benefit of SPC island member country fisheries departments, in Nouméa, from 6 to 12 October 1998.

The main aim of this workshop was to review some fast-developing issues in the marine sector – issues such as ecolabelling, trends towards community-led management of reef fisheries, the expansion of the export trade in live reef fish for food, and the prospects for sportfishing tourist development—along with institutional and regulatory issues—such as the termination of the South Pacific Regional Aquaculture Development Project, the restructuring of the SPC Coastal Fisheries Programme, requirements for increasing quality standards in seafood

exports and requirements for international standards in seafarer training – within the context of the sustainable Pacific Island living marine resource base, and to provide some guidance to the forthcoming (7th) session of the international Commission for Sustainable Development in 1999.

The Commission for Sustainable Development (CSD) is in essence the secretariat for “Agenda 21” – the document produced by the giant UNCED “Earth Summit” held in Rio de Janeiro in 1992, that outlines the global plan of action for describing and sustaining the natural environment. The 7th session of the CSD, chaired by New Zealand, will concentrate on ocean issues arising from the United Nations Year of the Oceans 1998 meeting. The statement on living marine resources produced by

SPC and FFA member fisheries departments at this SPC workshop will be submitted to a regional workshop organised by the South Pacific Regional Environment Programme (SPREP) to collate the views and needs expressed by Pacific Island countries and territories covering all ocean issues, both living and non-living.

Philipp Muller, the former director of both SOPAC (South Pacific Applied Geosciences Commission) and FFA (Forum Fisheries Agency), will play a key role in this process, and the SPC Marine Resources Division is greatly indebted to him for the work that he has already contributed via the SPC fisheries meeting.

Apart from its contribution to the international CSD7 process, the Second SPC Fisheries



Some participants at the Second Pacific Community Fisheries Management Workshop

Management Workshop was also an opportunity to consider more local issues, and a rare opportunity for SPC Coastal Fisheries Programme staff to present their work and to talk to their main clients as a group. If regional programmes of assistance are to maintain their relevance to needs within the region then regional staff need to talk face to face with national staff on a regular basis.

Not every SPC staff member can visit each of the 21 countries or territories within the SPC work area. Telecommunication is expensive, and written communication is rarely efficient. An occasional meeting of sectoral experts from all Pacific Community members is invaluable.

Although SPC in-country work is formally programmed by requests channelled through national Foreign Affairs departments, a considerable amount of this work is actually set up by

people talking in and around meetings.

Another major output of the meeting was to consider and endorse two sub-sectoral strategies that had been under consideration at the regional level for several months.

These were the "Live reef fish Pacific regional strategy: a collaborative approach" and the "Regional Aquaculture Strategy". Both of these are concept documents describing a strategy for developing a regional level of support to countries and communities in both these topical sub-sectors.

The regional strategy approach sets out to describe the problems involved in the sub-sector, agrees roles for major existing players and identifies gaps needing to be addressed. The SPC Marine Resources Division will be required to play a catalytic role in both these strate-

gies (unlike, for example, the issue of regional tuna management, where the SPC Marine Resources Division plays a supportive role behind FFA's lead, or the issue of fisheries education where SPC's short-term specialised training backs up USP's more generalised residential degree and diploma courses).

SPC is now actively seeking the funds that will be necessary to implement its role in both of these strategies. For the live reef fish (LRF) strategy the primary role of SPC will be to set up a bureau service which member country fisheries departments can approach for rapid advice and assistance when they receive an application for an LRF exporting operation.

This assistance might include rapid stock appraisal, identification of critical spawning areas, recommendations for sustainable fishing levels of each



**The Workshop was interesting and productive, covered a wide range of topics and provided important guidance for SPC's future work in fisheries.**

species, advice on workable regulation and enforcement (particularly in the avoidance of destructive fishing), advice on monitoring, long-term data analysis, and general information about the trade and the fishery.

SPC would also help other agencies and organisations with public and national awareness on critical issues, and generally act as a focal point for dialogue between Pacific Island fisheries departments and others interested in helping. There are expected to be spin-offs for the management of other reef fisheries as well.

To implement the aquaculture strategy, the main short-term need is to pick up where the FAO South Pacific Regional Aquaculture Project leaves off

in 1999. Although there is now a solid base of regional aquacultural research and education services available to SPC member countries, through ICLARM, USP, UOG and others, these services are mainly resident in their host countries and there is a need for the kind of roving advisory and extension activity that is SPC's main strength.

Whatever the feelings of certain development agencies, aquaculture is here to stay in the Pacific. Success stories are starting to build up, several island governments are putting considerable resources into stimulating private sector aquaculture development, and it is a hard truth that Pacific Island human populations are growing whilst wild fish populations are subject to environmental ceilings on production.

Given a minor level of specialist staffing the SPC Marine Resources Division would put national fisheries staff and the private sector in touch with the most appropriate regional or international advice and assistance, either through its own resources or by contact with other collaborators in the strategy.

The outputs and some of the working papers of the meeting, as well as a list of participants and agenda, can be downloaded from:

<http://www.spc.org.nc/coastfish/reports/ifmw3/index.html>

SPC also intends to publish, by more conventional means, a report and record of discussion from the meeting within the near future.



## ■ CAPTURE SECTION

The third quarter of 1998 was a busy time for the Capture Section. Peter Watt's longer-term assignment with the National Fisheries College in Kavieng has proved to be very successful and has been extended for another three months at the request of the PNG Government. This will allow Peter to work with the second group of students for continuity. A separate article on Peter's work at the Kavieng college is presented on page 23 of this Newsletter.

Masterfisherman, Steve Beverly, participated in the 1998 SPC-Nelson Polytechnic Practical Fishing Module which was held in Noumea, New Caledonia. Participants in the Pacific Islands Fisheries Officers Course, which is coordinated by SPC's Fisheries Training Section, attended the final sessions of their course, the Practical Fishing Module, in Noumea,

New Caledonia over several weeks in June and July 1998. During this time they fished aboard either the F/V *Dar Mad* or the F/V *Pop*. Both vessels were chartered from *Service Territorial de la Marine Marchande et des Pêches Maritimes* (usually just called *Marine Marchande*). Steve accompanied the trainees on all of the trips on board F/V *Dar Mad* and acted as tutor-fish master.

F/V *Dar Mad* is an aluminium twin engine 11 metre catamaran equipped with a Lindgren-Pitman monofilament longline system and a hydraulic hauler for vertical longlines and is capable of fishing with a variety of other gear types as well.

There were ten trainees in the Practical Fishing Module. They came from Federated States of Micronesia, Marshall Islands, Nauru, New Caledonia, Samoa, Tonga, and Vanuatu.

Before fishing trials actually started, Steve, along with SPC Fisheries Development Adviser, Lindsay Chapman, and SPC Fisheries Education and Training Adviser, Michel Blanc, gave lectures on the different fishing methods that would be used—at Marine Marchande's school, *École des Métiers de la Mer*, or EMM, as it is called.

Instructions were given in rigging fresh bait for trolling, bottom longline fishing and dropline fishing for deep water snappers, vertical longline fishing around FADs, mid-water handline fishing around FADs, and pelagic longline fishing for tunas and swordfish.

Steve also conducted a short session on on-board handling of sashimi grade tuna. Several of the trainees got to practise spiking, bleeding, and gilling and gutting on reject tuna from the local longline fleet. Samples of

all of the gear types were shown to the trainees.

All of these fishing methods were used during the following three weeks aboard F/V *Dar Mad*. During the longline fishing portion of the practical module, two big-eye tuna (*Thunnus obesus*) were landed, weighing 44 and 60 kg, several longtail snappers (*Etelis coruscans*) were landed during the bottom fish trials, and trolling around the FAD at Passe de Uitoé produced dozens of mahi mahi (*Coryphaena hippurus*).

During September, Steve conducted a national FAD fishing techniques workshop in Niue. Actually, three separate small workshops were held in the Department of Agriculture, Forestry, and Fisheries' workshop building at the Robert Rex Wharf in Alofi. Fisheries Research Officer, Brendon Pasisi, was Steve's counterpart during the workshops.

A total of almost thirty fishermen attended the three workshops. Practical training was carried out in making up rope and monofilament vertical longlines and in making up gear for one type of mid-water fishing—palu - ahi (Figure 1). Each group of participants made up two vertical longlines and one or two palu-ahi lines.



**Figure 1: Participants at one of the FAD fishing techniques workshop in Niue, making up mid-water fishing gear**



**Figure 2: One of the local charter boats used for the fishing trials component of the workshops being lifted into the water for fishing**

Fishing trials were carried out at four different FADs around Niue using local charter boats, which were lifted in and out of the water by crane each day (Figure 2).

Most of Niue's FADs are in relatively shallow water—300 metres—and have produced a mixed bag of fish including albacore tuna (*Thunnus alalunga*), rainbow runner (*Elagatis bipinnulatus*), and longtail snapper (Figure 3). During the last of the three workshops, a trip was made to the far FAD, in deeper water, and two good-sized yellowfin tuna (*T. albacares*) weighing 30 and 40 kg were landed on the vertical longlines.

Most of the fish were consumed, either barbecued or smoked, at a presentation ceremony where certificates were given to all participants.

Pacific Island Trainee Associate, Marsh Uele, spent six weeks in Kavieng, attending a national

observers workshop, organised by the PNG Fisheries Department and run by the FFA and SPC Observer Programme coordinators. He also received training from Masterfisherman Peter Watt on fishing gears, especially tuna longlining gear and nets. He assisted Peter construct and deploy one FAD.

Back in Noumea, Marsh assisted with compiling data for some of the old Capture Section reports and worked on his writing and computer skills. This will be an ongoing area that Marsh will get training in the months ahead.

The Fisheries Development Adviser, Lindsay Chapman, travelled to Samoa and Kiribati to progress work plans for upcoming Masterfishermen assignments.

In Samoa, technical assistance will be provided to increase the catch of bigeye tuna in the rapidly expanding tuna long-

line fishery, using the Fisheries Division's vessel. This project will commence in early 1999.

In Kiribati, technical assistance is being provided in two phases. The first phase to be conducted in late 1998 will have Steve Beverly assisting with fitting of fishing equipment and vessel electronics to a new twin-hull vessel designed for tuna longlining in Kiribati waters.

The second phase will be to conduct tuna longlining trials in early 1999 to test the resource and potential catch rates, and assess the new design vessel and its suitability for tuna longlining.

The new vessel is nearing completion and is 11.7 m long and 5.3 m wide. In September, the hulls were complete with the deck being fastened (Figures 4 & 5). The design is along the lines of an outrigger canoe, with one main hull and a second smaller hull. The vessel will be



Figure 3: Mixed catch from mid-water fishing trials around the shallower-water FADs



**Figure 4: Hulls of the new twin-hull vessel being built in Kiribati with the deck being secured**



**Figure 5: Deck area of new vessel before cabin is constructed**

powered by a single 40 hp diesel inboard engine with a conventional through-hull drive, mounted in the main hull. There will be two ice holds, one in each hull, which are estimated to hold around two tonne of fish with ice.

Lindsay also travelled to the Solomon Islands to provide input to a joint Solomon Islands Fisheries Division and Forum Fisheries Agency initiative to develop a national tuna management plan. The development of the plan was being funded by the Canadian-South Pacific Ocean Development Programme (C-SPODP II) and a Canadian consultant was employed as project manager and coordinator to produce the plan itself.

Lindsay's role was to assess fisheries development options that were feasible given the country's existing level of fisheries-related infrastructure;

identify other in-country physical constraints hindering the country's future tuna development prospects; identify potential infrastructure developments that would promote future tuna-related development; and review the availability of skilled fisheries-related personnel in-country and, for the different fisheries development options, identify those skills for which additional in-country and/or regional training was required.

To conduct this work and collect the necessary information, Lindsay, along with Mr George Boape, Chief Fisheries Officer for Licensing, Surveillance and Enforcement in the Solomons, held meetings with staff from the main domestic fishing companies, including Solomon Taiyo Limited (in Honiara and Noro), National Fisheries Development Limited (in Honiara and Tulagi) and Solgreen.

Meetings were also held with staff from other government departments, training institutions, stevedoring and fuel companies, Solomon Airlines, and others. The information collected was compiled into a report that was passed to the Fisheries Department and the consultant that was employed to produce the tuna management plan.

Given the work load of the section, there was little work conducted on reports back in Noumea.

However, the third and final volume of the FAD manual series 'Deploying and Maintaining FAD Systems' was completed and published in both English and French. Also, a manual of vertical longlining and other fishing methods associated with FADs is entering the final draft stage and should be published around the end of 1998.



## ■ REEF FISHERY ASSESSMENT AND MANAGEMENT SECTION

The Marine Resources Division has recruited Pierre Labrosse to the new position of Reef Fisheries Management Adviser. After training as a biologist and agriculturalist, he began his career in 1983 in Sete, France as an aquaculture project officer in a consulting company.

Three years later, he entered the Université de Montpellier II-Sciences et Techniques in the Languedoc region of France as both lecturer and co-ordinator of the European Masters Degree in Management of Living Aquatic Resources.

He has also worked on research and development aspects of fisheries and aquaculture at the interface between research and the private sector.



After arriving in New Caledonia in 1993, he did research work on the prospects for developing fish aquaculture

locally and, in conjunction with the Université française du Pacifique, he set up a pilot project in this sector.

He was hired by ORSTOM in 1995 to take responsibility for a commercial fish resource appraisal programme covering the lagoons of the Northern Province.

During this period, he continued his lecturing activities on a

contract basis at both the *Université française du Pacifique* and the *Institut Universitaire de formation des Maîtres du Pacifique* (a teacher training institution).

At the SPC, he will work on the design and implementation of sustainable resource manage-

ment plans for reef environments. This will relate particularly to export-oriented live reef fisheries and also other medium and long-term development areas such as aquaculture.



## ■ TRAINING SECTION

### Second Regional Workshop for Fisheries Enterprise Managers

From 10 to 21 August 1998, twelve managers of Pacific Island fisheries enterprises attended a workshop programme tailor-made to their needs by the New Zealand School of Fisheries in Nelson.

Funding for the workshop was provided by the Governments of France and Australia, as part of their annual contribution to SPC Fisheries Training Section.

This workshop followed a series of management training initia-

tives that started early in 1996 with a regional workshop programme for small fishing business operators. In March 1997, the first workshop for enterprise managers was run in Nelson, followed, in February this year, by a regional course on vessel operation management for commercial fishing skippers.

The programme for this year's workshop was based on the general theme of building and maintaining successful relation-

ships in seafood businesses using examples of business practices and collective experience from Nelson-based seafood companies.

Under this general theme, there were two main subject areas namely, "Business Planning and Management" and "Seafood Industry Specifics", each area covering a number of specific subjects or topics.

The different subjects covered over two weeks were:



**Julia Franz (Palau) working on her company's business plan**

Under the subject area “**Business planning and management**”:

**1. Functional Accounting for Managers**

Several sessions on spreadsheets and computers for accounting, accessing and interpreting financial information, cash-flow projections and monitoring, allocating business overheads, financial information for business planning.

**2. Developing, Implementing and Managing Business Plans**

Several sessions on approaches to the business planning process, computer-based business planning, operational perspectives in business planning, management of a business plan.

**3. General Management Perspectives for Successful Businesses**

Several sessions on what makes a good manager, the Human



Resource management role, getting the best from people, project management skills, training and technical skill development.

Under the subject area “**Seafood Industry Specifics**”:

**1. Quality for Profit**

Several sessions on what is quality and how it is deter-

mined, seafood handling practices and systems, adding value, New Zealand and international regulatory controls and systems, seafood industry organisations for business.

**2. Charters and Joint Ventures**

Several sessions on introduction to charters and joint ventures, the spectrum of charter relationships, the specifics of charter and joint venture contracts.

**3. Monitoring Fishing Vessel Performance**

Several sessions on fishing vessels and costs, vessel operation management, port infrastructure, the economics of tuna longlining – the Fiji case study, electronic aids and their application to the fishing industry.

**4. Marketing**

Several sessions on the ground work—trade practice for import/export, trade practice



**Toakai Karinintetaake (Kiribati) in the processing factory of F/V Amatal Atlantis**



**Colin Chan (Papua New Guinea) admiring the impressive set of electronic aids on board F/V *Amaltal Atlantis***



**Course participants at Amaltal wharf in Nelson port**

for regulatory standards, securing and maintaining reliable markets.

### 5. *Pacific Fisheries – problems and challenges*

Several sessions on challenges in Pacific fisheries, future trends in Pacific fisheries, technical assistance opportunities.

The SPC Fisheries Training Section and the New Zealand

School of Fisheries (NZSOF) are keen to continue offering good management training programmes to commercial fisheries enterprises in the region.

A grant from the Government of Taiwan/ROC will enable the operation of the third managers' course during the second half of 1999. Meanwhile, SPC and NZSOF will have run a four-week course on seafood business operations and manage-

ment for Pacific Island women in April–May.

For more information on our enterprise management training initiatives, contact the Fisheries Training Section in Noumea.



## ■ COMMUNITY FISHERIES SECTION

*Formerly the Women's Fisheries Development Section, the addition of a new specialist in 1998 (see article below) has enabled the section to expand its scope. The section will not lose sight of the special attention that has to be paid to women in certain fisheries issues, and will also take into account the broader community issues of which women are a part.*

### New Officer appointed

A new Community Fisheries Officer, Ms Lyn Lambeth, started work with the Community Fisheries Section (CFS) in September 1998. This section of the Coastal Fisheries Programme of the SPC has been increasingly in demand by member states and the need for a new officer was seen to be necessary to meet this demand.

Lyn worked for 12 years in the commercial fishing sector in the north of Australia, progressing from a brief stint as cook on prawn trawlers in Queensland to deckhand on 12 metre barramundi gillnetters and a 21 metre vessel involved in gill netting and longlining for shark, droplining for reef fish and trolling for spanish mackerel in the Northern Territory and Western Australia.

This vessel also introduced her to another side of fisheries, as at various times, it was chartered for scientific research trips for the Commonwealth Scientific & Industrial Research Organisation (CSIRO), the Australian

Institute of Marine Science (AIMS), the Northern Territory Museum and an anthropological research trip for the Northern Lands Council.

The fishing industry in the north of Australia is quite unique in that it has a fairly well-established tradition of women working on fishing boats. This had its beginnings with the advent of women being employed as cooks in the Northern Prawn Fishery in Queensland and the Northern Territory. Most of those women were required to do deck work as well as cooking and cleaning.

From that small beginning a number of women continued with the seasonal work, subsequently signing on as just deckhands rather than deckhand/cook. A few women went on to obtain their skipper's ticket and to run vessels themselves, but by and large it remains a male-dominated industry.

A number of women throughout the north of Australia are

also involved in small-scale fisheries (barramundi, mud crab, mackerel) as part of a husband and wife team.

This has made it somewhat easier for women to be accepted within some parts of the industry as it becomes more recognised that the ability to do the work and cope with the often difficult work conditions is often more a matter of individual personality than gender.



After leaving the commercial fishing industry in 1993 Lyn went on to do a Bachelor of Science degree (Fisheries) at the Australian Maritime College in Tasmania.

Following that she spent a year and a half as a regional extension officer in Samoa, first on Upolu then Savaii. This was an excellent introduction to subsistence and artisanal fisheries development and management in the Pacific.

The Samoa Fisheries Extension and Training Project (funded by AusAID and implemented by the Samoa Fisheries Division) has been very successful in encouraging all sectors of the village communities in recognising the problems with their

inshore fisheries and taking control of the solutions.

Management of the inshore fisheries of participating villages is now being handled by Village Fisheries Management Committees, made up of three or more representatives from each of the titled men, untitled men and women's groups.

This has taken much of the management and enforcement responsibility away from the Fisheries Division, leaving them with a more supportive and informative role. Positive contact between the village communities and the Fisheries Division has since greatly increased.

In April 1998 Lyn was employed as a technical consul-

tant by SPC for the Nauru Women's Workshop on Alternative Harvesting and Processing Techniques, taking sessions on sustainable harvesting methods, alternative fishing techniques, and basic gear technology.

Lyn will be working with the Community Fisheries Adviser in providing technical support for women and community-based fisheries, as requested by member countries. At present the Community Fisheries Section is looking at broadening its scope beyond exclusively women's development work to a more community-based management and development section, and flagged this idea at the Second Pacific Community Fisheries Management Workshop in October.



### **Gender analysis of the tuna industry Solomon Islands, 11–21 July 1998**

SPC, FFA and the Forum Secretariat are working together to assist the governments of the Solomon Islands, Palau, and Vanuatu produce Tuna Industry Management Plans.

Technical officers from SPC and the Forum Secretariat have the task of collecting and assessing data on the tuna stock, industry infrastructure and training needs, gender issues, and the investment climate. The technical reports on each area are submitted to the Project Manager,

who is working in liaison with both government and non-government representatives in compiling the Plan.

In July 1998 Patricia Tuara, Community Fisheries Adviser (CFA) and Gayle Nelson, Forum Secretariat Gender Issues Adviser, visited the Solomon Islands to collect baseline data on the existing roles of men and women in the tuna industry, identify key gender issues, and suggest strategies to address such issues. The preliminary

findings of their field work was presented to a focus group of stakeholders.

The Gender Issues Technical Report submitted to the Project Manager and the Forum Fisheries Agency has been discussed with members of the National Consultative Committee who are formulating the national Plan.

It is envisaged that work on the Palau and Vanuatu Plans will commence in 1999.



### **Workshop on Seafood Processing and Marketing Techniques Ebeye, Marshall Islands, 10–14 August 1998**

As a follow up to the women in fisheries baseline study carried out in 1997, the CFA was requested to conduct a workshop in August 1998, on seafood processing and marketing techniques for staff of the Kwajelein Atoll Fish Market Centre. Sixteen participants (11 women and 5 men), including 6 Fish

Market Centre employees attended the workshop.

Held over 5 days, the workshop covered such topics as seafood types and harvesting techniques, seafood nutrition, fish poisoning, seafood handling and hygiene, quality control and assessment, primary and

secondary processing techniques, packaging and marketing of seafoods, and gender. Lectures were held in the morning, with practical sessions held in the afternoons.

Local resource people included Capitol Bani, Chief Officer of the Marshall Islands Marine

Resources Authority and Evelyn Lanki, Manager of the Women's Programme of the Ministry of the Interior and Social Welfare.

In evaluating the workshop, participants stated that the topics of most benefit and interest to them included; quality control and assessment, icing of

fish, secondary processing (salting and drying of fish, making tuna jerky, and making new seafood recipes), and marketing.

Participants prepared seafood dishes for the closing ceremony, where they received their certificates.

As a follow-up to the Ebeye Fish Market Centre workshop, the Marshall Islands Marine Resources Authority has asked that the Community Fisheries Section conduct a similar workshop for Jaluit atoll.



**Capitol and Evelyn watch to see that the participants have understood their lessons in primary processing. Each group is given tuna to practise the techniques of cleaning, gutting, gilling and filleting.**

### **Workshop on the Production and Marketing of Shellcraft Niue, 29 September – 1 October 1998**

A field survey on the role of women in fisheries was completed in Niue (26 February – 12 March 1998) and a draft report compiled. During the visit to Niue, the CFA was able to meet with a number of women's handicraft groups, as well as the Niue Council of Women. The women expressed their need for training in the making of shellcraft and the processing of seafoods. As a result, two work-

shops were held in Niue in September/October 1998.

The Niue Women's Workshop on the Production and Marketing of Shellcraft held from the 29 September to 1 October 1998 targeted women who rely on selling shellcraft as a means of income. 18 women representing the 14 villages of Niue attended the course which was taught by artist and busi-

nesswoman Mrs Joan Rolls-Gragg. Joan is the successful owner of the Cook Islands Beachcomber store, which specialises in handicraft production and sale. (Joan is featured in the video tape, *Shellcraft, An income generating venture for women — The Cook Islands Experience*).

During the three days, the women were taught how to incorporate mother-of-pearl shell



**The women learned to weave mother-of-pearl shell into hats, fans, necklaces and bags. Here the shellcraft are displayed at the closing ceremony.**

into their weaving of hats, fans and baskets; the carving of mother of pearl shell; the making of pattern designs; and how to create new designs in jewellery and accessories.

In addition, the women were taught how to ensure quality in their products, as well as marketing and pricing of goods.

Throughout the course, consideration for the environment was stressed, and women were taught how to use less shells to create various craft. The emphasis was on creating shellcraft which is dis-



**In an effort to reduce the number of shells harvested, the women were encouraged to make designs which used few shells, and which incorporated other materials in the craft. Earrings and pendants, and necklaces which also use seeds are displayed by one participant.**

tinctly Niuean. At the closing ceremony, the participants proudly displayed the hats, fans

and other craft they had made during the workshop.



## Workshop on the Processing and Marketing of Seafood Niue, 2-7 October 1998

The seafood workshop targeted women who were interested in learning different methods of seafood processing, mainly for home consumption.

Attended by 25 women representing the 14 villages of Niue, the four-day workshop covered the topics of: sustainable harvesting techniques, seafood nutrition, quality control and assessment, seafood hygiene and handling, primary processing methods (gutting, gilling, skinning, and filleting of fish), secondary processing methods (making salted and dried fish,

sashimi, tuna jerky, smoked fish, and various seafood recipes), and the marketing of seafood (setting up a business, book keeping including pricing products, ensuring a profit, packaging and sales).

As with the participants of the shellcraft workshop, the seafood workshop participants displayed products of their learning experience at the closing ceremony. Shellcraft and seafood dishes were on display and enjoyed by all who attended the closing ceremony.

Representatives of both groups requested at the closing ceremony that the Minister responsible for fisheries not overlook the needs of women in the sector.

They asked that he create the post of Women in Fisheries Officer in the Dept of Fisheries. The President of the Niue Council of Women, Lady Rex expressed her appreciation for the two workshops, saying they were the most practical and beneficial workshops ever held for women in Niue.



A group leader presents the group's calculations used to set the price of tuna jerky

### Other news

#### *The CFS funds Vanuatu workshop for Women in Fisheries, 21-25 September 1998*

A five-day workshop funded by the CFS was conducted for 10

participants from the Shefa province of Vanuatu. Organised by the Santo Fisheries Training Centre, the course taught gear technology, harvesting techniques, fish poisoning, fish han-

dling and quality control, icing of fish, primary processing, fish preservation methods, sustainable resource management, and small business skills.

Resource people included staff of the departments of Fisheries, Forestry, and Health, as well as a graduate of a previous workshop.

In evaluating the workshop, the participants stated that they found all the topics relevant and useful, but in particular the net repair, business skills, and fish preservation methods. In addition, the participants felt that they would have liked the workshop to be longer in duration to enable them more time to practise the skills learned.

(Source: Nicolle Rutherford, Fisheries Training Centre, Espiritu Santo, Vanuatu)

**National Women in Fisheries Reports for the Marshall Islands and Nauru**

The national assessment reports on the role of women in fisheries compiled for the Marshall Islands and Nauru have been published and sent to the two countries for distribution. The reports outline the activities of women in the fisheries sector, identify issues of concern and areas of assistance required, and highlight national and regional support programmes.

**Women in Fisheries Special Interest Group Bulletin #3**

Keep an eye out for the next Bulletin which should be out at the end of the year. The Bulletin provides an update of activities within the Pacific and beyond.



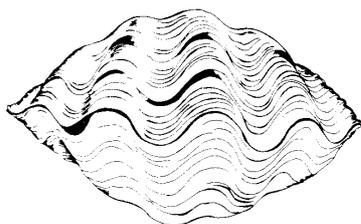
## ■ PALAU LOOKS TO CLAMS FOR FUTURE

Since becoming manager of the Palau Mariculture Demonstration Center in early 1997, Obichang Orak has been trying to convince local and foreign investors that raising giant clams is not only good business, but good for the environment.

The center, the world's largest producer of giant clams, supplies more than 500,000 of the farm-raised mollusks annually to restaurant and aquariums around the world and supports clam restoration projects throughout Micronesia and the South Pacific. The clams sell at prices ranging from 50 cents to US\$ 9 each.

Popular as both food and aquarium addition, the colorful *Tridacna derasa* is the best-selling of the center's six kinds of giant clam. Next in popularity are the smallest giant clam, *Tridacna maxima*, and the *Tridacna crocea*, with its corrugated shell. The center also raises the mammoth *Tridacna gigas*, which can reach a length of 4.5 feet (1.40 m) and weigh more than 250 pounds (113.4 kg).

"If we could operate simply as a business, we would have a healthy net income," Orak said. "This clam farm has been able to support itself for many years. But because of our status (as a government facility and research center), a lot of the money we generate doesn't go back into the business of selling clams."



*Tridacna derasa*

The mariculture center also faces other constraints; short staffing, difficulty in procuring supplies and an inability to react quickly to market changes. "The center is scrambling to keep pace with booming demand for aquarium clams in Europe," Orak said, "and its farm-raised corals are gaining popularity."

"For six months in 1997, we were not able to meet our orders because we ran out of foam boxes for shipping them", Oak said. "And just last week, we couldn't send a complete order of 600 kilos (of live clams) to Europe because Continental Air Micronesia has a limit of 300 kilos. So, we'll have to send out the other half next week."

The meaty mollusks' popularity among Asian diners also is driving market growth. Palau's recent increase of visitors from Taiwan has whetted Taiwanese appetites for clam sashimi and other such dishes served up at many of Palau's seafood restaurants. Japan continues to be the leading clam meat importer, but orders from Taiwan have begun to pick up.

The center also sells clams to a number of Pacific Island nations including the Federated States of Micronesia, the Marshall Islands, Fiji and the Solomon Islands, which are trying to restore natural populations of the endangered species.

Once found abundantly in shallow waters throughout the Pacific and Indian oceans, giant clams have been a source of food in the islands since at least 1500 BC.

Today, primarily due to over harvesting in the wild, the clams are listed as a threatened species under the terms of the

Convention on International Trade in Endangered Species. The mariculture center operates with full convention endorsement. Palau's wild clams cannot be exported.

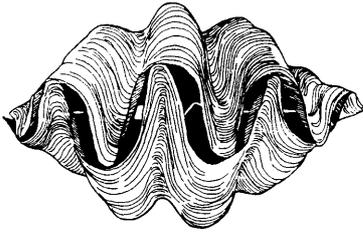
Faced with the possible loss of a link in the marine ecosystem and an important source of food, island nations have tried various ways of replenishing their clam stocks. In Tonga, mature clams are placed in circles in the shallow waters near some villages. These breeding clams are considered **tapu** (off limits), and villagers may harvest only their offspring.

The small-scale restoration efforts, however, don't match the clam-producing potential of Palau's mariculture center, which can cultivate one million market-size clams a year. The center has 64 shallow tanks and an underwater farm on the reef adjacent to the center.

"Having access to an ocean farm helps", Orak said. "The clams are kept in the shallow tanks for about a year and then introduced to the ocean farm, where they grow faster and develop the brilliant colors on their mantles."

"Once you have the system in place, raising clams is not a very difficult business," he said. "We have been essentially using the same techniques developed over 20 years ago. We've modified our techniques a little, but this center pretty much takes care of itself."

The clam's life cycle readily lends itself to mariculture. Mature clams are hermaphrodites — both male and female — each capable of producing sperm and eggs. In the center's controlled environment, a single pair of breeding clams can

*Tridacna gigas*

produce more than 5,000 offspring a year. The clams grow to a size suitable for aquariums in about a year. After five years, they are ready for the seafood market.

Through a symbiotic relationship with algae, or zooxanthellae, that live on their mantles, giant clams essentially feed

themselves. The giant clams get their nutrients from algae and the algae, in turn, thrive on sunlight and the clams' waste.

"Without the algae, the clams cannot survive," Orak said, "We use a special technique for introducing the algae, and that is what has made our project successful. For an aquarium, they are an ideal specimen because you don't have to feed them and they filter that water."

Although the mariculture center has perfected the science of raising giant clams, Orak won't claim success until he's found investors interested in starting their own farms. So far, the

effort has been frustrating. Some investors shy away from the start-up costs, which are close to US\$ 250,000 for a farm capable of producing more than 500,000 clams a year.

"But after three years you can forget about the capital, and the farm will continue to produce thousands of clams for as long as you run the facility." Orak said. "When I tell (potential investors) that the business may not see a profit until two or three years, they seem to lose interest. Today, everyone wants to get rich quick".

(Source: *Pacific Sunday News*, 16 August 1998)



## ■ PNG FARM CULTURING REDCLAW AND PRAWNS

*To date, the only commercial-scale aquaculture in Papua New Guinea is crocodile farming, although small-scale culture of pearls, carp, tilapia, and trout is also under way. A new project is being established to farm the local species of redclaw crayfish, as well as black tiger prawns.*

Ian Middleton first sensed the enormous potential of aquaculture in Papua New Guinea (PNG) four years ago, when as a post-graduate marine biologist and aquaculturist at James Cook university, Queensland, he saw that the world's wild-catch fisheries would soon reach their maximum sustainability. "Properly managed aquaculture can fill the enormous seafood shortfall left by dwindling world fisheries", he told *Austasia Aquaculture*. "It has consequently grown at a phenomenal rate since the 1970s, particularly throughout South-east Asia."

On his return to PNG, Ian's research quickly showed the great potential of that country for further aquaculture devel-

opment. "PNG is suitably located on the doorstep to the world's largest seafood markets, and the largest aquaculture-producing region in the world, Asia", he said, "and it adjoins the continually growing seafood market of Australia. PNG harbours a physical environment suitable for all tropical aquaculture practices from extensive to intensive and pond to cage culture in fresh, brackish, and marine waters.

In 1996, the Middleton family established *PNG Aquaculture*, which has targeted Dylup Plantation Estate as the best possible site for initial aquaculture development. Dylup is a 2,400 ha estate, 67 km up the north coast from Madang, on PNG's northern coastline.

"Dylup offers approximately 250 ha of prime coastal land suitable for natural earthen pond construction", Ian explained. "The estate has existing plantation infrastructure (including office complex, large workshop, retail store, bulk fuel storage, high and medium covenant

housing, vehicles and self-generated power), several surrounding villages to draw labour from, and proximity to Madang via a sealed roadway.

Madang itself offers medical and international-standard schooling facilities, a port regularly serviced by ships from Asia and Australia, an airport with daily passenger and freight services to Port Moresby (possibly to be extended and upgraded to international standard by 1999), shopping centres, recreational venues, entertainment, and various other amenities.



“Dylup incorporates ideal physical features for pond construction, with a 78 per cent clay soil profile allowing excellent natural water-holding capacity. There are river and underground fresh water supplies and deep nutrient-rich ocean water directly off the foreshore. Coupled with constant 28–32°C air temperatures and uniform day lengths year round, we enjoy excellent environmental conditions for continuous growth rates.”

### Focus on redclaw and prawns

The site offered PNG Aquaculture the option of farming either marine estuarine, or freshwater species. “We wanted the company to have broad base for diversification to take advantage of favourable markets and species in either of the culture mediums.”

“Consequently, we chose the common tiger prawn (*Penaeus monodon*) and redclaw (*Cherax albertsii*), both species we believe can be invaluable and lucrative export earners.”

“The tiger prawn is expected to yield five to six tonnes per pond and the redclaw one to two tonnes per pond. This reflects conservative and manageable stocking densities. Some of the more intensive farms in Aus-

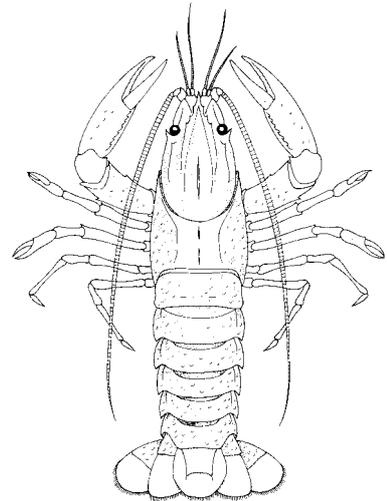
tralia produce eight tonnes and three tonnes respectively in equivalent size ponds.”

*Cherax albertsii* is the most common *Cherax* species in the country. To date the local species are performing well, with some animals growing to over 100g in six months. “They grow really fast during the first four months after hatching, reaching 50 g, then slow down considerably”, Ian said.

“They have a smaller claw than *C. quadricarinatus* but seemingly have a larger tail, especially the females. *Cherax albertsii* reproduce readily at 20 g so in the future I hope to hybridise them with the Australian redclaw (*Cherax quadricarinatus*).”

“Hopefully the crossing will produce hybrids with larger claws and tails and delayed reproductive maturing.”

“Dylup Plantation provides an ideal growing environment for redclaw and because they’re omnivorous the surrounding plantation provides an ideal avenue for low-cost feeding. For instance, early trials conducted here throughout 1997 have indicated that redclaw can be successfully cultured and reproduced on coconut meal—a byproduct of oil extraction—alone.”

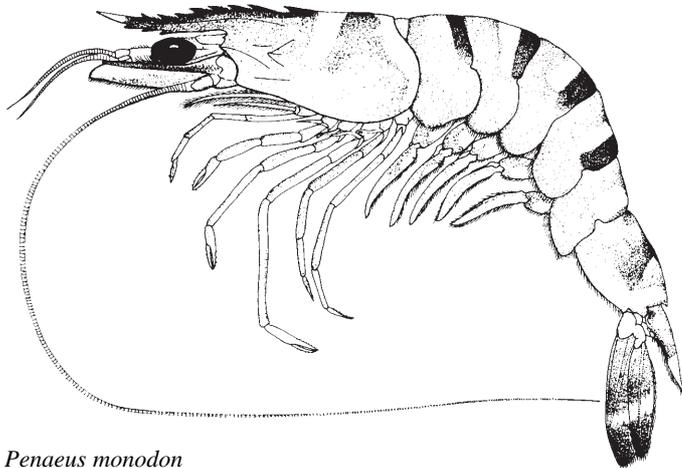


*Cherax quadricarinatus*

An initial 15 ha site was cleared and nine 0.8 ha earthen ponds, each 1.7 m deep, were completed in early 1998. With the availability of both fresh water and salt water, six ponds will initially be stocked with prawn larvae (PL 15–17) from southern Queensland and three ponds will be stocked with juvenile redclaw (2–5 mm) produced during the 1997 trials or from a Queensland producer.

The redclaw have a 150 mm PVC pipe and the prawns a 400 mm specially pressure-rated PVC pipe to supply water to the inlet channels. The water then gravity-flows into the ponds. Monks are used for the outlets and, as the ponds are above sea level, gravity drainage can be used.

In the crayfish ponds, water exchange is low and really only top-up water is used so that plankton blooms can be maintained. The stocking rates are five to eight animals per square metre and two aerators per pond are used to maintain high oxygen levels. In the prawn ponds, up to six aerators can be used, and water exchange is used to maintain good algal blooms. The initial stocking density is 30 PLs/m<sup>2</sup>.



*Penaeus monodon*

"Maintenance of water quality is the very essence of success in aquaculture and it must be carefully managed," Ian explained, "so we monitor for temperatures, pH, salinity, and dissolved oxygen up to four times a day."

Discharge waters will also be sampled after every crop harvest to ensure there is no biological or nutrient overloading of the ocean. The detection of adverse water quality will warrant the immediate use of settling ponds.

"In the case of prawn effluent, these ponds may be stocked with filter feeding species that have commercial value acting as a secondary crop and being fed by the farm's waste water. Species suitable in PNG include tropical oysters, clams, and beche-de-mer."

### Local foods

A range of byproducts from the estate, including copra meal, are used to feed the redclaw. Feeding is undertaken three or four times a day for the prawns and in the late afternoon for the redclaw.

Ian said that they will undertake a weekly sampling scheme to inspect the stock for health. A daily pond inspection will also be used, and may include a diving survey of the bottoms of the ponds.

With the results from the 1997 trials, Ian expects that the 2.4 ha of ponds will produce up to five tonnes of redclaw. "They will be stocked in May (1998)", he said, "and then sold live on the domestic market to restaurants and should earn us over K 30,000 (A\$ 24,000)."

According to Ian, the inclusion of prawns will provide a quick cash flow and all the ponds should be stocked by July 1998.

"Once harvested, the prawns will be cooked, then dipped in a brined ice slurry and sold fresh into markets in Australia. A building with a walk-in cooler room will be used for processing the catch."

"The crop can be harvested within five months and PNG Aquaculture expects to export 25 to 30 tonnes of prawns by December 1998, earning around K 400,000 (A\$ 320,000) in export revenues. A second crop will be stocked by January 1999."

He said that culturing a second species requires extra labour, particularly during the intensive harvesting, processing, and packaging periods, so the need for an increased workforce will generally benefit the wider rural community of Madang.

An international-standard prawn hatchery is planned for 1999, allowing complete integration of the farm and further employment opportunities. The company ultimately aims to collect broodstock from wild stocks in the Papuan Gulf.

### Other species

With the infrastructure and culture expertise developed on the farm, some other species are also being tested for their aquaculture potential.

"We are undertaking a joint project with the National Fisheries Authority at present on the **pacu** (*Piaractus mesopotamicus*)", Ian said. "This native Brazilian fish is a vegetarian, eating any type of seed from cocoa beans to coconuts. It grows to 30 kg and is considered the finest quality eating fish in Brazil, with large fillets the main product. It is also cultured in Asia."

"The PNG Government wants me to produce fingerlings for

stocking inland waterways here. I have the only 140 adult fish in the country, all around 23 kg at present."

He explained that they will be grown up to sexual maturity (around 4 kg) and then injected with hormones to induce spawning. Reared fingerlings will be sold to the government for stocking. PNG Aquaculture will also undertake some growout trials.

"Recently, I built a couple of trial ocean cages 1.8m x 2.2 m x 1.75 m deep and have converted *Tilapia mozambicus* to full strength sea water", he told us. "Each cage has black cargo netting around it to exclude predators. The cages are in a 10 m deep channel some 50 m off the plantation. The channel is fed by a constant current. I am feeding the tilapia twice a day with a pellet I have formulated using locally available ingredients, and the fish are growing very well, up to 80 g in the first two months."

"The aim is to develop methods to cheaply produce a hardy fish to 250 g that the local villagers may be able to carry on with. I have also started a couple of local village tilapia pond farms, which have gone over very well politically and have generated a great deal of interest—the so-called Family Farmer Programme."

"We will also be examining opportunities for eels and pearl oyster culture".

*For more information contact Ian Middleton, PNG Aquaculture, Dylup Plantation Estate, P.O. Box 521, Madang, Papua New Guinea, Tel: +675 853 7411, Fax: +675 853 7463*

(Source: *Austasia Aquaculture*, June/July 1998)



## Predicting skipjack tuna forage distributions in the equatorial Pacific using a coupled dynamical bio-geochemical model

by Lehodey P.<sup>1</sup>, André J.M.<sup>2</sup>, Bertignac M.<sup>1</sup>, Hampton J.<sup>1</sup>, Stoens A.<sup>3</sup>, Menkes C.<sup>3</sup>, Memery L.<sup>3</sup>, Grima N.<sup>3</sup>; In: Fisheries Oceanography (1998), GLOBEC Special Issue, Volume 7, number 3 and 4, p 317–325.

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Skipjack tuna (*Katsuwonus pelamis*) contributes ~70% of the total tuna catch in the Pacific Ocean. This species occurs in the upper mixed-layer throughout the equatorial region, but the largest catches are taken from the warmpool in the western equatorial Pacific.

The analysis of catch and effort data for U.S. purse-seine fisheries in the western Pacific has demonstrated that one of the most successful fishing grounds is located in the vicinity of a convergence zone between the warm (>28–29°C) low-salinity water of the warmpool and the cold saline water of equatorial upwelling in the central Pacific (Lehodey et al., 1997).

This zone of convergence, identified by a well-marked salinity front and approximated by the 28.5°C isotherm, oscillates zonally over several thousands of km in correlation with the El Niño Southern Oscillation. The present study focusses on the prediction of skipjack tuna forage that is expected to be a major factor in explaining the basin scale distribution of the stock.

It could also explain the close relation between displacements of skipjack tuna and the convergence zone on the eastern edge of the warmpool.

A simple bio-geochemical model was coupled with a general circulation model, allowing rea-

sonable predictions of new primary production in the equatorial Pacific from mid-1992 to mid-1995.

The biological transfer of this production toward tuna forage was simply parameterised according to the food chain length and redistributed by the currents using the circulation model. Tuna forage accumulated in the convergence zone of the horizontal currents, which corresponds to the warmpool/equatorial upwelling boundary. Predicted forage maxima corresponded well with high catch rates.



## A spatial population dynamics simulation model of tropical tunas using a habitat index based on environmental parameters

by Bertignac M.<sup>1</sup>, Lehodey P.<sup>1</sup>, Hampton J.<sup>1</sup>; In: Fisheries Oceanography (1998), GLOBEC Special Issue, Volume 7, number 3 and 4, p 326–334.

<sup>1</sup> Secretariat of the Pacific Community, B.P. D5, Noumea, New Caledonia

We are developing a spatial, multi-gear, multi-species population dynamics simulation model for tropical tunas in the Pacific Ocean.

The model is age-structured to account for growth and gear selectivity. It includes a tuna movement model based on a diffusion-advection equation in which the advective term is proportional to the gradient of a habitat index. The monthly geographical distribution of recruitment is defined by assuming that spawning occurs in areas where sea surface temperature is above 25°C.

During the first three months of their life, simulated tunas are transported by oceanic currents, after which movement is conditioned by gradients in the habitat index. Independent estimates of natural mortality rates and population size from large-scale tagging experiments carried out by the Secretariat of the Pacific Community are used in the simulations.

The habitat index consists of components due to forage density and sea surface temperature, both of which are suspected to play major roles in determining tuna distribution. Since direct observations of forage are

not available on a basin scale, we developed a sub-model to simulate the surface tuna forage production (Lehodey et al., this vol.). Presently, only skipjack (*Katsuwonus pelamis*, a surface tuna species caught by purse-seine and pole and line) is considered, at a one-degree square resolution and on a monthly climatological time-series.

Despite the simplicity of the model and the limitations of the data used, the simulation model is able to predict a distribution of skipjack catch rates of the different fleets involved in the fishery, which is fairly consistent with observations.



# SPC MASTERFISHERMAN ASSISTS PNG'S NATIONAL FISHERIES COLLEGE IN TRAINING FISHING CADETS

## Introduction

The National Fisheries College (NFC) was established in 1977 and has been responsible for training many of the national fisheries officers and persons employed in the fisheries sector. The college originally provided training for the domestic pole-and-line tuna industry.

By 1981, the pole-and-line fishery in PNG collapsed due to limited access to the tuna resource and falling fish prices. As there was no need to provide training for the pole-and-line industry, the college implemented a two-year certificate programme in Tropical Fisheries. This programme had a broader syllabus which focused on training fisheries extension officers and generalists for the fisheries sector.

As the domestic fishing industry grew over the next decade it became apparent that the certificate course was inappropriate and did not provide adequate training in the technical skills required for the commercial fisheries sector.

A review by the Asian Development Bank (ADB) in 1995, of the NFC Tropical Fisheries Course syllabus, recommended a radical change to meet the needs of the industry as employment opportunities for Papua New Guineans in the commercial sector were dependent upon the availability of appropriately trained and qualified people. In response to

*by Peter Watt,  
Secretariat of the Pacific  
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Noumea, New Caledonia*

these recommendations the NFA, with input from the Fishing Industry Association of PNG, established an industry-related modular training programme in 1997.

## New Fisheries Cadet Course

This new course for Fishing Cadets consists of three training modules with a duration of three months each. The modules are designed to meet the minimum performance and competency standards as set by the International Maritime Organization (IMO) under the 1995 Convention of Standards of Training and Certification and Watchkeeping (STCW) and also to meet the technical skill requirements of the growing fishing industry.

The first module is held at the PNG Maritime College in Madang. The college provides training in a Pre-Sea Induction (STCW 95 Requirements) module for a Qualified Deckhand Course.

This module includes training in basic seamanship skills, first aid, survival at sea and fire fighting. Students who graduate receive an STCW (Pre Sea Induction Deck and Engine Rating 2—for general purpose) certificate which qualifies them

to be employed on a commercial vessel.

The second module is held at the National Fisheries College in Kavieng. The syllabus includes training in basic fishing gear technology, fishing operations, seafood technology, refrigeration and mechanics and carpentry skills for fishing vessel operations.

The third module is an industrial attachment where the students are assigned to work with local commercial fishing companies to gain some 'hands-on' experience and use the skills they were taught at the colleges.

Students enrolled in the 1997 courses were either assigned to prawn-trawl, purse-seine, or tuna longline operations. Some students were also assigned to work in local tuna canneries to learn further processing skills and assist in basic operations.

After the Industrial Attachment is completed the students return to NFC in Kavieng to attend a short two-week course in Fisheries legislation and regulations.

The students are tested and evaluated throughout the course to determine the level of their competency and understanding of the theory and skills taught by the tutors.

Managers of the companies where the students are assigned for their Industrial Attachment also evaluate the student's competency. Students who graduate receive a 'Fishing Technology Certificate'.

## SPC's assistance in 1998

Following an official request by the Government of Papua New Guinea for technical assistance from the Capture Section of the

Coastal Fisheries Programme, to assist in running the second module of the new Fisheries Cadet Course in 1998, SPC assigned the services of Masterfisherman Peter Watt to this project. The aim of this project was to provide technical training in various fishing techniques for students attending the Fisheries Cadet Course at Kavieng, New Ireland.

On arrival at the airport in Kavieng to start the assignment the Masterfisherman was met by the NFC principal, Mel Ware, who gave a quick run down on the content of the course syllabus and what his responsibilities for the next three months would be. The Masterfisherman would be working with the skipper of the college's training vessel, FTV *Leilani* (Figure 1), Kisi Geotau, and fisheries technology specialists, Camillus Kabinawedi and Satoshi Nagashima.

The team would be responsible for providing students with theoretical information for various fishing methods, train the students in the fabrication of fishing gears and conduct fishing operations to demonstrate the applica-

tion of the fishing gears fabricated in classes.

Also, the team were responsible for training the students in on-board handling of the catch as well as basic navigation and seamanship skills. The main objective of the fishing operations during the course was to develop the students' skills to an acceptable level for employment in the fishing industry.

There were eighteen students enrolled in the first three-month training block at the college. The students came from every part of the country and included two from the highlands who had never experienced being on the ocean before. Also there were three women who at first were thought by the male students to be bad luck on a fishing boat but who later proved to be as competent at fishing as the men and often had better catches.

The students were split into two groups. Each week, one group was taught how to make fishing gear then went to sea for fishing operations while the other group stayed ashore and was taught theoretical and practical skills in

seafood technology, carpentry skills for fishing operations, refrigeration and mechanics. The groups alternated between going to sea and staying ashore weekly.

The students were exposed to as many fishing techniques as possible in the short time frame scheduled for the course. Special emphasis was placed on acquiring practical skills needed for the main commercial fisheries in PNG: the prawn-trawl, purse-seine and tuna longline fisheries. Most of the on-shore practical training sessions in fishing technology focused on making nets and tuna longline gear.

### Fishing programme

A comprehensive fishing operation programme was designed to ensure that the students were given as much sea time as possible to learn the skills required for each fishing method. The fishing operations for the three-month course included:

- ☞ *Week 1 & 2:* Trolling for pelagic species and dropline fishing for bottom fish species;



Figure 1: College training vessel, FTV *Leilani*

- ☞ *Week 3 & 4:* Trolling for pelagic species and deep-water handreels for bottom fish species;
- ☞ *Week 5, 6, 7, & 8:* Tuna long-line fishing;
- ☞ *Week 9 & 10:* Gillnet fishing and handline/handreel fishing; and
- ☞ *Week 11 & 12:* Beach-seine, trawl net and handline/hand reel fishing.

A rigid work schedule was followed every week for the fishing operations. Usually two days and one night were spent at sea but occasionally the vessel had to return to port after only one day's fishing as there was not enough ice or room in the fish hold for another day of operations. If this was the case, the vessel would return to port, off-load the fish and head back out to sea early the next morning. The weekly work schedule was the following:

- ☞ *Monday:* Theoretical lectures on fishing gear technology and fishing operations;
- ☞ *Tuesday:* Fishing gear fabrication, preparation of fishing vessel for fishing operations;
- ☞ *Wednesday:* Demonstration and training in fishing gear utilisation aboard the FTV *Leilani*;
- ☞ *Thursday:* Same as Wednesday; and
- ☞ *Friday:* Vessel clean-up, repair and maintenance of fishing gear

**Figure 2: Students at the college's processing plant filleting and loining tunas caught on the longline**

## Results from fishing activities

Catches during the fishing operations aboard the FTV *Leilani* were quite exceptional. A total of 4,446 kg of fish were caught in 12 weeks; 1,280 kg of bottom fish were caught with the drop-lines, handreels and handlines; 204 kg of skipjack and other pelagic fish were caught trolling and 2,673 kg of yellowfin tuna and 289 kg by-catch were caught tuna longline fishing.

Tuna longline catches were the most impressive as only 9 sets of 200 hooks were deployed. This is an average catch ratio of 1.6 kg/hook which is almost three times above the average catch ratio for the Pacific region.

The fish when brought aboard the boat were killed, gilled and gutted, and placed immediately into an ice slurry. Large tunas and other pelagic species such as marlin and sailfish were stored in the fish hold and packed in ice.

When we returned to port the catch was transported to the college and the fish was cut into

either fillets or loins at the Fish Processing Plant (Figure 2).

This gave the students an opportunity to have some 'hands-on' experience in fish handling and processing methods. The processed fish were sold to restaurants and stores in Kavieng, given to the mess at the college to feed the students or distributed to the staff. The college collected almost K 1,000 from fish sales to donate to the Aitape Disaster Relief fund.

The students have now completed the three-month module at NFC and have been assigned to work at a number of fishing companies for their three-month Industrial Attachment.

One company has taken five of the students and guarantees them full-time employment if they prove to be competent. Hopefully, through this training programme there will be sufficient qualified Papua New Guineans to meet the demand for the current and projected developing fishing industry.



# DEVELOPING INSHORE SPORTFISHING IN PALAU

*This article has been presented, as Background Paper #19, at the SPC Second Pacific Community Fisheries Management Workshop, which was held in Noumea from 12 to 16 October 1998.*

*by Noah Idechong and  
Tom Graham,  
Palau Conservation Society<sup>1</sup>*

## Pre-Project Situation

### *Fish stocks and fishing*

The importance of fish and fishing to Palauans is enormous. But fishermen in Palau have increasingly complained about the depletion of their reef fish resources, and most fishermen have recognized that limitations on fishing pressure must be put in place in order to stem the decline<sup>2</sup>.

Fishing effort continues to increase, however, and most of the increase has been in the commercial sector, with more and more of the catch exported to feed the growing demand from Guam and Saipan. Within Palau, fishing pressure has been spreading farther and farther from the urban center of Koror where the demand is greatest.

Larger boats and higher fish prices have allowed Koror-based commercial and recreational fishermen<sup>3</sup> to make more distant fishing trips to the waters of Palau's outlying (and much less populous) states. Ngarchelong and Kayangel in

the far north, for example, have only a few hundred residents each, but together own about one third of Palau's reef and lagoon areas—about 500 km<sup>2</sup> (see map on following page). Fishermen in these states have increasingly felt a loss of control over their marine resources and blame the depletion they see largely on outside fishermen<sup>4</sup>.

And the fishermen in these outlying states, partly in response to government initiatives during the last decade to develop the inshore fishery<sup>5</sup>, have also been fishing more and more for commercial purposes, supplying Koror, Guam, and Saipan with reef fish.

### *Tourism development*

Palau has been seeking alternative economic opportunities, especially since its gradual weaning from U.S. Government funding after independence in 1994. Tourism is decidedly the most promising sector, and it has been growing steadily since the early 1980s. Tourism, however has been almost totally based on scuba diving and has thus been mostly confined to

Palau's southern lagoon—an area that offers spectacular diving on the steep barrier reef walls, the beautiful scenery of the Rock Islands, and ready access from Koror. The economic benefits from tourism have not been making their way beyond Koror (except the large portion of benefits that flow directly out of Palau—a separate problem). Certainly, the many immigrants to Koror from Palau's outlying states have participated in the economic activity in Koror, and benefits have made their way to those states through family connections and through government taxation and spending.

The problem has been that there are few opportunities to benefit from tourism without being based in Koror. Koror has become overcrowded while the communities of the outlying states have shrunk. While the outlying states have complained about fishermen from Koror taking their fish, Koror has complained about immigrants from the outlying states burdening their infrastructure and social services, as well as taking fish from Koror's waters.

Another problem has been the "intrusion" of tourism—mostly scuba diving—into waters traditionally used by fishermen, and the resultant tension, between fishermen and tour operators. As tourism has effectively edged fishermen out of the southern lagoon's most popular dive sites, fishermen have felt their fishing grounds dwindle in size.

<sup>1</sup> P.O. Box 1811, Koror, Palau 96940

<sup>2</sup> See Johannes, R.E. (1991). Some suggested management initiatives in Palau's nearshore fisheries, and the relevance of traditional management. Palau Marine Resources Division Technical Report 91.14, Republic of Palau.

<sup>3</sup> There are few people in Palau that rely exclusively on fishing for their livelihoods, but there are many "weekend" fishermen that fish for fun and a little profit, sometimes making distant day trips.

<sup>4</sup> Although there are only a couple dozen fishermen that reside in these communities, there are others from these communities that reside in Koror; these have a status somewhere between "insider" and "outsider."

<sup>5</sup> Many of these initiatives were funded through Japanese grant aid; activities included the provision of fishing boats and gears, development of port and ice-making facilities, and development of village-based fishing cooperatives.

In 1995, for example, Koror State declared off-limits to fishing a 30 km<sup>2</sup> area of reef that includes many of Palau's most popular dive sites. The growth of dive-based tourism has, of course, provided alternative opportunities for fishermen and others, and many fishermen have switched occupations from fishermen to dive guide.

Tension between the two groups, however, has continued, and it is naturally linked to the importance of fishing to Palauans. Whether it be for subsistence, fun, or commercial purposes, fishing plays such a central role in Palauan culture that any changes or threats to traditional fishing rights and patterns is sure to be met with some resistance.

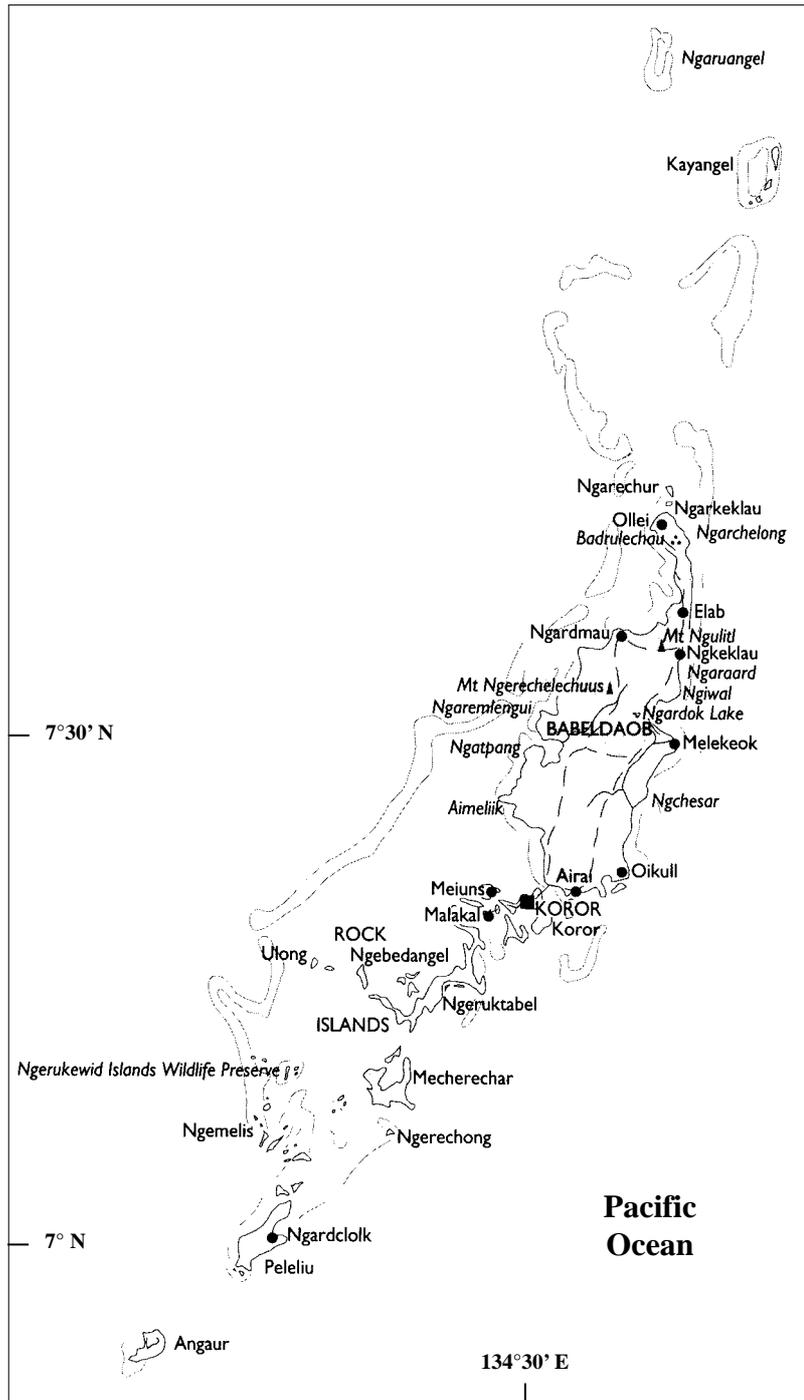
**Sportfishing**

Sportfishing has long been an activity available to tourists in Palau, but few tourists have taken advantage of the opportunity—most of them only as a secondary activity. Very few have visited Palau for the primary purpose of sportfishing. Many of the thirty-odd Koror-based tour companies offer fishing, but there are no companies that offer nothing but fishing.

There probably hasn't been enough sportfishing to cause much resentment among local fishermen, but the potential for conflict has been an important concern. A bigger cause of resentment among Palauans has been tourists harvesting giant clams and removing corals and shells.

**Project Purpose**

In 1993 a team that included the marine resources office of the Palau national government, The Nature Conservancy, and several of Palau's outlying communities and local governments embarked on a project to develop a tourist-



Map of Palau

based inshore sportfishery. After two years the newly founded Palau Conservation Society took over as project leader. Funding was provided by the U.S. Government through the Saltonstall-Kennedy program of the National Marine Fisheries Service. Other collaborators included the Palau

Visitors Authority, the South Pacific Commission, the Forum Fisheries Agency, the Guam Division of Aquatic and Wildlife Resources, and the Japan Tourism Bureau.

The project responded to two main problems: disappearing reef fish resources from fishing

and the failure of Palau's outlying communities to receive an adequate share of the benefits from Palau's growing and most promising economic sector—tourism. From the perspective of resource management, these problems could together be described as one of Palau's reef fish resources not being put to the best possible use.

Given Palau's relatively abundant fish resources, its natural beauty, and its growing reputation as a desirable vacation destination, a sportfishery would almost certainly have developed without the "intervention" of this project. But the purpose of the project was not just to see the development of the sportfishery; it was to see it develop with certain characteristics:

- ☞ The sportfishery would contribute to the conservation of fish resources rather than to their depletion.
- ☞ The emerging sportfishing businesses would be controlled to the extent possible by local interests, and especially by people in the target communities.
- ☞ Participation in the industry by Palauans would be maximized to the extent possible, and fishermen in the target communities would participate as fishing guides as an alternative to commercial, extractive fishing.
- ☞ The reputation of Palau as a fishing destination would be a positive one from the beginning, helping to ensure the sustainability of the industry—that is, visiting anglers would be satisfied through great fishing, safe boats and equipment, and

good services, as well as positive non-fishing experiences.

- ☞ The sportfishery would develop in harmony with, rather than in conflict with, the subsistence and commercial fisheries, as well as with scuba diving and other marine tourism activities.

### Progress to Date

The sportfishing development project has progressed through two main phases, assessment and demonstration. Concurrent with those phases, several communities have been taking initiatives to conserve and make better use of their inshore resources.

These initiatives were aimed at issues of resource management broader than just the development of a sportfishery, but to the extent that they related to sportfishing, they are discussed here.

### Assessment

The first two years of the project were dedicated to assessing the feasibility of developing an inshore sportfishery and identifying the issues that would have to be addressed in such development<sup>6</sup>.

### Vessels and gear

An assessment of equipment and gear needs recognized that the vessel and gear requirements for offshore trolling would be well beyond the means of all the target fishermen. Thus the preferred strategy was to focus on inshore fishing (casting and nearshore trolling), which can be done from smaller boats and with less sophisticated gear. Most of the boats already owned by the

fishermen—generally open fiberglass boats in the 20 to 24 foot range with single outboards—would not be quite adequate, twin engines being an important requisite for safety. An investment of US\$ 20,000 to US\$ 25,000 would be needed for an ideal boat. An additional few thousand dollars would provide for the fishing, safety, and other gear needed for inshore casting and trolling.

### Economics

An assessment of the economic feasibility of small-scale inshore sportfishing businesses concluded that a fisherman that switched occupations from commercial fisherman to fishing guide would stand to make about the same level of profits. The assessment, however, did not account for the possible "conservation" benefits that development of the fishery might bring to Palau's inshore fisheries as a whole.

### Fishing action

An assessment of fishing grounds and target species found that the far northern waters of Ngarchelong and Kayangel probably offered enough variety of habitat and species and enough fish to provide a satisfactory fishing experience to most anglers. An assessment to the south, in the waters of Peleliu and Koror, was less positive.

In both cases, the assessment found that the perpetual protection of some areas, such as through the establishment of catch-and-release-only zones, would probably be necessary to guarantee an adequate number of fish to satisfy visiting anglers.

<sup>6</sup> The results of this assessment are available in: Anon. (1996), Small-scale sustainable sport fishery development for Palau: assessment, strategy, and consensus-building. Report by Division of Marine Resources, Bureau of Natural Resources and Development, Republic of Palau.

### **Tourist markets**

An assessment of Japan's tourist market recognized the large potential of drawing both serious anglers and marine enthusiasts that would engage in sportfishing as a secondary activity. Markets not assessed but recognized to also have considerable potential were the U.S. and Europe.

### **Community interest**

Community meetings and workshops with fishermen in Kayangel, Ngarchelong, and Koror were held in order to gauge the local interest in developing a sportfishery and to identify outstanding issues. In general, the local leadership and residents saw sportfishing as a desirable economic alternative, but only if the community maintained adequate control and if an adequate level of benefits ended up in the community.

In general, the fishermen were interested in sportfishing as an alternative occupation. It was recognized that the profound differences between sportfishing as a service occupation and fishing for food and income as an occupation that values independence would limit interest to only some of the fishermen.



The fishermen received preliminary training in safety and other service-related aspects of sportfishing in order for them to better assess their own interest in the business.

### **Institutions and resource management**

The importance of both fishing and tourism to Palau's economy and way of life has led to the Palau Government having a substantial institutional system dedicated to both these sectors<sup>7</sup>.

But sportfishing is not a traditional component of either sector. The central government objectives in fisheries have been developing underutilized resources, improving marketing, and protecting vulnerable reef-associated species. The central objective in tourism has been promoting scuba diving. Non-government groups involved in fishing and tourism include a tourism industry association and a sportfishing association<sup>8</sup>.

The latter has mostly occupied itself with organizing offshore fishing tournaments. Inshore sportfishing has generally fallen between the institutional cracks.

An assessment of the institutional environment found that legislative and other initiatives would be necessary at the national and local levels in order to create an environment conducive to sportfishery development.

At the national level, initiatives would be desirable to provide incentives for fishermen to

switch to sportfishing, such as tax breaks and low-interest loans. Safety in the industry would have to be ensured through a national system of certification or licensing for guides and boat operators.

Participation in the industry by Palauans might be controlled through occupation restrictions, such as those already in place for tour guides and taxi drivers. The Palau Visitors Authority would have to actively promote sportfishing abroad.

At the local level, the state governments (e.g. Kayangel and Ngarchelong), would have to put in place systems to: 1) better control access to their fisheries resources, 2) conserve adequate fish and fishing grounds for visiting anglers, and 3) extract rent from the fishery<sup>9</sup>.

The first could be done through restrictions on who could act as fishing guides in the states' waters (e.g. as part of the national guide certification system). The second could be done through the establishment of catch-and-release fishing zones. The third could be done through permit systems that levy fishing fees on tourists<sup>10</sup>.

Because separate permit systems in each of the states could cause unreasonable hassles for the visiting angler, another chore for the national government would be to harmonize and possibly act as clearinghouse for the state permit systems.

Both national and model state-level laws were drafted that

<sup>7</sup> The Division of Marine Resources is concerned with fisheries management and development; it has sections devoted to foreign offshore fishing, marketing, and aquaculture; the Palau Visitors Authority is in charge of tourism development.

<sup>8</sup> The Belau Tourism Association and the Palau Sport Fishing Association, respectively.

<sup>9</sup> The 16 states of Palau are accorded "exclusive ownership" of living and non-living resources out to 12 miles from the outer reef. It follows that any public sector benefits gained from those resources should be directed to the state governments rather than the national government.

<sup>10</sup> Kayangel and Koror are the only two states with such systems in place. Koror's system applies to all visitors to its Rock Islands, regardless of activity; Kayangel's applies to virtually all tourists, with the fee level depending on the activity.

would accomplish all of the above institutional and policy objectives. At the national level, legislation was introduced in 1996 but no action has been taken. Actions taken at the state level are discussed further below.

### **Demonstration**

During 1996 and 1997, the project team undertook a series of activities to test the fledgling sportfishery "system"—that is, everything from the services of the guides, boat operators, and hotels to the fishing itself.

Experienced anglers were recruited from the Japan and the U.S. and put in the care of local fishing guides for a few days of fishing in the waters of Kayangel and Ngarchelong.

Because the target fishermen in those communities were still not adequately equipped with vessels and fishing gear, the vessels and services of experienced Koror-based tour/fishing guides were used in these fishing trials.

But prospective guides from Ngarchelong and Kayangel accompanied these guides as "apprentice" guides. While the Koror-based guides were more experienced in serving tourists, the fishermen from Ngarchelong and Kayangel were more knowledgeable about the local fishing grounds. Together, they made very effective teams.

At the end of the trials, the anglers provided detailed assessments of their fishing experiences, with evaluations of fishing action, vessels and gear, the services of guides and others, accommodations, and their non-fishing experiences while in Palau.

The assessments were generally positive, but highly variable from angler to angler. To some,

for example, fishing action was the only important attribute to be judged. For others, scenery, accommodations, food, comfort, and other attributes were just as important as the fishing itself.

### **Fishing action**

There was a consensus among the test anglers that Palau's northern reefs held enough fish to satisfy most anglers. The second of two trials saw especially good fishing, and one very experienced angler ranked Palau as his third favorite fishing destination in the world, behind Panama and Midway.

There was concern among the anglers, however, that Palau's reefs were not very extensive, so they might be vulnerable to being fished-out, and controls would have to be put in place to protect the fish stocks. A little offshore trolling was done in addition to reef casting, but the results were not impressive.

The anglers attributed it to either Palau not having much pelagic fish, or the guides not being knowledgeable enough about the times and places to find the various species of pelagic fish. Although the anglers found the vessels and gear to be adequate, they offered numerous recommendations for minor improvements.

### **Services**

The services of the guides, boat operators, and others were generally rated as good, but it was acknowledged that the fishing guides would need more experience and training in order to better know what kind of experience visiting anglers are looking for.

### **Accommodations**

The assessments of the accommodations in Koror were,

almost without exception, very good. The northern fishing grounds, however, are about two hours by boat from Koror.

The anglers that chose to make the trip every day from Koror found it too long. Those that chose to lodge near the fishing grounds found the accommodations inadequate. Clearly, improved lodging at Kayangel and/or Ngarchelong would be necessary.

### **Non-fishing experiences**

Except for the few anglers that had no interests beyond fishing, there was a consensus that Palau had a lot to offer besides good fishing. The scenic value of its coastlines and reefs especially impressed the visitors. The city attractions of Koror got moderate evaluations from the anglers.

### **Conservation**

One anticipated outcome and benefit of the sportfishery development project was that communities that stood to benefit from the sportfishery, as well as the national government, would put in place controls over fishing that would safeguard the fish stocks necessary to sustain the fishery.

For example, catch-and-release would be the general rule for visiting anglers, and fishing zones would be established that allowed only catch-and-release fishing. As the fishery developed, it was expected that nationwide controls less directly related to sportfishing would also be put in place, such as limits on the amount of reef fish exported from Palau.

Several relevant pieces of legislation have been considered by the national legislature. One would prohibit the export of reef fishes from Palau.

Another would create a marine reserve in the far north of Palau. But no relevant national laws have been enacted since 1994, when groupers were protected from fishing for four months a year and the export of lobsters, giant clams, coconut crabs, mangrove crabs, humphead parrotfish, and napoleon wrasse was prohibited.

Some of Palau's 16 states have recently taken some steps towards protecting and making better use of their fisheries resources. In 1994, the traditional leaders of Ngarchelong and Kayangel put a seasonal ban on fishing in certain reef channels known to hold spawning aggregations of groupers.

In 1996, partly as steps towards pursuing sportfishing as an alternative enterprise, the leadership of Kayangel enacted two laws. The first established a permit system whereby all tourists, including anglers, would have to pay a permit fee to engage in any marine activities in the state.

The second established the Ngaruangel Reserve, 35 km<sup>2</sup> of excellent fishing habitat comprising Ngaruangel atoll, about 10 km north of the community of Kayangel. The law puts the atoll completely off-limits for three years, during which time the community will prepare a long-term management plan for the Reserve. One option being considered is for Ngaruangel to be reserved for catch-and-release fishing and perhaps diving.

With this option in mind, the second sportfishing trial, conducted in May, 1998, focused its fishing at Ngaruangel—both to assess the reef in general, and, if possible, to see whether the previous 18 months of closure had had any effect on the atoll's fish stocks. Although only preliminary, the results were impressive.

Fishing action was non-stop at times, and two desired species, the giant and bluefin trevallies, were especially abundant and large. The giant trevally had been completely absent during a fishing trial two years before. The positive fishing results provided important reassurance to the people of Kayangel that their Ngaruangel Reserve initiative was on the right track.

## Outstanding Issues

Important progress has been made in seeing a sportfishery with the right characteristics develop in Palau. Most important have been the local conservation initiatives, the positive assessments of fishing action and economic feasibility, and the gaining of consensus in the communities and among fishermen that such a fishery is desirable. There remain, however, a number of outstanding issues.

### *Distribution of benefits*

First, there is uncertainty as to how to make sure the benefits from the fishery get to the people who need them (e.g. the communities that own the fisheries resources).

Although the entrepreneurial prospects of a sportfishing business look good, no village-based fishermen have yet made the leap of investing in the necessary equipment and gear. In the meantime, experienced and well-financed Koror-based tour businesses are gearing up for fishing. A group of Koror-based boat owners and fishing guides recently organized themselves into a loose sportfishing association, with the idea of cooperating at least in promotion.

Although such steps reflect positively on the prospects for developing a successful industry, there is the concern that the village-based fishermen will be

left behind. It appears that the best strategy, at least initially, will be to encourage the Koror businesses to team up with the village fishermen, the former taking advantage of the fishermen's superior knowledge of the northern fishing grounds.

### *Limited fishing grounds*

The conservation initiatives taken by the community of Kayangel have been very encouraging. But a single reef full of fish in the extreme north of Palau may not be enough to sustain a flourishing sportfishery.

Protection of other fishing grounds, such as the more accessible and sheltered reefs between Kayangel and Ngarchelong, may be necessary. Consultations with Ngarchelong regarding sportfishing and fish conservation have received feedback just as positive as in Kayangel, but little action has been taken by the local leadership. Another area with sportfishing potential—especially deep jigging and trolling—is Velasco, the extensive deep reef extending north from Ngaruangel.

### *Difficult access to fishing grounds*

The long boat ride to the northern reefs and lack of adequate accommodations in the northern villages is a serious constraint to the growth of the industry. Options are now being examined for developing a fishing lodge near the northern reefs.

By the year 2002, there will be a new surfaced road around the island of Babeldaob. The road will allow quick and easy access to the northern tip of Babeldaob, perhaps allowing development of Ngarchelong as a staging area for sportfishing in the northern waters of Palau.

### **National government leadership**

The Palau national leadership, including representatives of the legislature, resource management agencies, and the tourism office, has been involved in this project from the beginning, and support is generally universal.

But the only national-level action taken so far in support of sportfishery development has been some promotion of sportfishing abroad. In addition to its role in creating an environment conducive to industry development, it would seem important that the national government recognize, support, and work to harmonize the community-level management initiatives, especially for local initiatives that require some degree of enforcement effort, such as area closures and permit requirements, national support—both moral and material—is essential for success.

### **Acceptance of sportfishing**

The transition from the occupation of subsistence or commercial fisherman to the occupation of fishing guide is a dramatic one. It is a change from a livelihood in which independence and freedom are central attributes to a service occupation in which the wants of the customer are most important.

It will certainly not appeal to all fishermen. But judging from the high level of participation by

Palauans—all of who are fishermen—in Palau's scuba diving industry, this does not seem to be a serious constraint to the growth of sportfishing. Another question is how prospective guides and others will adjust to the exotic idea of catching fish (and releasing them) for the sake of fun rather than for food.

Again, judging from the success of the scuba diving industry, in which guides take visitors in search of fish merely to look at them, it shouldn't be much of a problem.

### **Industry development**

The most important achievement of the project so far has been gaining a consensus among interested parties—from the resource owners to the business sector—that inshore sportfishing offers a viable long-term alternative use of Palau's fish resources.

Without that consensus, it is likely that as the industry developed, sportfishing guides would have found themselves battling with fishermen over access to dwindling resources, local communities would have felt cheated, visiting anglers would have left disappointed, and Palau would be struggling to improve its second-rate reputation as a sportfishing destination.

Perhaps the project cannot be credited with having avoided quite so much mayhem. But it is clear that the project's step-by-

step approach to industry development has resulted in an environment where all the players are more aware of the risks and rewards of developing a sportfishery and more prepared to work together towards mutually beneficial goals.

One of these players is the entrepreneur who is going to take the risk of putting money into a sportfishing business or a fishing lodge. It is not clear whether these investors are going to be Palauan, foreign, or joint venture.

But after the intervention of this project, it is clear that they will have to be committed to working closely with the communities that own the fish and committed to maintaining the long-term viability of the resource.



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