Fisheries Newsletter

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Editorial

Following the tradition of most Pacific Island anniversaries, you might expect the 100th issue of the SPC *Fisheries Newsletter* to be an excuse for oratory. SPC is a self-effacing institution and we rarely take advantage of this kind of opportunity, however, just this once, I would like to give ourselves a pat on the back.

Delving into the archives, I see that the first SPC *Fisheries Newsletter* was published in April 1971. In fact, SPC has been continuously involved in regional fisheries work since 1952 (the fisheries programme has its 50th anniversary this year). However, 1970 marked the start of a more intensive, project-driven level of involvement, when SPC became the host for the South Pacific Islands Fisheries Development Agency (SPIFDA). The first newsletter, in 1971, was a first attempt at an 'information system which would permit the Territories to be kept up to date on developments in fisheries and marine biology'.

You might say that things have changed a lot since then – there are now around 50 staff working at SPC on various aspects of fisheries instead of the two we had in 1971 – but then again, you might not – the 1971 newsletter notes the arrival of a locally owned longliner with an entirely local crew in one of our member countries, intending to develop the domestic tuna fishery – an achievement which many countries are still working towards.

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Hillary Kasal (Papua New Guinea) holding a mahi mahi during the practical module of the SPC National Fisheries Officer Training Course, which is the only training course specifically designed to cover the skills needed by Pacific Island fisheries officers.

[Photo: Michel Blanc]

in This Issue

SECRETARIAT OF THE PACIFIC COMMUNITY
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FISHERIES DEVELOPMENT SECTION

Most of the activities of the Fisheries Development Section during the first quarter of 2002 centred around the three-year fish aggregating device (FAD) research project that commenced in Niue and Cook Islands in mid 2001, funded by New Zealand. The Section deployed a record number of FADs during the first quarter as part of this project.

Preliminary work on the FAD research project commenced in the second half of 2001, when the Fisheries Development Adviser, Lindsay Chapman, in consultation with counterpart officers in both Niue and Cook Islands, developed the FAD designs to be trialled. After quotes were received from many suppliers, a container-load of materials arrived in each project country in January 2002. Lindsay also identified twenty suitable locations for installing FADs (8 off Niue, 7 off Rarotonga, and 5 off Aitutaki), after discussions with fisheries staff and local fishers in both countries.

Fisheries Development Officer, William Sokimi, conducted all the FAD site surveys around Niue, Rarotonga, and Aitutaki in November and December 2001. In all, nineteen areas were surveyed (two of the sites in Niue were in the same survey area). Computer-generated, three-dimensional plots were produced of each survey area.

Fisheries Development Officer, Steve Beverly, supervised all the rigging and deployment of the FADs in both countries. Steve used the site-survey data collected by William and drew bottom-contour charts that were used to select fifteen FAD deployment sites. In Niue, four shallow-water FADs and four deep-water FADs were rigged and deployed in February. For the shallow-water FADs, a large (200 litre) mussel float was attached to an Indian Ocean type buoy system consisting of five oval, hard-plastic pressure floats and four purse-seine floats, strung alternately on nylon rope (Figure 1).

The buoy systems were designed to have 120 kg of floatation plus enough floatation to support all of the hardware. The deep-water buoy systems consisted of 15 oval, hard-plastic pressure floats and 14 purse-seine floats, strung alternately on nylon rope (Figure 2). They were designed to have 200 kg of floatation plus enough extra floatation to support all of the hardware. The deepest deep-water FADs also had dan buoys with radar reflectors and strobe lights attached to the end of the buoy system. Aggregating devices, consisting of round styrofoam floats strung on PVC-sheathed nylon rope from which strapping material was tied (Figure 3), were attached to the buoy system. Other designs were also prepared for comparison.

Four different mooring types were used on the FADs. One design used 9 mm galvanised wire rope in the upper mooring with 3-strand polypropylene rope in the lower mooring. Another design used lead-core 3-strand polypropylene rope in the upper mooring and regular 3-strand polypropylene rope in the lower mooring. Two of the

Figure 1: Shallow-water FAD buoy system
[Photo: Lindsay Chapman]

designs were more traditional: a reverse catenary mooring using nylon in the upper mooring and polypropylene rope in the lower mooring and a counter-weight design using all polypropylene rope with a chain counter-weight. All of the FADs were anchored with two-tonne concrete blocks.

Figure 2: Deep-water FAD buoy system
[Photo: Lindsay Chapman]

Figure 3: Aggregators to attach to the FAD buoy system
[Photo: Steve Beverly]

The FADs in Niue were deployed from the Public Works Department's vessel, M/V *Tafehemoana* (Figure 4). All deployments used the straight-line method: the FAD buoy system was released first as the boat steamed toward the intended site, the mooring was paid out, the boat crossed over the intended site, and finally the anchor was deployed just past the intended site. In all cases, the deployment vessel steamed from shallow water to deeper water so that the anchor would swing in towards shallower water upon deployment, thus decreasing the chance of losing the mooring in deep water.

For the first five deployments in Niue, a 67/33 per cent formula was used. In other words, the buoy system was released at a distance away from the intended site equal to 67 per cent of the total mooring length. The mooring was paid out as the vessel steamed towards the intended site. The site was crossed over then the anchor was deployed at a distance equal to 33 per cent of the mooring length away from the site. With luck, the anchor would swing back as the mooring came tight and would land very near the intended site. In three of the deployments, a formula of 80/20 per cent was used, i.e. the buoy system was released at a distance equal to 80 per cent of the mooring length away from the intended site and the anchor was deployed at a distance equal to 20 per cent of the mooring length away from the site. Using both these formulae, the anchor landed near the intended sites, but the 80/20 per cent formula resulted in more accurate deployments.

***Figure 4: Deployment vessel used in Niue, M/V* Tafehemoana**
[Photo: Steve Beverly]

In early March, Lindsay headed to Cook Islands to conduct the community surveys in selected villages. As in Niue, where the surveys were conducted in December 2001, the aim of the community surveys was to gather information on the current fishing activities of households in the selected villages. The same survey will be conducted after 12 and 24 months with the same households and the data will be assessed at the end of the project.

Five staff of the Ministry of Marine Resources (MMR) assisted Lindsay with the survey work at different times, with one of the five staff assisting in both Rarotonga and Aitutaki. A total of 202 households were surveyed in Rarotonga in five village areas. As the surveys were being conducted, it became apparent that very few of the fishers fishing outside the reef were included, so an additional 19 fishers from outside the five selected villages were interviewed.

In Aitutaki, 245 households, covering seven villages, were surveyed. There appeared to be a representative sample of fishers in the households surveyed, so no additional fishers were interviewed. A preliminary analysis of the data will be made in the coming months and will be presented in the next issue of the *Fisheries Newsletter*.

Also while in Cook Islands, Lindsay introduced a new catch and effort logbook to local fishers. Two meetings were arranged with fishers in Rarotonga and one meeting in Aitutaki. In total, around 60 fishers attended the different meetings and were issued with a logbook. Logbooks were also distributed by MMR staff to other fishers in both locations. The aim of these logbooks is to collect catch and effort data that can be used to analyse the costs and benefits of FADs to local fishers. This analysis will be conducted towards the end of the project, although the aggregated data will be analysed after six months and presented to the fishers who provided it.

The same logbooks were airfreighted to Niue in late March and were distributed by the Fisheries Department.

Steve arrived in Cook Islands in mid-March to rig and deploy the seven FADs in both Rarotonga and Aitutaki. Two shallow-water and two deep-water FADs were deployed in waters around Rarotonga and three deep-water FADs were deployed around Aitutaki. In Rarotonga, a 40 m cargo vessel, M/V *Manu Nui* (Figure 5), was used to deploy all the FADs. In Aitutaki, the FADs were deployed using a motorised barge and the

***Figure 5: Deploying the FAD anchor block in Rarotonga from M/V* Manu Nui**
[Photo: Steve Beverly]

anchors were released using a forklift (Figure 6). All of the deployments in Cook Islands used the straight-line method and the 80/20 per cent formula, going from shallow water to deeper water as the mooring was paid out. Table 1 summarises the FAD sites and positions for all 15 FADs deployed in Niue and Cook Islands.

The experimental designs used in Cook Islands were based on those used in Niue and used the same buoy systems and the same materials. Only the length of the mooring lines changed to fit the differing deployment depths.

Figure 6: Deploying the FAD anchor block in Aitutaki with a forklift
[Photo: Steve Beverly]

William, who had been on leave for the first two months of the year, commenced a new assignment in Nauru in mid-March. In this new project, William aims to run a series of FAD fishing skills workshops with local fishers and staff of the Nauru Fisheries and Marine Resources Authority (NFMRA), to assist NFMRA with their FAD programme, including the deployment of FADs if materials are available, and to provide training and assistance to the skipper and crew of NFMRA's tuna longline vessel.

In Noumea, the Section was able to hire a part-time graphic artist, Ms Youngmi Choi, in March, to begin some of the many electronic drawings and diagrams needed for the long-awaited technical manual on small-scale and medium-scale tuna longlining. The manual itself is starting to take shape and the diagrams (more than 250) will add to the overall presentation. The English version of the manual is tentatively scheduled for publishing in October or November 2002, with the French version of the manual scheduled to be published several months later.

Table 1: Summary of the FAD deployments undertaken in Niue and Cook Islands from February to early April 2002

Deployment date	Area	Latitude	Longitude	Deployment depth (m)
	Niue:			
8 February 2002	Lakepa	19º 00.000' S	169º 47.375' W	400 m
8 February 2002	Avatele	19º 07.125' S	169º 56.750' W	900 m
11 February 2002	Limufuafua	19º 11.125' S	169º 51.875' W	900 m
11 February 2002	Vaiea	19º 08.875' S	169º 54.125' W	400 m
11 February 2002	Halagigie	19º 04.000' S	169º 59.500' W	800 m
13 February 2002	Toi 1	18º 56.725' S	169º 53.025' W	550 m
13 February 2002	Toi 2	18º 56.225' S	169º 52.150' W	1100 m
14 February 2002	Hikutavake	18º 57.250' S	169º 55.375' W	650 m
	Rarotonga:			
27 March 2002	Matavera	21º 13.000' S	159º 43.000' W	650 m
27 March 2002	Southeast Titikaveka	21º 18.125' S	159º 43.750' W	1150 m
27 March 2002	Rarotongan Hotel	21º 17.500' S	159º 50.250' W	1150 m
27 March 2002	North of Black Rock	21º 10.875' S	159º 48.250' W	550 m
	Aitutaki:			
5 April 2002	West of Maina	18º 56.000' S	159º 52.625' W	950 m
5 April 2002	Southeast of Motukiti	18º 59.500' S	159º 42.000' W	1030 m
5 April 2002	North of Arutanga	18º 48.500' S	159º 47.500' W	960 m

'Still a good FAD, mate!'

'Still a good FAD, mate!' That was the title of an e-mail message that surprised Fisheries Development Officer, Steve Beverly, sent by Tim Park, Fisheries Research Analyst at Micronesian Maritime Authority in Pohnpei, Federated States of Micronesia. Tim was referring to an FAD that had been deployed by SPC in October 2000 at Palikir Passage. The FAD consisted of a single orange plastic buoy and a mooring made up of 3-strand nylon and polypropylene ropes. It was deployed on 24 October 2000 from the tugboat, M/V *Lien Dekehtik*, in 1200 metres of water. The position of the FAD was 06º54.625'N and 158º03.500'E, or about 2.5 nm northwest of Palikir Passage (see *Fisheries Newsletter* #95). Mr Yoster Henry and the rest of the staff at the Artisanal Fisheries Support Station in Koror helped with the rigging and deployment.

However, in December 2000, the FAD was reported missing. This was too soon after its deployment and seemed very unfortunate at the time. Two months later, however, Tim Park announced that he had won the first fishing tournament of the year by catching a boatload of fish near the FAD. Reports of its disappearance had been premature. It may have been difficult to find but it was still there and was working well. Now, fifteen months after the deployment of the FAD, Tim has once again proved that the reports of its disappearance were incorrect.

On 2 February 2002, Tim and Steve Lindsay, Director of Micronesian Aquaculture & Marine Consultant Services in Pohnpei, caught a 205 kg blue marlin (*Makaira mazara*) at the FAD after only five minutes of trolling. Steve was the angler and Tim was the boat operator. It took them a total of three hours to land the fish, however, as it had died and had sunk to a depth of about 250 m. By the time they landed the prize catch, their boat had drifted about eight miles offshore into rough water. The fish was too large for them to handle, so they towed it back to Kolonia and then had to use a crane to lift it. Tim reported that there were several other boats that landed fish the same day, including one that caught around 100 kg of wahoo and mahi mahi. Scientists might be interested to learn that the blue marlin was a ripe female with a fork length of 255 cm.

TRAINING SECTION

The SPC National Fisheries Officer Training Course

The SPC National Fisheries Officer Training Course is the only training course specifically designed to cover the skills needed by Pacific Island fisheries officers. It is an intensive, six-month course, which includes a classroom module run by the Nelson Polytechnic School of Fisheries in New Zealand and a field module at a Pacific Island location. In recent years, this field training programme has been conducted in New Caledonia, thanks to a grant from the Government of New Caledonia.

The course is a model on its own, not only because of its durability – the course has run for over 20 consecutive years – but also for its diversity. Many Pacific Island governments willingly contribute a significant share of the financial expenses. The Government of New Zealand provides the nucleus of the course and the course fees for the New Zealand-based component of the course, while several other donors, particularly the Commonwealth institutions, also contribute .

Every SPC Pacific Island member (except Pitcairn) has sent personnel to attend the fisheries training course and many of these graduates now form the backbone of Pacific Island fisheries services and fishing companies. Graduates have included, for example, the current General Manager of the National Fishing Corporation of Tuvalu, the head of the Fisheries Service in Wallis and Futuna, several heads of provincial and state fisheries services in New Caledonia and the Federated States

of Micronesia, the Director and the Chief Licencing Officer of the Marshall Islands Marine Resources Authority, the Chief Fisheries Officer of Kiribati, and many others.

In recent years, SPC member countries have nominated a number of women for the course, which has traditionally been attended only by males. The course is likely to become one of the most effective routes by which more women can become involved at a high level in the professional work of government fisheries services.

The longevity and success of the course is becoming somewhat of a handicap in keeping it running. All donors naturally seek to wean their beneficiaries away from dependence and any activity that has been running for more than 20 years, however collaboratively, tends to raise questions in the minds of project-cycle managers. The course itself is not static; the content is regularly reviewed, while the course itself is regularly discussed and scrutinised at the SPC Heads of Fisheries Meeting. The main questions asked by donors are not about how effective the course is, but rather, 'If the course is so effective and useful, why is the financing not taken over entirely by Pacific Island governments?', and 'Could the course not be run entirely by an island institution?'.

The course will, in fact, be reviewed again in 2002 with these precise questions in mind, but the short answer is that past attempts at 'regionalisation' have not been sustainable for financial and political reasons. In addition, the tendency of cash-strapped Pacific Island institutions to reduce the practical components of the course, which are the most expensive, in favour of cheaper classroom-based academic content would also reduce the effectiveness of the course.

The avowed aim of the SPC Fisheries Training Section is to 'fill the gaps that established training institutions cannot currently fill', and if the Pacific Island Fisheries Officer Training Course can become self-sufficient both financially and institutionally, then SPC will willingly assist in its devolution.

For the time being, however, the fisheries training course is a primary vehicle for passing on to successive generations of young Pacific Island fisheries managers the collective principles of sound fishery stewardship – principles that are currently changing in a major way worldwide. The course also provides essential practical skills; at this critical stage in the evolution of Pacific Island fisheries management, SPC does not wish to see these skills compromised by the termination of the course.

Participation in the SPC National Fisheries Officer Training Course by country

Country	1979–1996	1997–2000	2001	Total
American Samoa	1	0	0	1
Cook Islands	8	0	0	8
Commonwealth of the Northern Mariana Islands	5	3	0	8
Federated States of Micronesia	16	1	0	17
Fiji Islands	22	2	0	24
French Polynesia	4	1	0	5
Guam	3	0	0	3
Kiribati	17	6	1	24
Marshall Islands	6	2	0	8
Nauru	3	6	1	10
New Caledonia	8	1	0	9
Niue	6	0	1	7
Palau	7	3	0	10
Papua New Guinea	25	2	0	27
Solomon Islands	22	2	0	24
Samoa	9	5	1	15
Tonga	17	6	3	26
Tokelau	4	0	1	5
Tuvalu	13	2	1	16
Vanuatu	13	1	1	15
Wallis and Futuna	2	0	1	3
Total	**211**	**43**	**11**	**265**

The SPC National Fisheries Officer Training Course provides essential practical fishing skills [Photos: Michel Blanc]

In brief

☞ Section staff are actively seeking funds from the donor community. Several needs have recently been identified but the implementation of training activities is pending until the Section can source additional finances. Early in 2002, Section staff prepared and submitted funding proposals to:

- the Government of Taiwan/ROC (for the training and certification of quality-control staff at Pacific Island seafood processing companies);
- New Zealand (for the production of safety-at-sea materials in I-Kiribati and enterprise management training for the Palau Federation of Fishing Associations);
- France (for providing specialised training for fishing vessel engineers and on-the-job training attachments for aquaculture technicians);
- Australia (for the apprenticeship programme for Pacific Island fishing vessel engineers and the 2003 SPC/Australian Fisheries Academy traineeship programme for Pacific Island fishers); and
- Japan (for developing a training package that addresses bycatch issues in pelagic longlining).

☞ A funding proposal submitted to the Government of Taiwan/ROC was approved in March. The corresponding grant will enable the Section to run at least three in-country HACCP workshops for the quality-control staff of seafood companies. Requests for HACCP training assistance have been received from Palau, Fiji Islands and Solomon Islands. The workshops in Palau and Fiji Islands are scheduled to be held in August 2002.

☞ Following a request from the Palau Bureau of Marine Resources (BMR), Section staff travelled to Micronesia in January. The purpose of that visit was to assist BMR to assess training needs in the fisheries sector and to plan SPC's future assistance accordingly. A series of training activities will take place as follows: SPC Fisheries Development Section will implement a tuna longlining

training programme aimed at screening local crews for prospective domestic longliners; the quality-control staff of local seafood processing and retailing companies will benefit from a HACCP workshop scheduled in August; provided funding is identified, enterprise management training will be provided to staff of the Palau Federation of Fishing Associations (PFFA); and a training attachment is also earmarked for the future skipper of BMR's training and research vessel.

- SPC Training Video #13 is under production. Using the remaining funds from a Taiwan/ROC-funded aquaculture project, the Section has hired a video production company in Kiribati (Nei Tabera Ni Kai video unit) to produce a video on seaweed farming. The aim of the movie is to promote seaweed farming as a potential income-earning activity for coastal communities. The movie is expected to be available in August/September and will complement a more technical video being produced by the University of the South Pacific (USP).

- A manual for the co-management of commercial fisheries in the Pacific was widely distributed in January. Written by Peter Watt from Samoa Fisheries Division, the manual promotes the involvement of stakeholders in the management of commercial fisheries resources. In his work, the author focuses on the system in Samoa, where the Commercial Fisheries Management Advisory Committee (CFMAC) advises on fisheries management, as he believes this system could be easily adapted to suit other Pacific Island countries. Persons interested in obtaining this publication should contact the SPC Fisheries Training Section.

- In March, Section staff attended the annual regional meeting organised by the SPC Maritime Programme. As part of the meeting, a workshop on Safety Management Systems (SMS) gave the Section the opportunity to present the SMS resource materials it has recently developed. Of particular interest to meeting participants were the model systems for medium-sized and small vessels. Subsequently, some countries, including Papua New Guinea, are considering the introducing SMS into their legislation for non-convention vessels (vessels under 500 GT). Model systems are available from the Section, in both electronic and paper forms.

- The second SPC/AFA Traineeship Programme for Pacific Island Fishers ran from January to March in Adelaide and Port Lincoln (South Australia). Stories about this successful training programme can be found in this issue, in the article written by the Australian Fisheries Academy (AFA)'s Managing Director, Grant Carnie.

- This year's SPC/Nelson Fisheries Officers Course started at the New Zealand School of Fisheries on Monday 21 January. Ten trainees from nine countries attended the course. The practical fishing component will be run in Koumac, in the Northern Province of New Caledonia, from May 28 to June 28. As in recent years, this practical training will be co-ordinated by the staff of the Training Section with technical and teaching inputs from Steve Beverly (Fisheries Development Section), and staff from the local fisheries department and maritime college. Koumac hosts a new tuna longlining company, Pêcheries de Nouvelle Calédonie (PNC), which will make its infrastructures available to SPC for the duration of the course. In return, Section staff will train PNC processing staff on tuna grading. A detailed report on the 2002 practical fishing module will be given in the next issue of the *Fisheries Newsletter*.

- After the tuna handling and training workshops held in Nauru late in 2001, the Section will continue to assist the local tuna industry by training prospective skippers of tuna longliners. The Nauru Fisheries and Marine Resources Authority (NFMRA) is in the process of acquiring its first 'super-alia' longliner built in Samoa. In that context, and for safety and insurance purposes, NFMRA skippers need to hold a suitable certificate for that type of vessel. The Section is offering to contribute to the training costs of acquiring such a certificate and envisages that two prospective skippers will go to the Fiji School of Maritime Studies to sit a Class 6 master/engineer's ticket.

COMMUNITY FISHERIES SECTION

Mejato Islanders move towards community fisheries management

The community of Mejato Island, in the northeast of Kwajalein Atoll, is the first in the Republic of Marshall Islands and Micronesia to implement a community-based fisheries management programme. Metjao's interest stemmed from the workshop conducted by SPC in March this year at Majuro to promote the participation of local communities in the management of subsistence fishery resources and the marine environment.

In April this year, the Community Fisheries Adviser travelled to Mejato with the staff of the Marshall Islands Marine Resources Authority (MIMRA) and spent one week conducting a series of community workshops for the island community. The workshops aimed to educate the Mejato community on how to formulate a fisheries management plan so that it can properly look after its fishery resources and marine environment. All sectors of the community, including men, women, and the youth group were involved in workshop sessions. During the workshop, community members discussed the problems facing Mejato's fishery resources and identified community management actions that would help resolve the problems. Some of the actions identified by the Mejato community required technical support and services to be provided by MIMRA.

During their week's stay in Mejato, the Adviser and his team were able to introduce all the community members to the importance of marine resources. Two workshop sessions were conducted for the women, two for the men, and one for the youth group. Two presentations of one hour each were also delivered to the junior and senior classes of Mejato Elementary School. Sectors of the Mejato community have appointed the members of the Fisheries Management Advisory Committee who will be meeting in Majuro to continue examining issues which are important for their fisheries management plan and to begin drafting the plan.

Florance Edwards doing a presentation for the Junior classes at Mejato Elementary School
[Photo: Ueta Fa'asili]

Terry Keju in his presentation for the senior classes of Mejato Elementary School
[Photo: Ueta Fa'asili]

One of the workshop sessions for women in Mejato
[Photo: Ueta Fa'asili]

AQUACULTURE SECTION

Inaugural SPC Aquaculture Meeting held in Suva, March 2002

Introduction

The first SPC Aquaculture Meeting, entitled 'Building Capacity for Aquaculture in the Pacific', was held at the University of the South Pacific (USP) in Suva from 11 to 15 March 2002.

The meeting formed part of the process of developing the plan of action for implementing the SPC Regional Aquaculture Programme. Moreover, it provided one of the few opportunities in recent years for regional consultation to take place amongst aquaculturists. The objectives of the Suva meeting were to:

- understand and benchmark the status of aquaculture in the SPC region;
- advance networking amongst aquaculturists working in the SPC Pacific Island countries and territories and amongst interested parties in and beyond the region;
- select a shortlist of the aquaculture commodities that will become the primary focus for the SPC Regional Aquaculture Programme's commodity-based work. This process led to the identification of regional priority needs for aquaculture commodity development and the designing of a strategic action plan to address the priority needs identified.

Participants and working groups

About sixty participants from twenty countries attended the meeting. They represented a cross-section of government organisations, the private sector, regional organisations and non-governmental organisations (NGOs). The USP aquaculture postgraduate students also participated fully in meeting discussions, enabling them to secure their stake in the future development of the industry.

Most of the work during the meeting was done in a group setting. Participants were allocated to small groups of about five people representing a mix of countries and organisations. After consensus was reached in each group, a representative

About sixty participants from twenty countries attended the meeting [Photo: Litiana Waqalevu]

would address the plenary. Working in small groups is a recognised and effective way of stimulating discussion. The small-group format also saved time during the course of the workshop by avoiding the need for breakout sessions.

The composition of the groups was changed to more specialised aquaculture-commodity grouping once the priority commodities were identified later during the meeting.

The status and main features of aquaculture in the region

National reports were presented to the meeting in Powerpoint format. They addressed the main features of the aquaculture sector, trends in production, markets and uses, aspirations for the sector, the major advantages and potential for aquaculture, and the major impediments and constraints to achieving the national aspirations.

In summary, aquaculture in the Pacific is expanding and diversifying. Commercial industries for the culture of pearls, prawns, seaweed, and tilapia are established in various parts of the region. A rough estimate of the value of aquaculture production in the region would be in the order of USD130–180 million per annum.

Some highlights from the country presentations were as follows:

- Mr Flinn Curren from American Samoa described the fledgling giant clam and tilapia markets and the potential aquaculture industry for tuna baitfish.

- Mr Ian Bertram of Cook Islands highlighted the need for training in pearl seeding, quality controls, environmental management, and ways to address the labour shortage in the cultured black pearl industry. Black pearl exports for 2001 were down from the year 2000, probably due to the disease that struck the pearl oysters in Manihiki lagoon.

- Mr Satya Nandal described the diverse aquaculture industry in Fiji Islands. The polyculture of prawns and fish is growing. Mud crabs are being investigated as a potential new brackish water species. The domestic demand for prawns is about 600 mt per annum of which only 200 mt is wild or locally farmed produce. Plans are afoot to export tilapia to the United States and Australia.

- Mr Peter Jacob from Nauru described the efforts to eradicate the introduced Mossambique tilapia (*Oreochromis mossambica*), which have impaired the traditionally significant practice of farming milkfish (*Chanos chanos*). Barramundi (*Lates calcarifer*) may possibly be useful as a biological control in infested ponds. Trials indicate the feasibility of co-farming the Nile tilapia (*O. nilotica*) with milkfish.

- Mr Roman Yano presented visual images of the hatchery facilities of the Palau Mariculture Demonstration Center (PMDC). He described the progress made in propagating juvenile groupers (*Plectropomus* spp. and *Epinephelus* spp.). The PMDC is also involved in breeding giant clams and trochus.

- Augustine Mobiha from Papua New Guinea (PNG) pointed out that there are already about six-thousand pond farmers in his country, an indication of the huge scale of development in PNG. Potential opportunities exist in the pristine waters of the highlands and coastal areas. Domestic production for carp sales is about 60 mt, with trout and barramundi emerging as important local and export products. However there is a need to develop local feeds for the former two species.

- According to Mr Nikolasi Apinelu from Tuvalu, modern aquaculture industry is non-existent there. However, the holding and relay of wild fish and shellfish has been commonly practised. In the past, staff training in milkfish rearing has occurred in Asia. Milkfish fry is readily available from Vaitupu. Some commodities of interest include giant clams, cultured pearls, and seaweed.

- Mr Sompert Gereva explained that, in Vanuatu, hatchery production of giant clams and trochus is intended for restocking purposes. Some traditional forms of polyculture aquaculture are practised, such as freshwater prawns in taro terraces.

- Mr Barney Smith delivered a paper written by Matthew Dadswell about the Australian experience in aquaculture management and planning. Aquaculture in the year 2000 was worth USD350 million. As Australia is a federation of states and territories, there is an interactive process in place to develop strategies, standards, and trade-sharing agreements. The paper highlighted the systems and policies guiding issues such as animal health, quarantine, and invasive pests. These are common concerns among the Pacific Islands.

- Mr Terii Seaman's presentation revealed that aquaculture in French Polynesia is very well developed. Commercial production includes prawns (*Litopenaeus* spp. and *Macrobrachium* spp.), blue tilapia (*Oreochromis aureus*), barramundi, and lagoon fish. Commodities with economic prospects include trochus, ornamental fish, and giant clams. Cultured black pearls continue to be the major export, although the value in 2001 was much less than in previous years. Terii's talk injected a dose of realism for countries contemplating pearl culture as he described the strict quality-control measures being imposed to offset the overproduction of inferior products.

- According to Mr David Crisostomo, the main aquaculture product in Guam has been tilapia, although this could be displaced by prawns (*Penaeus* spp.) by the year 2003. Other fish cultivated in recent years include species of carp, milkfish (used as baitfish), and Thai catfish (*Pangasius sutchi*). Guam has over 100 acres of earthen ponds for aquaculture. The University of Guam has introduced technology for re-circulating ponds.

- Mr Johnny Kirata's presentation from Kiribati showed that seaweed (*Kappaphycus alvarezii*, commonly known as *Eucheuma*) is still a major product, with more than 1000 mt exported in 1999. Kiribati has 860 hectares of natural and manmade ponds. Traditional and integrated forms of milkfish farming are being investigated. The culture of the brine shrimp (*Artemia salina*) may be revitalised. Milkfish are sold live for baitfish and smoked milkfish is becoming a delicacy for locals and neighbouring countries. Research is ongoing into hatchery production and farming of the black-lip pearl oyster (*Pinctada margaritifera*) and the white teatfish sea cucumber (*Holothuria fuscogilva*).

- Ms Malvine Lober from Samoa described the many types of aquaculture that have been trialled in the past. However, aquaculture still remains a minor industry in terms of national statistics. There are two main types of aquaculture: (1) village-level subsistence culture of tilapia in existing water bodies and stock enhancement of giant clams and (2) small-scale commercial production of giant clams for export to the aquarium market.

- Mr Gideon Tiroba from Solomon Islands reported that commercial prawn farming and giant clam hatchery production have been closed due to the recent ethnic tension. However, ICLARM is still operating its demonstration pearl farm. A small amount of seaweed is produced with 16 mt expected by the year 2002. Aspirations for the future include the commercialisation of pearl farming, the expansion of the seaweed industry, the restocking of over-harvested resources such as giant clam, trochus, and sea cucumber and the restarting of prawn farming.

- Tevita 'Ahoafi reported that over the past forty years Tonga has amassed a large amount of research into various species as candidates for aquaculture. Few have developed to commercial fruition. Giant clam for the overseas aquarium market and seaweed (*Cladosiphon*

Ms Malvine Lober informing participants of the status of aquaculture in Samoa
[Photo: Jean-Paul Gaudechoux]

sp.) exports to Japan are the main forms of production. However, pearl culture has potential. The government is also supporting efforts to restock and conserve the giant clam, trochus, and green snail fisheries.

- Francis Itimai's country report for the representative of the Federated States of Micronesia stated that black pearl farms are operating in Nukuoro atoll. The College of Micronesia Land Grant Program has established a research/demonstration hatchery and laboratory for pearl oysters in Pohnpei State. The feasibility of culturing mud crabs in enclosures is being investigated.

Last-minute changes meant that the national representatives from New Caledonia, Federated States of Micronesia and Marshall Islands were unable to attend the meeting.

Understanding the technical potential of aquaculture commodities

After a session describing the status of national and regional aquaculture development, the meeting turned to a more technical appraisal of the potential for aquaculture commodities.

Dr Johann Bell from the International Center for Living Aquatic Resources Management (ICLARM) set the stage by recapping the history of aquaculture development in the Pacific and highlighting the important role that aquaculture can play in enhancing the stock of capture fisheries.

Warwick Nash (ICLARM) then introduced the main working document, 'Profiles of high-interest aquaculture commodities for the Pacific Island nations'. This document, edited by Warwick, is a compilation of resource profiles of seventeen aquaculture commodities and was produced specifically for the meeting. Many of the profiles were received at the last moment; the staff from the Australian Centre for International Agricultural Research (ACIAR) are to be congratulated on the professional layout of the document, achieved in such a short time. The list of commodities, the authors of the profiles and the experts consulted are outlined in the table below.

For those interested, the commodity profiles will be posted on the SPC aquaculture website, which is currently under construction:

http://www.spc.int/aquaculture

Warwick is also planning to develop the commodity profiles into a more comprehensive review focusing on the priority commodities selected during the meeting.
After a summary presentation of the commodity profiles by Mark Gervis, participants were given some time to mull over the resource profiles.

After a thorough exercise in setting priorities, eight commodities were identified as top priority for regional development: corals, giant clams, prawns (*Macrobrachium* spp.), milkfish, pearl oysters, sea cucumbers, seaweed, and tilapia.

Developing the SPC Action Plan

The meeting then identified an Action Plan for the regional development of each priority commodity. SPC will act as the regional focal point, instigating and co-ordinating aquaculture networking in the Pacific. The plan identifies objectives and deliverables. It notes the lessons

Commodity	Author and experts consulted	Commodity	Author and experts consulted
Pearl oysters	Paul Southgate, Kim Friedman, Neil Sims	*Spiny lobsters*	Kevin Williams, Clive Jones, Ram Mohan
Penaeid prawns	Hassanai Kongheo	*Mud crabs*	Collin Shelley, Clive Keenan, Mike Heasman
Giant clams	John Lucas, Idris Lane	*Tilapia*	Peter Mather, Satya Nandlal
Sea cucumbers	Stephen Battaglene, Steve Purcell	*Seaweed*	Tim Pickering
Macrobrachium shrimp	Chan Lee, Satya Nandlal, Peter Mather, Kevin Williams, Xiaowei Zhou	*Tropical abalone*	Tanetr (Tim) Pumtong, Mark Gervis
Trochus	Chan Lee, Steve Purcell, Bob Gillett	*Sponges*	Michelle Kelly-Shanks, Chan Lee, Graham Dobson
Aquarium fish	Cathy Hair, Johann Bell, Being Yeeting, Vincent Dufour, Paul Lokani	*Carp*	Xiaowei Zhou
Groupers	Mike Rimmer	*Coral*	Austin Bowden-Kerby, Bruce Carlson
Milkfish	FAO, Rolando Platon		

[Note: The names underlined represent the main authors of the commodity profile booklet, which was prepared for the Aquaculture Meeting under the supervision of Warwick Nash.]

learnt from past experiences, the countries where the main focus will be, the people who need to be involved, and the types of assistance and actions that need to occur within the next three years.

The table below lists some of the actions called for to develop the priority commodities over the next three years.

Special presentations

The participants witnessed a series of special presentations:

- Mr Robert Smith from the South Pacific Applied Geoscience Commission (SOPAC) demonstrated the application of geo-referenced multiple-beam sonar for mapping pearl farm areas and lagoon depths in Manihiki lagoon, Cook Islands.
- Dr Simon Funge-Smith from the Food and Agriculture Organization of the United Nations (FAO) office in Bangkok and Ms Natalie Macawaris-Ele from the FAO office in Apia outlined FAO plans for regional projects on legislation, seaweed farming, and country profiles.
- Dr Tim Pickering led a session in which the USP graduate students introduced their research projects.
- Dr Kenneth MacKay, coordinator of the Canada-South Pacific Ocean Development (C-SPOD) Program, described a marine ornamental accreditation scheme being funded by Canadian aid under the C-SPOD project.
- Mr Maciu Lagibalavu, Director of Fiji Fisheries, presented the results of his investigation of the Network of Aquaculture Centers for Asia-Pacific (NACA) and its links to the Pacific.
- The NACA Director General, Mr Pedro Bueno, aptly presented an overview of NACA.
- Mr Terii Seaman gave a presentation outlining the controls on pearl quality being implemented by Service de la Perliculture, the French Polynesia Government agency for pearl culture.
- Mr Ben Ponia presented a prototype of the proposed SPC aquaculture website.

Actions called for to develop the priority commodities for aquaculture over the next three years

Commodity	Actions
Coral	• Host a regional forum to identify partners, market demand, and mechanisms to interact with growers. • Support the demonstration and research site at Makogai Island, Fiji Islands.
Giant clams	• Analyse the lessons learnt in community management (for example in Samoa) to support regional needs. • Establish an information network for culturing giant clams.
Prawns (*Macrobrachium* spp.)	• Undertake a comprehensive review of *Macrobrachium* spp. in the Pacific. • Assess the potential for integrating the culture of indigenous species into agricultural practices (for example, culturing *Machrobrachium lar* in rice paddy fields).
Milkfish	• Conduct a market analysis of the baitfish requirements for tuna fishing.
Pearls	• Organise a high-level government consultation among the major producers (in French Polynesia and Cook Islands) to discuss marketing issues. • Consolidate a list of reputable pearl seeding technicians. • Disseminate information on the best environmental management practices.
Sea cucumbers	• Identify sites where restocking is required to rebuild biomass. • Support demonstration and research in New Caledonia (ICLARM).
Seaweed	• Identify the key socio-economic indicators for establishing criteria to gauge the feasibility of introducing seaweed farming in the community. • Resolve collection issues between producers and local buyers/exporters.
Tilapia	• Improve fish strains through selective breeding programmes (for example, in Fiji Islands). • Identify better feed formulations (Papua New Guinea to take the lead).

Study tour

Dr Tim Pickering led the participants on a study tour of the USP Marine Studies Program aquaculture facilities located on the lower campus. A display of graduate research projects was provided. A variety of research projects are being undertaken, including an investigation of factors affecting coral morphology (such as colour), breeding of ornamental shrimp, the growth of live rock (rock with live organisms such as sponges or ascidians attached), and tilapia growth trials. Research into breeding Penaeid prawns is also being conducted. Mr Tony Chamberlain, Lecturer, Marine Studies, also showed participants the post-harvest facilities suitable for aquaculture.

There followed a tour of the Montfort Boystown facility where the resident students maintain chicken and vegetable farms integrated with fish (tilapia and carp) farms. The culture of ornamental fish and mud crabs has also been recently trialled.

The tour continued to the Fiji Fisheries Department Naduruloulou Aquaculture Research Station

where Mr Satya Nandlal explained developments in the culture of tilapia strains, carp fish, ornamental goldfish and Macrobrachium prawns. At Naduruloulou, aquaculture feeds from local products are also being investigated.

The day finished in a fitting way, with the Fiji Fisheries staff hosting everyone at Naduruloulou to a delicious feast of tilapia and shrimp, complemented by kava.

Acknowledgements

The Australian Agency for International Development (AusAID) provided major funding for the meeting through the AusAID-SPC regional aquaculture project. The ACIAR also provided funding support.

The aquaculture meeting was the result of months of planning by a small drafting group, which included Mr Barney Smith from ACIAR, Mr Johann Bell from ICLARM, Mr Tim Pickering from the University of the South Pacific (USP), Ms Natalie Macawaris-Ele from FAO, and Government officials from Fiji Islands. Marie-Thérèse Bui, SPC staff member, provided valuable logistical and secretarial support.

A tour of the Fiji Fisheries Department Naduruloulou Aquaculture Research Station was organised for the participants
[Photo: Jean-Paul Gaudechoux]

Import Risk Analysis Workshop for Aquatic Animals

Import Risk Analysis, what does it mean?

Import Risk Analysis (IRA) is a term that aquaculturists are probably hearing often these days. However, IRA issues are not new to aquaculture. For instance, IRA relates to aspects of trans-shipments and quarantine, which have long been priority concerns in the Pacific region.

IRA is the process of identifying the hazards associated with the movement of a commodity and assessing mitigative options and/or managing the risks. Hazards could be, for example, diseases or introduced pests. Movements include either international or local transplants. The IRA process requires the results of the hazards or mitigative analyses to be communicated to the proper authorities responsible for approving or rejecting the import.

Persons interested in further information may refer to a 2001 publication by FAO and NACA entitled *Manual of Procedures for the Implementation of the Asia Regional Technical Guidelines on Health Management for the Responsible Movement of Live Aquatic Animals* (FAO technical paper 402/1).

IRA workshop

From 1 to 6 April 2002, Steve Angus, SPC's Veterinary Epidemiologist, visited Bangkok to participate in an expert consul-

tation among Asia-Pacific Economic Cooperation (APEC) countries on the IRA of aquatic animals. More specifically, the purposes of his visit were:

- to represent SPC at the APEC Fisheries Working Group (APEC/FWG 01/2002) first training course and workshop on capacity and awareness building for the IRA of aquatic animals;
- to meet with personnel involved in risk analysis and aquaculture from the Asia-Pacific region;
- to contribute to the workshop the experiences gathered from the IRA of animals and animal products from the Pacific region; and
- to explore the possible role of SPC in capacity building for the IRA of aquatic animals and their products in the Pacific region.

Issues relevant to the Pacific region

A summary of Steve's conclusions and recommendations from the workshop for the Pacific region follows.

- Import risk analysis for aquatic animals is best tackled by a team approach. While veterinarians may have experience in the IRA of animals and animal products as well as the experience and professional infrastructure for certification, they often lack detailed knowledge of aquaculture and aquatic animal disease. Fisheries staff, on the other hand, may have the expertise in aquaculture and aquatic animal disease but often lack experience in IRA and certification. Given these constraints, it is recommended that SPC promotes a joint approach to the IRA of aquatic animals between fisheries and animal health departments.
- Increasing numbers of countries in the Pacific region are joining the World Trade Organization, which stipulates that any trade restrictions should be based on IRA. This also applies to trade in aquatic animals and aquaculture products within the region and with countries outside the region. This will in turn mean an increase in the number of IRAs required to be carried out. It is therefore recommended that SPC takes a lead role in capacity building within its member countries and territories for the IRA of aquatic animals and their products.
- At present, there is very little expertise or experience in IRAs of aquatic animals and their products within the Pacific region. It is recommended as a short-term measure that, while capacity building is underway, SPC should assist individual countries with IRAs as requested. This will require SPC to have a response plan in place to deal with these requests and to make it known to its member countries and territories that this service is available.
- Each country will have to identify the competent authority to carry out IRAs and to assist third countries to carry out IRAs by examining and certifying aquatic animals and their products. It is recommended that SPC assists in this planning process for member countries and territories, being mindful of the joint approach mentioned in the first point above.
- It became very obvious during the IRA workshop that the information required to carry out an IRA of aquatic animals is often scant or missing. To assist in the

Participants at the Import Risk Analysis Workshop for Aquatic Animals
[Photo: Steve Angus]

process of IRAs in the Pacific, it is recommended that SPC collects this information as an archive so that some data on the subject can be available to member countries and territories. In the future, this may be supplemented by a database on the Internet to allow the widest possible access to the information.

Additional reading

Steve's recommendations are consistent with the following past SPC papers and publications:

Eldredge, L.G. 1994. Introductions of commercially significant aquatic organisms to the Pacific Islands. Noumea, New Caledonia: Secretariat of the Pacific Community.

Humphries, J.D. 1993. Risk associated with movements of marine animals: disease and quarantine implications. Paper presented at the First SPC/OIE Regional Technical Meeting of Heads of Veterinary Services, Noumea, New Caledonia, 15–18 November 1993. Noumea, New Caledonia: Secretariat of the Pacific Community.

Humphries, J.D. 1995. Perspectives in aquatic exotic species management in the Pacific Islands, Volume II: Introductions of aquatic animals to the Pacific Islands: disease threats and guidelines for quarantine. Noumea, New Caledonia: Secretariat of the Pacific Community.

FAO Committee of Fisheries First Session for the Sub-committee on Aquaculture and the World Aquaculture Conference 2002

In April 2002, Ben Ponia, SPC Aquaculture Adviser, travelled to Beijing, China to participate in the FAO Sub-committee on Aquaculture and the World Aquaculture Conference 2002.

COFI Sub-committee on Aquaculture

The Sub-committee on Aquaculture was formed as a result of a recommendation arising from the 23rd Session of the Food and Agriculture Organization of the United Nations (FAO) Committee of Fisheries (COFI) held in February 2000. The approval for the formation of the Sub-committee was given in recognition of the growing importance of the aquaculture sector and culture-based fisheries. The Sub-committee will be a global intergovernmental mechanism for exchanging information and building consensus and a means to advise and guide COFI and FAO.

The Beijing session was the first meeting of the Sub-committee on Aquaculture. The meeting was attended by members of FAO and representatives from specialised agencies of the United Nations, and from intergovernmental and international non-governmental organisations (NGOs). Many of the national FAO representatives also represent their countries on COFI. There were two Pacific Island nations present, Fiji Islands and Tonga. SPC was the only Pacific regional agency present.

Mr Ichiro Noumura, Assistant Director General, opened the meeting on behalf of FAO. His Excellency Qi Jingfa, Vice Minister for Agriculture, represented the Peoples Republic of China. Mr Glen Hurry from Australia was nominated as chairperson for the meeting.

At the meeting, global issues and recommendations to COFI were discussed. The FAO representatives presented working papers to the plenary, which were the starting point for deliberations. The four working papers addressed:

(1) aquaculture development and management: status and prospects;

(2) the role of aquaculture in rural development;

(3) the implementation of aquaculture-related provisions for the Code of Conduct for Responsible Fisheries; and

(4) better reporting.

The Sub-committee identified four priority areas for future work:

(1) 'Creating an enabling environment for the promotion of aquaculture development and management', which highlights the need for guidelines on certification procedures and a comparative costing of aquatic food production in relation to other terrestrial food production;

(2) 'Establishing a framework for rural aquaculture', which encompasses development issues such as the environment, fishery conservation, economic viability, and impacts on women;

(3) 'Education, information sharing and capacity building',

with special emphasis on collaboration at all levels from sub-regional to regional and bilateral, south-south cooperation, and technology transfer; and

(4) 'Data collection and reporting to improve knowledge and management of the sector', which includes training in data management and guidelines for clearer definitions to be used in the sector.

The Canadian representative raised an interesting proposal, suggesting that the bad name that aquaculture has acquired due to its supposed adverse environmental impacts needs to be changed in the public eye. In order to improve the public image of aquaculture, the environmental impacts of aquaculture should be compared to those of terrestrial food production. Such a global analysis is suited to the realm of FAO. The resulting information needs to be fed into the mainstream media.

World Aquaculture Conference 2002

The World Aquaculture Conference was organised by the World Aquaculture Society (WAS). This conference drew more than a thousand international participants. Held over four days, it comprised 45 sessions. Key topics included biotechnology, sustainability and the environment, quality management and food safety, poverty alleviation and food security, polyculture systems, seaweed/algae culture, live-feed culture, intensive systems in Asia, inter-regional networking, stock enhancement, and land tenure and property rights.

The various exhibitions on display formed half of the event; weaving through all the booths took at least half a day. The large companies in particular used the occasion to showcase their spending power with very elaborate booths. Almost every aquaculture product and new technology was on display, ranging from herbal remedies for sick fish to the latest strains of probiotics.

The SPC Aquaculture Adviser delivered a paper entitled 'An aquaculture network in the Pacific Islands: Purposes, prospects and opportunities for linkages with other organisations'. The Pacific is in a favourable position to form aquaculture networks through the well-established fisheries networks, the Council of Regional Organisations in the Pacific (CROP), and the Pacific Islands Forum leaders' meeting. Some countries in Africa and Latin America have had difficulties in establishing networks because of the lack of inter-regional organisations and the dominance of private sector interests in their area.

There was a special session on pearl culture. Bernard Poirine, an economist from the local university in French Polynesia, gave a very extensive presentation on the overproduction in eastern Polynesia, attributed to the 'tragedy of the commons'. He showed how profits decrease as the number of farms increase and suggested that a farm quota system is essential to maintain profits within the maximum yield of the lagoon.

The conference was also an eye opener as to the huge scale of development in China. One Chinese professor has three-hundred aquaculture graduate students at his university.

The World Aquaculture 2004 conference will be held in Hawai'i. This Pacific location will provide an excellent opportunity for the Pacific aquaculture industry to showcase its products. The 'Pearls 94' conference, which many view as a milestone for the industry, was also held in Hawai'i.

REEF FISHERIES ASSESSMENT AND MANAGEMENT SECTION

The DemEcoFish Project's Second Field Trip

The DemEcoFish project's second field research mission was successfully completed in two villages in the Vava'u island group of Tonga from late February to 23rd March 2002. Staff on the mission collected relevant socio-economic data concerning fishing grounds, fishing, and the collection, consumption, and marketing of reef and lagoon marine resources from households, individuals, fishers, and students of the two villages of Mataika (on the main island) and Ovaka island. Further to the project's pilot survey, information was gathered on key parameters aimed at testing for relationships between patterns of marine resource consumption and nutritional/health status expressed in occurrence of lifestyle diseases. These data sets were also completed for the two pilot project survey sites on Ha'apai, the villages of Koulo and Lofanga.

During this mission, the diving team performed almost 50

underwater visual censuses (UVCs) of commercial fish species and about 35 such surveys of total fish species in the fishing grounds of both villages. The UVCs also included data collection on habitat structure. Fish species possibly new to Tonga were collected and identified.

For both parts of the survey, improved and extended methodological approaches were applied and evaluated and proved to be adequate.

This mission involved staff from SPC's Reef Fisheries Observatory and the French Research Institute, Institut de recherche pour le développement (IRD), complemented by personnel from the Tonga Ministry of Fisheries Vava'u office, and officers from the Tonga Ministry of Forestry to facilitate the UVC and socio-economic surveys. People of both communities, as well as fish-shop owners and fishers on Vava'u, were highly cooperative and supportive in participating during this mission.

With this the second data set completed in Tonga, analysis now allows the comparison of ecological, fish, and socio-economic parameters between the two island groups of Ha'apai and Vava'u. From this comparison, initial trends emerge regarding the estimation of fishing pressure, diversity and biomass of fish populations, degree of urbanisation, dependency on marine resources, consumption patterns, fishing strategies, and marketing systems.

Fish-shop owners and fishers were very cooperative during the survey
[Photo: Mecki Kronen]

The socio-economic survey of the remaining two communities in Tonga, both located on the main island of Tongatapu, is planned to take place in the beginning of June 2002. Underwater visual censuses and additional socio-economic research will be carried out from late July to mid-August 2002 in a mission planned to involve a number of visiting scientists. Preparations to implement comparative surveys in Fiji Islands are under way.

SPC Pacific Regional Live Reef Fish Trade Initiative: an update

The SPC Pacific Regional Live Reef Fish Trade Initiative (referred to in this article as the 'Pacific LRFT Initiative'), funded through the Asian Development Bank (ADB) Regional Economic Technical Assistance (RETA), was in full swing for most of the year 2001 and up to the first quarter of the year 2002. For completeness, the present article gives a description of all activities implemented to date from the last description of activities published in the #97 edition of this newsletter.

The field activities conducted included fisheries assessment surveys, evaluation of management frameworks, and the provision of advice and recommendations on management measures and monitoring programmes for the live reef fish trade (LRFT) in various Pacific Island countries. These activities are described below.

Resource surveys of aquarium and live reef fish in Efate, Vanuatu

In reply to a request from the Vanuatu Department of Fisheries for assistance to assess their live reef food fish resources and set up management guidelines, a trip was made from the 13 to 24 August 2001. This request met the requirements of the ADB RETA activities and therefore funding to conduct the fieldwork was available.

The initial request was to conduct an assessment of three islands in Vanuatu: Efate, Malekula and Santos. Given the logistical difficulties and the limited time and funds, it was agreed that the work should concentrate on Efate alone and that the fieldwork should be used as an opportunity to introduce the assessment methodology to the local fisheries officers and where possible train them in the use of the method.

In all, 19 sites were surveyed, giving a total of 38 transects. These transects consist of two 15-minute swims at 10m and at 20m depths. The number and size of grouper species and humphead wrasses were recorded.

The number, size, and number of harems were also recorded for all the important aquarium trade fish species. Sites were selected around Efate to give good coverage, taking account of the fished and unfished areas identified by local fisheries officers, for comparison. The sites were mostly on the leeward side of the island and where the sea conditions made it possible to conduct the surveys. No sites were surveyed on the windward side due to rough sea conditions.

As part of the capacity building exercise for the local fisheries officers, some time and effort was given to training them how to use the survey method. One of the main problems found was the difficulty of identifying the fish, especially the aquarium fish species. The use of fish identification templates or fish picture cards that can be used underwater is a possible solution. These cards are now being developed as part of the awareness package and will be provided once they become available.

The results of the survey are being written up in a technical report that should be completed by the end of June 2002. Some preliminary observations were that groupers were generally in low abundance; however, this observation should be verified further with a few more repeat surveys in the same sites. The aquarium fish resources seem more capable of sustaining some level of export. To make this fishery sustainable, the Vanuatu Fisheries Department needs to formulate management measures as soon as possible. The pending report will aim to provide some initial management measures and guidelines based on the survey findings.

Assessment of the live reef food fish resources of Ha'apai, Tonga

In early 2001, some Chinese foreign investors showed up in Tonga seeking permission to start LRFT operations. This resulted in the Ministry of Fisheries sending a request to SPC for advice and technical assistance. Part of the advice given was to withhold any operations until the resources had been assessed.

In May 2001, funding was approved by ADB as an extension of the existing Pacific LRFT Initiative, making it possible to plan and conduct the required assessment work.

From 28 November to 11 December 2001, a survey team, consisting of staff from SPC, Institut de recherche pour le développement (IRD), and International Marinelife Alliance (IMA) went to Ha'apai (for two days only) to conduct a series of fisheries surveys. With three teams of divers, a total of 131 50m transects were conducted using UVC. Ninety-seven of the transects targeted commercial reef fish species and 34 targeted all reef fish species. On the selected reefs, which included mainly fringing and intermediate reefs, transects were done on both the exposed and protected sides of the reefs. The dive sites for UVC were selected in consultation with the socio-economic team members to ensure that the most frequently harvested fishing grounds were covered. The diving depth was between 7 and 15 metres, which was assumed adequate to get a good coverage of the reef fish populations given the time available. Along each transect, fish were counted and sizes were estimated. Data on habitat structure were also collected.

From the field surveys, it would be fair to say that adequate resources are not available to support a LRFT industry since the species observed were mostly of low to medium value. It would, however, be wise to wait for the final analysis of the data to confirm this. Moreover, further, similar surveys should be repeated in the same areas for proper verification.

Cromileptes altivelis

Workshop on the sustainable management of coastal fishery resources and assessment of the management capacity and framework for the live reef fish trade in Papua New Guinea

In early October 2001, an invitation was received from ADB to participate in its two-day workshop on the sustainable management of coastal resources in Papua New Guinea (PNG). One of the main issues of the workshop was to discuss the management guidelines for LRFT trial operations in the Kavieng area. Under the Pacific LRFT Initiative, one of the planned activities was to evaluate PNG's

capacity and institutional framework to manage the LRFT. It seemed therefore appropriate to combine the two activities. The trip was therefore made from 30 October to 3 November 2001 to coincide with the workshop.

The workshop

The workshop was held at the Kavieng Fisheries Training College on 30 and 31 of October 2001. The workshop was organised by the National Fisheries Authority (NFA) in collaboration with the consultancy firm of Gillett, Preston and Associates (GPA) on behalf of ADB.

The participants were senior officers from the NFA office in Port Moresby; senior officials from the Provincial Government; representatives from NGOs such as the International Marinelife Alliance (IMA), The Nature Conservancy (TNC), World Wildlife Fund (WWF), and Conservation International (CI); representatives from international funding organisations, such as the United Nations Development Programme (UNDP), the Australian Agency for International Development (AusAID), and ADB; a representative from the business operators and from the consultancy firm (GPA); and the Live Reef Fish (LRF) Specialist representing SPC. In total there were 45 participants.

The workshop was in two sessions: the first session was specifically to discuss and review the Kavieng area Live Reef Fish Trade Management Guidelines and the second session was to discuss, on a broader scale, opportunities for the sustainable management of the coastal fishery resources.

The first session was chaired by the Fisheries Management Adviser for NFA, Mr Augustine Mobiha. The first presentations were made by the SPC LRF Specialist who gave the international as well as the Pacific regional perspective of the LRFT in general, describing the market chain, and where the Pacific fishers fit in the overall picture. He briefly described the experiences in the Pacific and gave a summary of the current problems and how SPC is hoping to address these problems under the Pacific LRFT Initiative. This was followed by a presentation on the PNG situation by NFA and various comments by stakeholders, including dive operators, local resource owners, and a LRFT operator.

It was evident from the discussions that a number of issues need to be addressed. The NFA wishes to allow a trial operation under strict management conditions and regulations. Some of these conditions and regulations need verification. The dive operators on the other hand want the fish to be left alone for dive tourists and tried to convince the resource owners that this was a more attractive option given its sustainable and non-destructive nature. The local resource owners, given their lack of opportunities to earn income from other sources, see the LRFT as a great opportunity for earning a cash income to pay for school fees, church donations, and basic daily needs. They were not convinced that leaving the fish alone for the dive-tour industry would benefit anyone except the dive operators themselves. They therefore supported NFA's efforts to allow the LRFT to begin, but stressed that it should be strictly managed.

The LRFT operators were concerned that the restrictions proposed would make it impossible for them to operate economically.

Generally, it was evident that the proposed management guidelines need to be further reviewed to ensure they will control a LRFT operation practically and effectively. In their current form, the guidelines put too much emphasis on the idea of a trial and therefore tend to be too lenient and flexible, which would be ineffective in real circumstances.

Mr Thomas Gloerfelt Tarp of ADB chaired the second session. This session was basically a brainstorming exercise to see what the local community understands about sustainable management of resources and to find out what opportunities exist for coastal fisheries development that meets the needs of the local people.

Much of the second session focused on the ADB-funded wharf to be built in Kavieng and how this development could boost other commercial opportunities as well as create more jobs for the local community. After much discussion, there was general agreement that something more outreaching and accessible to the remote local communities was needed to provide them with an alternative means of generating income.

Evaluation of Papua New Guinea's management capacity and framework for the live reef fish trade

Papua New Guinea's capacity and framework for managing the LRFT was also evaluated through interviews conducted with local fishers, local stakeholders, provincial government officials, NFA staff, NGOs present, and the industry people (dive operators, tourist operators, and the LRFT Company) both in Kavieng and Port Moresby.

In Kavieng, the opportunity was taken to visit the holding facility of the only operational LRFT company. There were 5.3 tonnes of fish in the company's cages, consisting of humphead

wrasse (35%), groupers (25%), coral trout (20%) (including species of little value, such as *Plectropomus maculatus* and *P. oligacanthus*), and other species (10%), which included even rock cod species such as *Cephalopholis miniata*, *C. urodeta*, and *C. argus*, which are of very low value. The poor conditions of the holding facilities and the fish themselves indicated poor handling practices and poor management of the facilities. This was further confirmed by the high mortality rate of 70 per cent.

In Port Moresby, short interviews were conducted with various staff of NFA from the Research Section and the Enforcement Section and the Acting Director of NFA, Mr Michael Batty. It was fortunate to have the GPA consultants there as well, since they were able to provide all the information relating to the restructuring and capacity strengthening of NFA necessary to understand the management capacity of NFA.

Other meetings held were with NGOs such as CI and WWF to look at the possibility of involving them in SPC's LRFT-awareness work for local communities.

The results of this evaluation will be included in a formal report, together with recommendations and guidelines for improving the local management capacity and an effective management framework. The report is expected to be ready by the end of June 2002 at the latest.

Workshop on the sustainable management of the live reef fish trade in Solomon Islands

A workshop to discuss the sustainable management of the LRFT in Solomon Islands was held over a two-day period from 14 to 15 November 2001 in Honiara. The Department of Fisheries organised the workshop with the assistance of their Australian counterparts from Southern Cross University. The Australian Centre for International Agricultural Research (ACIAR) provided funding for the workshop and the project.

Cephalopholis argus

Forty-one participants attended the workshop. These included diverse stakeholders from the local community, such as Paramount Chiefs, leaders, and spokespersons from the different provincial communities and one representative from the business operators. Two NGOs were also present, namely TNC and WWF. Other participants were senior officials from the Provincial Government and the National Fisheries Office, including project staff. The SPC LRF Specialist was invited as a resource person, the cost of his participation being provided by ADB under the Pacific LRFT Initiative.

In Solomon Islands, the LRFT has gone through a series of dramatic events. Starting in 1994 with one Hong Kong-backed company, the operations very quickly became a concern. In February 1999, a moratorium was placed on all LRFT operations. At the same time, ACIAR initiated and funded a project to look at the socio-economic situation linked to the LRFT and to come up with a workable management plan.

Since the moratorium, there has been a lot of pressure from the industry and from some of the resource owners to lift the ban. The moratorium was subsequently lifted, helped somewhat by the civil unrest that put a new government into power. In November 2000, the new Minister of Fisheries lifted the moratorium.

With the ACIAR project coming to an end, it was timely to have the workshop to present the results and use them to put some control on the industry. The workshop was co-ordinated by Mr Ryan Donnelly, Project Leader, from Southern Cross University and facilitated by Dr Melita Samoilys, the ACIAR Project Biologist.

The workshop was divided into two sessions. The first session presented the results and findings of the ACIAR study. An Australian consultant gave an overview of the Australian LRFT situation to support the results of the ACIAR study and SPC gave a regional perspective of the LRFT.

The second session dealt with the management plan and consisted of a presentation by Dr Transform Aqorau, the Forum Fisheries Agency (FFA) Legal Counsel, on the Live Reef Food Fish Trade Regulations. Working group discussions on management measures for the draft management plan then followed the presentation.

Some of the management measures resulting from the first session included:

1. measures to address the issue of fishing targeting spawning aggregations, such as:
   - the temporal closure of fishing on spawning aggregations and during spawning seasons, and
   - the use of marine protected areas (MPAs) for spatial closures of spawning aggregation sites;
2. limiting the number of licences and areas to operate in;
3. the use of quotas; and
4. strict monitoring using an observer's programme at all levels of the operation (i.e. monitoring fishers, middlemen, and overseas buyers).

In the second session, the legal aspects of managing a LRFT operation were outlined. The discussion highlighted certain issues that need to be better defined in order to make management regulations effective. These issues include:

1. the jurisdiction by which regulations should be implemented and enforced;
2. which input versus output controls are more effective and realistic (i.e. is it better to put controls at the level of the fishers or the company?);
3. who should be involved in the fishery at the different levels;
4. which systems could be used to put some control, especially on the prices of the middlemen; and
5. how customary owners can be involved in management and enforcement.

These issues were further discussed in four different working groups. Each working group reported back on how these issues could be addressed and incorporated in the management plan. All these group recommendations were then discussed and the most acceptable ones were selected as potential guidelines for the management plan.

A visit to update information on the status of the live reef fish trade in Kiribati and complete the evaluation of the institutional capacity and framework for managing the trade

On 8 January 2002, the LRF Specialist, in Tarawa for the Christmas break, took the opportunity to undertake some of the work outstanding under the Pacific LRFT Initiative.

Firstly, an evaluation of the LRFT situation was conducted through meetings and interviews with the relevant government departments, especially the Ministry of Natural Resources Development and the Fisheries Division.

The latest news was that the Chinese company, BrightFuture Industries that had been given permission to operate, had apparently almost given up. The company was unable to catch enough fish for shipment under the new conditions it was given for Abaiang Atoll. Recently the company has indicated an interest to go to Butaritari, another atoll further north.

Fortunately, as in Abaiang Atoll, the LRF resources on Butaritari have been assessed by staff of the Fisheries Division's local resource assessment team, who have been trained in the assessment method by the LRF Specialist in the Abaiang assessment work. However, unlike the case in Abaiang Atoll, no conditions for the LRFT operation have been drawn up. It is highly recommended that conditions be drawn up before the operation is allowed in the atoll, if some control over the exploitation of the resources is to be achieved to ensure maximum benefits to the community.

At the same time, an assessment of the legal framework, policies, and regulations, as well as the local capacity to manage the LRFT, was also conducted. This was done by collecting relevant information through interviews and meetings with relevant government officials and local fishers.

Assessment of the management capacity for the live reef fish trade in the Republic of the Marshall Islands

The Republic of the Marshall Islands is also included in the ADB-funded Pacific LRFT Initiative. The work scheduled for the Republic includes an assessment of LRF resources, an evaluation of the management framework and local capacity for the management of the LRFT, and the formulation of a management system and plan for the fishery.

The trip was initially scheduled for three weeks in collaboration with IMA. IMA was however unable to make this trip and it was therefore reduced to two weeks, and so the scope was reduced to cover only the evaluation of the management framework and the management capacity.

With the assistance of Mr Terry Keju, one of the Fisheries Officers, the SPC LRF Specialist

was able to meet quite a wide range of people in government, local government, and the private sector, including the operators. There seems to be one LRFT company in operation called the Pacific Marine Resources Development Inc. This company is a joint venture: 75 per cent Taiwanese owned (by Mr Thomas Tse, based in Hong Kong) and 25 per cent locally owned (by Mr Phillip Muller, politician and former Minister of Foreign Affairs). The company has collected fish from four islands, shipping to Hong Kong every two months. It currently employs 70 Filipinos who are the main fishers, although locals are allowed to fish if they wish.

In the aquarium fish trade there were more operators. The Robert Reimers Enterprises mariculture facility focuses on giant clams although it was experimenting on the side with reef fish (clown fish and some Pomacentridae). OK Davies, one of the oldest aquarium operators and formerly one of the biggest, now runs a very simple small operation. He also buys fish regularly from an aquarium fish exporter in Tarawa, Kiribati. The Tarawa fish exporter, Mr David Pine, was in Majuro when the LRF Specialist was there. He therefore took the opportunity to meet and talk to him about his operations. Mr Pine said that he was shipping petfish from Tarawa to sell in Majuro because of the limited air cargo space on the flight from Tarawa to Majuro. He is also hoping to start up an operation in Majuro but is waiting for his permit.

A report on the findings and recommendations for a LRFT management framework is being written up and is expected to be out by June or July 2002.

Also while in Majuro, the LRF Specialist was able to follow up on the ciguatera work he had conducted in Ujae and Lae in June 2000. The follow up was to acquire the information required for the report, i.e. data showing the number of cases of fish poisoning recorded by the Department of Health. Once the information was obtained, the LRF Specialist was able to finalise the first draft of the report and submit it to the Marshall Islands Marine Resources Authority (MIMRA) for comments before leaving Majuro. The final report will be completed when MIMRA's comments have been received.

A workshop to develop a global initiative to protect reef fish spawning aggregations

From 13 to 15 March 2002, the Live Reef Fish Specialist attended a workshop in Honolulu at the invitation of The Nature Conservancy (TNC) and Conservation International (CI). The primary goal of the meeting was to bring together a group of researchers working on spawning aggregations to design, as a component of a global initiative, a programme to integrate spawning aggregations sites into the selection, design, and management of priority coral reef MPAs and to create MPA networks around the world. The issue of fishing spawning aggregations is especially important for the management of the LRFT fishery where spawning aggregations of groupers are often targeted. The specific objectives of the meeting were to:

1. identify key target fish species for research,

2. identify key areas to work,

3. discuss key questions that may provide the basis for research:

   - Where do adult fish in a spawning aggregation come from?

   - Do individuals participate in more than one aggregation per year?

   - Where do larvae from the aggregations eventually settle?

   - Can overexploited aggregations recover?

   - How might ecotourism positively or negatively affect aggregation conservation?

4. discuss how to apply current and future research results (e.g. site identification tools and strategies for the protection of spawning aggregations) and identify an iterative process for developing, testing, and refining approaches for incorporating spawning aggregations into the selection and design of MPA networks.

5. identify the scientific, technical, and managerial skills needed to accomplish the objectives of the spawning aggregation component of the overall programme, including activities to strengthen the ability of the Society for Conservation of Reef Fish Aggregations (SCRFA) to provide scientific and technical advice to the global initiative and the SCRFA network.

6. provide a budget estimate for the research and application activities to feed into the overall programme.

At the workshop, key speakers presented the major issues and the discussions that followed were included in a 57-page document. This document is now the formal proposal for this

component of the overall global initiative and is available from TNC and CI.

A handbook of guidelines for the management of the live reef food fish trade

The Nature Conservancy and SPC have been discussing development of a handbook of guidelines for the management of the LRFT for the last few years. Although heavy work commitments on both sides had delayed efforts to start work on such a handbook, after meeting in Honolulu in the spawning aggregation workshop, both parties agreed to meet for a short time, outline the contents of the handbook, discuss what needs to be done, and allocate the work. The meeting was held in Brisbane from 25 to 28 March 2002 with Dr Andrew Smith and Paul Lokani representing TNC and Being Yeeting, LRF Specialist, representing SPC.

TNC and SPC have been working together as partners in addressing the problems and challenges in managing the live reef food fish trade. Both organisations therefore are fully aware of these problems and have had extensive experience in dealing directly with them at the regional level as well as at the local country level. The idea therefore is to use this solid expertise to produce a handbook to guide Pacific Island Fisheries Managers in managing their LRFT. The handbook does not of course attempt to provide a complete answer to the problems and questions of managing the LRFT but it will provide some practical answers based on real experiences elsewhere in the region.

The outline of this handbook has been written and both TNC and SPC are working on the details of the contents. It is expected that the handbook will be completed and published before the end of the year.

Plectropomus leopardus

Future activities to be conducted under the Pacific LRFT Initiative

Most of the activities scheduled under the Pacific LRFT Initiative have been implemented except for a number of in-country workshops. Most of the activities not yet completed are the writing of reports and publication of materials. The ADB funds for the project formally end at the end of June 2002 and therefore it is hoped that all these materials and reports will be completed before this date.

To mark the end of the ADB funding, a regional LRFT workshop has been scheduled in order to present the final results of the project, to evaluate its impact in relation to the progress of management and development of the LRFT in the Pacific and to update the issues and problems that may need to be further addressed. The date and venue of this workshop are yet to be confirmed but it will most probably be held in the next 2–3 months in Suva, Fiji Islands. An official announcement will be circulated to potential participants soon.

NEW BAIT METHODS TO SPARE SEABIRDS

Hawaii's longline fishing industry is hoping that a new baiting technique will help save seabirds that are killed annually in waters around the state. The birds, most notably the albatross, die when they get hooked or tangled in the longlines.

The Katy Mary, an Oahu longline vessel, was the first to try the new underwater bait-setting chute in fishing grounds north of islands where seabirds are abundant. No seabirds were caught or killed during the experiment, according to vessel owner Jim Cook, who is chairman of the advisory panel to the Western Pacific Regional Fishery Management Council and legal liaison officer with the Hawaii Longline Association.

The chute works by discharging baited hooks about 15 feet underwater out of the sight and reach of diving seabirds, Cook said. The conventional method involves throwing the baited hooks off the end of the boat, where they float on the surface of the water, making it easy for seabirds to get the bait, he said. This is how they get accidentally caught.

Environmental groups have criticised longline fishing methods for years because of the number of turtles, sharks, and other animals that get caught and die in the 25 to 30 miles of hooks and lines.

The experiment involved running 6500 hooks through the chute, which is hung off the end of the boat. There were only 50 attempts by seabirds to take the bait, when some of it may have become dislodged from the hooks, but none was successful, Cook said.

Using the conventional method, Cook said, there were 750 attempts to take the bait and 24 albatross were hooked and killed.

'The albatross can't get to the bait underwater', he said. 'They don't dive more than three or four feet. You gotta see something to want to dive, and they don't even see it.'

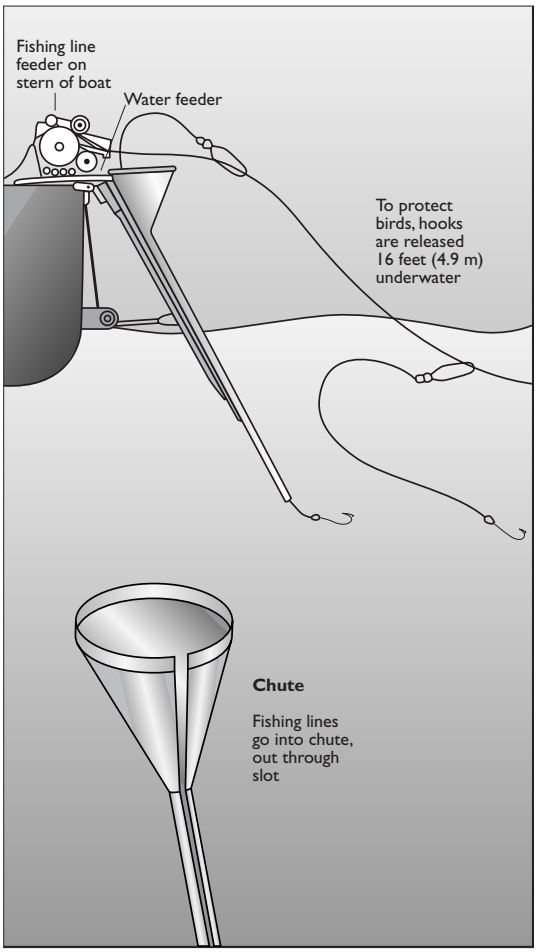
And the 50 attempts recorded using the 27-foot-long steel chute were actually questionable, Cook said, because 'if a bird even looked like he was taking the bait, we recorded it; in reality, it's zero (the number of attempts).'

Consultant Nigel Brothers was instrumental in the development of the chute in the mid-1990s in New Zealand. It was initially tested in 1996 in Australia and cost USD 2000 to 3000.

'This was a particularly exciting trip', Brothers said. 'It's the first time the chute is being given a rigid test of its effectiveness in avoiding seabird fatalities. And it's been excellent.'

Partners in the experiment include the Hawaii Longline Association, the National Audubon Society's Living Oceans Program, the National Marine Fisheries Service Honolulu laboratory, Albi Save (the Australian company that manufactures the chute), Capt. Jerry Ray and the Kate Mary crew, the Western Pacific Council, and the US Fish and Wildlife Service.

(Source: *Honolulu Star Bulletin*, 12 March 2002)



FINANCIAL SUPPORT FOR FISHERS WHO ARE AFFECTED BY MARINE RESERVES: EXAMINING THE MERITS

Commercial fishers sometimes suffer financial losses due to the designation of new no-take marine reserves. Their catches may decline, at least in the short term, while trip costs—affected by having to travel to farther fishing holes—may rise. This prospect can lead to opposition to new reserves from the fishing sector.

To gain commercial fishers' support for reserves, some politicians have taken a new tack: namely, subsidising or compensating the fishers affected by new closures. This method has supporters in the fishing sector, but some conservationists and others view it warily. This month *MPA News* describes an assortment of reserve-related financial assistance programs for fishers, and offers the views of supporters and skeptics.

Victoria and Tasmania: Australian states pursue assistance schemes

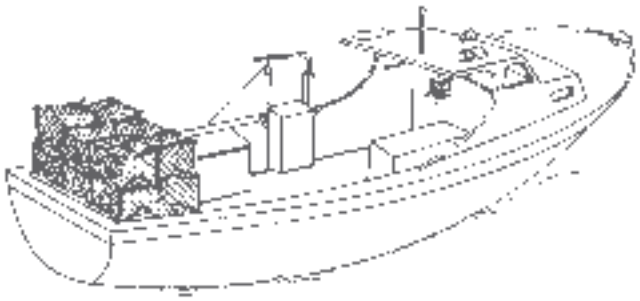
In general, subsidies to support commercial fishers have existed for some time. In the US, for example, federal fishery managers have often provided research and funds to help fishers adjust to catching alternative species. In several nations, resource managers have offered boat-buyback programs and job-retraining to fishers to guide them out of the industry, thereby reducing overcapacity.

But the concept of providing financial compensation to fishers affected by reserves, in particular, is fairly novel. The compensation programs that have been implemented—or which are under consideration—are not generally geared to help fishers leave the sector. They are there to help the industry adjust to a new system of closures, and to enable it to continue fishing elsewhere, should that be a viable option. Perhaps most importantly, they are there to secure 'buy-in' for reserve plans from fishers.

The government of the Australian state of Victoria has a plan, now under state parliamentary consideration, to create a system of marine national parks that would set aside 5.5 per cent of Victorian waters as no-take areas (*MPA News* 3:9). Enshrined in the plan is a compensation scheme for fishers affected by the new closures: financial assistance would be available to fishery-licence holders to cover increased fishing operating costs and reduced catches directly related to the new parks. This assistance would be available for up to three-and-a-half years, depending on the type of fishing license held and the park site. A three-member assessment panel, including at least one person associated with the fishing industry, would determine compensation amounts.

The Victorian government proposed a more limited compensation plan last year, capping the financial assistance at a total of AUD 1.2 million, roughly equivalent to USD 685,000 (*MPA News 3:1*). Criticism of that plan by opposition members of parliament, backed by fishing interests, led the government to remove the cap from the plan's current version. James O'Brien, an adviser to the state environment ministry, said that even without the limit, however, compensation claims should be minimal. 'We don't believe there will be a huge need for compensation payments, as we expect the fishing industry will be able to make the adjustment to the creation of marine national parks,' he said. 'But in the interests of fairness, if there is an impact on the fishing community, then they will be able to access compensation.'

Meanwhile, the Australian state government of Tasmania has released its own state-level strategy for establishing a system of MPAs. Under the Tasmanian proposal, any person who could show that the designation of an MPA resulted directly in a financial loss—and that there was no alternative for recouping the loss elsewhere—could be eligible for an 'adjustment payment' from the government (*MPA News* 3:4). Fishers would be eligible, but so would be owners of shops, motels, or other services, as long as they could prove they had been affected by an MPA.



Doug Nicol, Principal Fisheries Management Officer for the government's environment agency, is careful to point out that the assistance program is not compensation. Rather, he said, it is a subsidy to help individuals adjust to changes, such as by enabling them to move or change their operations. A local fishing tackle shop, for example, could use the money to purchase snorkel gear or a glass-bottomed boat to serve tourists to the MPA.

As in Victoria, Nicol said the Tasmanian plan would not likely be subject to large payouts. 'Most fishers operating around Tasmania are very mobile, either on the water or by road,' he said. Because of this mobility, it would be difficult for fishers to demonstrate an inability to recoup losses elsewhere. 'It is true that some fishers will lose access to specific sites, but they will maintain their access to the remainder of the open state waters,' he said.

Two compensation programs: one large, one small

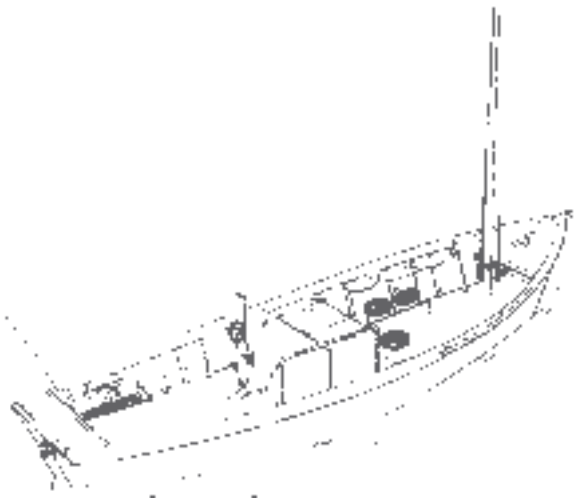
What is likely the most expensive compensation program to date is ongoing in the US State of Alaska, in Glacier Bay. The National Park Service (NPS), under pressure from conservationists, developed a plan in the late 1990s to phase out most commercial fishing in Glacier Bay National Park, the waters of which had been fished commercially for much of the past century. In response, the US Congress—prompted by an influential Alaskan senator—allotted USD 23 million to compensate fishing-permit holders, crew, processors, and local communities expected to suffer lost income due to the closure.

The deadline for applications was in January 2002. As of May 2002, USD 20 million had been assigned, with the remainder being held pending completion of an appeals process. 'Every last penny will be paid out of the USD 23 million,' said Ron Dick, manager of the compensation program for the park.

The USD 23 million figure arose from a 1999 economic estimate of the closure's impact. To be eligible for compensation, permit holders, crew, and processors had to demonstrate participation in a Glacier Bay commercial fishing activity during the years 1989–98, with proof of current participation. Eligible communities were judged on their number of resident fishers and their proximity to Glacier Bay, among other factors. Because of the difficulty of demonstrating actual losses, compensation was to be based primarily on share of past harvests. Each approved recipient of compensation will receive a one-time payment roughly equal to eight times his average annual Glacier Bay earnings during the 1989–98 qualifying period. Notably, recipients may continue to fish elsewhere.

On a much smaller scale, fishers on the Caribbean island of St Lucia benefited from a targeted compensation program a few years ago. In 1995, pot and gillnet fishers around the Soufrière Marine Management Area (SMMA) complained of severe declines in their catches as a result of new no-take zones within the MPA. They could only set their gear in multiple-use areas, where there happened to be little concentrated reef habitat. Pressure from these fishers grew until the St Lucian government crafted a plan: a group of 20 pot and gillnet fishers—consisting of individuals judged to be the most dependent on this type of fishing for food and income—would be compensated a sum equivalent to USD 150/month for a year, and part of one reserve would be reopened to pot fishing. In addition, the SMMA management team worked to improve access to loans for fishers to invest in deepwater fishing, offered training in longline fishing, and performed various other projects to encourage acceptance of the closures.

The result was a success, according to Juliana Samuel, officer in charge for the SMMA. Among other things, the year of compensation allowed time for the fishers to become knowledgeable of the benefits of the reserves. 'The existing marine reserves continue to flourish, and fishers have expressed satisfaction and cooperation,' she



said. Asked whether the compensation program would now necessitate similar measures for reserves elsewhere on St Lucia, Samuel said no. 'Fishing communities to the east, south, and northeast of the island are closer to migratory routes of valuable ocean species such as mahi mahi, tuna, and kingfish, and rely less heavily on reef fishes captured using pots,' she said.

For and against compensation

Several commercial fishing organizations have expressed their support for the concept of compensation. In the US, where the Glacier Bay compensation program remains somewhat of an anomaly on the national MPA scene, some fishing organizations have called for similar measures elsewhere in US waters. The US-based Pacific Coast Federation of Fishermen's Associations, in its position statement on MPAs, states that where significant reductions in catches are an unavoidable consequence, then 'funding for the compensation of fishers in proportion with the reduction of the fishery shall be part of the establishment of the MPA.' The Tasmanian Fishing Industry Council (TFIC), in Australia, is also a strong proponent of compensation, and has reportedly indicated its intent to raise the matter as an issue in forthcoming state elections.

But other stakeholders caution that reserve-related compensation may present managers with an array of dilemmas, both managerially and ethically. Patrick O'Leary, former regional coordinator of the Marine and Coastal Community Network in Northern Territory, Australia, said the question of compensation opens a Pandora's box of other questions regarding its fairness to non-fishing groups.

'If fishing-industry activity is shown to be damaging to marine ecosystems and fish stocks, should industry have to pay compensation to other stakeholders—divers, tourists, conservation groups, aboriginal groups, and management agencies?' said O'Leary. 'And if the creation of no-take MPAs results in stock recovery and increases the viability of the industry, should industry be asked to contribute to the upkeep of the reserve?'

Some skeptics of compensation worry that once managers begin considering it, fishers will demand it, engendering situations in which no reserves will be designated without compensation. It remains to be seen how the issue of economic mitigation for reserves—whether through compensation or subsidies —will evolve, and how it will affect the other challenging discussions that are already apart of reserve-planning efforts.

(Source: *MPA News*, Vol. 3, No. 11, June 2002)

■ MEDITERRANEAN BLUEFIN TUNA ON ENDANGERED LIST?

A sharp increase in the number of Mediterranean bluefin tuna fattening facilities is beginning to endanger the species. 'Stocks of breeding-age fish have fallen by 80 per cent. We can fear the worst in the years to come', states Paolo Guglielmi, an oceans and coastal zones officer with the World Wildlife Fund (WWF).

Non-existent in 1997, these fish farms exported 15,000 mt of bluefin tuna to Japan last year. There are now some 30 such farms, with 14 located in the three main exporting countries: six are located around Murcia province (southern Spain). Last year, they marketed 7000 tonnes of bluefin tuna, representing a value of EUR150 million on the Japanese market. Six more have been set up along the Croatian coastline (3000 mt in 2001). Malta, with its two farms, produces 1200 mt annually.

The experts believe that this is just the beginning: all the Mediterranean Rim countries are initiating large-scale bluefin tuna farming projects. Algeria, Tunisia, Turkey and Greece have projects under way. In France, Ifremer is planning to set up an experimental farm in the Gulf of Fréjus: four pens able to cater for 200 tuna each will be submerged 700 m offshore. According to the scientists, several other projects are in the pipeline. Many of the tuna fishing vessels already operating in the Golfe du Lion using purse-seine nets (large purse-shaped nets that are drawn closed with a cable like a draw-string) are selling their catches to the Murcia farms: fish caught alive are transferred at sea into the huge cages, which are towed by tugboats at low speed to their destination. During their journey, they are fed abundant quantities of sardines and anchovies.

According to the International Commission for the Conservation of Atlantic Tunas (ICCAT), 70% of the 6780 mt of bluefin tuna caught last year with these nets by French vessels were sold to Spanish fish farms. This trade occurs outside all international control.

Why such enthusiasm? The response is economic. The Japanese consider Mediterranean bluefin tuna a delicacy. They love its colour and taste and prefer it to Atlantic or Australian species. But before it can become sushi or sashimi, tuna meat must have a certain fat content. So far, Japanese buyers have accounted for three or four out of every 10 fish sold on the European market. The rest is supplied to local markets. Hence the idea of growing out or fattening tuna in special farms: this process takes approximately four months. It makes it possible to supply the total production to the Japanese market in an extremely lucrative manner.

This, however, is not aquaculture. It is not possible to get tuna to breed in captivity. 'Japanese scientists have been trying to do so for 30 years but so far without any tangible results', explains Paolo Guglielmi.

These fattening farms therefore exercise extra pressure on stocks. This large pelagic fish, which is capable of swimming several thousand kilometres at great depth to reach its spawning grounds, has a 20-year life span. Some measure up to 3 m and weigh 650 kg. Sexual maturity is reached at between five and eight years. In the madragues or fish ponds of the Egadi Islands (western Sicily), where ancestral fishing techniques are still used, their size is shrinking inexorably every year. Conservation measures have been introduced, such as quotas for countries of the Union and a ban on using helicopters in June, during the spawning season, to locate schools. But offshore checks far beyond territorial waters remain ineffective.

The quotas for 2001 have been set at 29,500 mt, including 18,915 mt for the European Union. Beyond the 33,000 mt level, the Commission considers that the point of no return would be reached. The average size of catches has dropped over ten years from 50–60 kg to 25–30 kg and the percentage of juveniles (under 6 kg) not having reached breeding age, is constantly increasing.

WWF urges Brussels and the Mediterranean Rim countries to realise the danger of this overfishing. It is demanding a moratorium on the construction of new farms and stricter control on fishing and fattening conditions. 'The survival of the species is at stake in the short term', believes this nature conservation body.

(Source: *Le Figaro*)

SPC PARTICIPATION IN THE NACA GOVERNING COUNCIL MEETING, AQUABUSINESS SEMINAR AND STUDY TOUR, MALAYSIA AND THAILAND

by Ben Ponia,
Aquaculture Adviser
and
Aymeric Desurmont,
Fisheries Information Specialist,
SPC, Noumea, New Caledonia

Introduction

The Network of Aquaculture Centres in Asia-Pacific (NACA) Governing Council Meeting (GC13) and AquaBusiness Seminar and Exhibit 2002 (AFBiS 2002) were held concurrently at the same venue in Langkawi Island, Kedah, Malaysia. SPC staff members Ben Ponia and Aymeric Desurmont participated in GC13 and in the AFBiS respectively. Mr Maciu Lagiba-lavu was also part of the SPC delegation on a special mission to investigate the issue of NACA membership. The GC13 and AFBiS concluded with a study tour of aquaculture facilities in Southern Thailand. The SPC delegation continued on to Bangkok to the NACA headquarters and to the FAO Asia-Pacific Aquaculture office for discussions.

Thirteenth NACA Governing Council Meeting, Langkawi, Malaysia, 15–18 January 2002

NACA has its origins in the FAO Technical Conference on Aquaculture (1976) which proposed the establishment of regional networks of aquaculture centres in developing regions. The Network has twenty members and participating countries, which account for about 90 per cent of the global aquaculture production by volume. Key countries are China, India, Thailand, and the Philippines.

Mr Pedro Bueno, NACA Director-General, tabled an annual report which outlined the extensive activities of the NACA network, particularly in the areas of training and information. This was followed by reports from the leading regional centres (Integrated Fish Farming, Wuxi, China; Central Institute of Freshwater Aquaculture, India; National Inland Fisheries Institute, Bangkok, Thailand; Aquaculture Southeast Asian Fisheries Development Center (SEAFDEC), Iloilo, Philippines). Other organisations including SPC then presented their activities.

Of the work programmes of NACA, one of the most relevant to SPC is the Aquatic Animal Health Program. Particular relevant aspects of this programme include the proposed expert consultation on legal aspects of aquatic animal health management, the Import Risk Analysis (IRA) workshop, and courses on molluscan health being jointly organised with FAO.

The NACA Regional Information Program also shares many common goals with the SPC. The programme has expanded its scope with the launch of 'eNACA', which aims to take advantage of Internet-based communications technology to share information faster and more cheaply. The SPC Aquaculture website currently under construction incorporates many of the same features as the revamped NACA website:

http://www.eNACA.org/

Although the original mandate of NACA was to service the Asia-Pacific region, generally the network has operated exclusively within the Asian area. During the 2nd SPC Heads of Fisheries (HOF) Meeting (July 2002, Noumea), NACA outlined its work programmes and relevant linkages to the Pacific. The HOF delegates subsequently recommended that SPC 'investigates the costs and benefits of membership of the NACA'.

To conduct this task the SPC enlisted the services of Fiji Director of Fisheries, Mr Maciu Lagibalavu. The GCM provided an ideal opportunity for Mr Lagibalavu and SPC to investigate NACA membership. Consultations were held among NACA officials and NACA's member countries on the relevant linkages of NACA with the Pacific region.

From these discussions, it emerged that one of the most effective mechanisms for the Pacific Islands to enjoy the benefits of NACA membership is

through SPC having associate membership with NACA. This would essentially accrue the benefits of membership to Pacific Islands countries while forgoing the fees incurred by direct membership. The provision of associate membership for agencies such as SPC under the NACA Agreement was accepted by the 13th GCM.

Aquabusiness Seminar 2002, Langkawi, Malaysia, 15–17 January 2002

The purpose of the Aqua-Business Seminar was to encourage the exchange of information on innovations and technology for aquaculture development between governments and the farming and business sectors. It was attended by more than seventy people, including fish and shrimp farmers, business operators, scientists, technologists, representatives from a few regional governmental agencies, and NGOs, present as observers.

Based on the theme 'New opportunities for sustainable aquaculture development', the seminar was organised in five different sessions comprising some 40 topics.

An overview of the benefits, lessons, and experiences of a regional approach to aquaculture problems

One of NACA's objectives was to promote the creation of a regional aquaculture producers' association that would be formed by the different national producers' associations. The model of the Federation of European Aquaculture Producers was presented as a possible example to follow. But despite several presentations describing the benefits of approaching problems at a regional level, particularly where environmental monitoring or diseases control are concerned, further discussions showed that the extreme diversity of producers both nationally and throughout the region does not yet allow the creation of such an association. However, it was recommended that NACA be used as a catalyst for the development of such an association and for NACA to gather information on the existing local and national producers' associations and assist in their strengthening.

Shrimps, mangrove crabs, and spiny lobsters

Shrimps are valued as the second most important aquaculture production in Asia. Thailand alone produced 290,000 tonnes of tiger shrimp (*Penaeus monodon*) in 2001, of which 70–90 per cent were exported for a value of USD 2280 million. However, the rapid expansion of intensive shrimp culture has, in many places, affected the coastal environment, resulting in extensive destruction of mangrove habitats and problems created by the drainage of waste (water and sludge) from farm ponds. Ways to minimise these impacts, such as pond management and closed water systems, were presented.

Methods of producing juvenile mud crabs on a large scale have been developed and tested at SEAFDEC/AQD. While female crabs produce 3–4 million eggs each, the survival rate of juvenile mud crabs is only 1.25 per cent after 45 days. The commercial feasibility of full-cycle crab aquaculture still needs to be demonstrated. Presently, crab farmers in Asia just 'fatten' small and soft-shelled crabs captured in the wild.

The culture of spiny lobster (mostly *Panulirus versicolor*) is being tested in northern Australia with promising results. Lobsters are captured as pueruli (postlarvae) in the wild using crest nets and light cages.

Disease control, health management, and feed and nutrition

Disease outbreaks are a major constraint to aquaculture production. Different techniques to deal with this problem were presented to the seminar, ranging from the practice of using vaccines or antibiotics and laboratory monitoring and diagnosis, to good pond or cage management practices. Several speakers emphasised the fact that disease control needs to be approached on a regional basis.

The 'feed and nutrition' part of the session essentially provided a forum for industry advertising. An interesting hi-tech system to control the amount and time of feeding in fish cages was presented. As the main feed for aquaculture remains 'trash fish' captured from the wild, the setting up of low-cost adapted feeds using other sources of protein is viewed as essential for the future success of aquaculture.

Promising species, culture systems, species introduction, and movements

Finfish culture is well developed in Asia, and most presentations concerned marine species. Amongst the 'promising species', cobia (*Rachycentron canadum*) certainly appeared as the hot favourite because it grows 10 kg in the first year and fetches USD 5–8 per kg on the Japanese or Hong Kong fresh fish markets. This species is currently being farmed in Malaysia using 'Norwegian type' sea cages (see 'Study tour', below). The humpback grouper (*Cromileptes altivelis*) also has potential

as an aquaculture species. Full-cycle culture has been mastered in Bali and several small-scale commercial farms have entered the production phase. This fish is one of the most valued species on the live fish markets of Hong Kong, Singapore, and China.

Other promising species include the pomfret, the tropical abalone (*Haliothis asinina*) and the Pacific oyster (*Crassostrea gigas*). Johann Bell from ICLARM also made two excellent presentations on the blacklip pearl oysters (*Pinctada margaritifera*) and the sandfish (*Holothuria scabra*).

Under the topic of 'culture systems', two presentations were of particular interest.

- Ramon Macaraig, from *Alcantara and Sons Aquatechnologies Inc*., gave a very impressive presentation on their Philippine farm. With 300 ha of ponds, last year the company produced 4300 t of milkfish (*Chanos chanos*), 300 t of shrimps and 600 t of tilapia. They also produced 400 million milkfish fry that they sold to farmers all over Asia. Their farm includes a factory for chilled and processed (boned, filleted, smoked, dried, etc.) products that they export to Asia, the US, South America, and other destinations.

- Jim Smith, from *Skretting Australia*, gave a presentation on the company's barramundi (*Lates calcarifer*) farm in Darwin, Northern Australia. *Skretting Australia* is the second biggest animal feed producer in the world and this farm is their first experiment with tropical fish farming. *Skretting Australia* used the latest technologies to set up the farm but still had to cope with some local constraints, including crocodiles and sharks. Cages had to be made out of galvanised steel wire, causing real problems with electrolysis and oxidisation. Also, by the time the farm reaches full production, it is feared that the barramundi price on the Australian market will have dropped.

Product quality, trade, and marketing in aquatic products

Three presentations referred to Hong Kong and China as the best markets for marine finfish, particularly coral reef species. It is interesting to note that in all the presentations referring to Asia during this meeting, the marketing or transport of marine products was never presented as a problem. For example, one presentation described the way in which Malaysia plans to increase its aquaculture production from 167,000 t in 2001 to 600,000 t in 2010. The presentation referred briefly to the way in which the Malaysian government was approaching some of the problems, such as investment schemes, code of conduct, area zoning, environmental factors, fish health and diseases, and the training and education of farmers, but nothing was mentioned about the markets they will be targeting.

Study tour, 18–20 January 2002

Langkawi floating marine cages (Malaysia)

We could not see much from the Malaysian navy boats that took 70 of us to two 'Norwegian type' marine cage farms. However, one of the farmers who was on the boat with us acted as tour guide. The Government of Malaysia actively encourages the development of marine fish farms by providing new farmers with all the equipment they need for four years (including five 50 m grow-out cages, 20 smaller cages for juveniles, nets, and moorings) Farmers are also allowed to use the Fisheries boat to change the nets in their cages once a month and can use

Fish farmers in Langkawi, Malaysia, are using 'Norwegian type' marine cages to grow sea bass (*Lates calacarifer*), groupers (*Epinephelus coioides*) or cobia (*Rachycentron canadum*)
[Photo: Aymeric Desurmont]

the Fisheries facilities to clean and store their spare nets and other equipment. Farmers only need to pay the running costs – mostly fry, fish feed, and employees' wages. They market their production themselves. It is hoped that, after four years, successful farmers will be able to invest in their own farms, once again with government support. Most farmers would prefer to grow cobia (*Rachycentron canadum*) or grouper (*Epinephelus coioides*) but are limited by the availability of fry. For example, cobia fry have to be imported from Taiwan. Sea bass (*Lates calcarifer*) seems to be the only species for which fry is easy to get (from Thailand).

Satul Coastal Aquaculture Development Center (Thailand)

The Government of Thailand is also very supportive of aquaculture development. However in this country, it appears that the industry has developed faster than expected. Government hatcheries are not producing enough fish fry and farmers mostly rely on captures from the wild. Likewise, shrimp (*Penaeus monodon*) broodstock is still captured from the wild.

The Center has two main facilities that we visited: a big hatchery, based inland, where research as well as production occurs (fry is sold to farmers) and a marine station where the broodstock is kept. Several fish species are bred, including *Plectropomus maculatus*, *Epinephelus coioides*, *E. lanceolatus*, Carangidae, *Lutjanus argentimaculatus*, and Cobia. However, the hatchery manager admitted that seabass (*Lates calcarifer*) is the only species for which they are able to produce big quantities of fry. The Center is also working on winged pearl oysters (*Pteria penguin*).

***Top**: Ben Ponia, SPC Aquaculture Adviser, checking coralgrouper (**Plectropomus** sp.) breeding cages at the Satul Coastal Aquaculture Development Center, Thailand*

***Bottom**: 'Trash fish', captured from the wild, is the main feed used for grouper cage culture in Thailand*

[Photos: Aymeric Desurmont]

Satul fish farms

The fish farms at Satul were probably the most impressive part of the study tour. In a mangrove zone at the entrance of the small Satul harbour, dozens of small fish farms line each side of a channel. Farms are made of galvanised pipes or bamboo poles forming squares from which nets are hung to make 'cages'. Wooden planks are lashed to the pipes and form pathways between the cages. All cages are approximately the same volume of 8 m x 8 m x 4 m deep. One cage holds 500–700 fish.

The smallest farms have three or four cages, while the biggest ones have more than 100 cages. New farmers can get free equipment for three cages from the government to start their operation. Most of the farmers used to be fishers.

The green grouper (*Epinephelus coioides*) is the preferred species for farming because of the high price it can fetch (USD 8) on the Hong Kong and Singapore markets.

Juveniles 10 cm in length are bought at USD 0.8 each from local fishers and take one year to grow to 1.2 kg. Feed is exclusively 'trash fish' (e.g. sardines) bought from local boats or directly fished from the surrounding mangroves by the farmers themselves. With an average of 8 kg of trash fish needed to grow 1 kg of grouper (Mike Rimmer, pers. comm.) it seems that the trash fish species have a dark future in this area.

Another problem is that the very high concentration of farms in these enclosed coastal waters must have an adverse impact on water quality and would make it impossible to control an outbreak of diseases. When you watch fish swimming in these dirty enclosed waters, you realise that 'fresh fish' does not necessarily mean 'healthy fish'.

The National Institute of Coastal Aquaculture (Thailand)

Established in 1981 using a USD 7.5 million grant from Japan, the National Institute of Coastal Aquaculture (NICA) employs more than 200 people, 28 of whom are fisheries biologists. NICA sees its primary responsibility as 'exploring knowledge of further advancement in the fields of shrimp health, genetic selection, nutrition and feed technology development, coastal environmental protection, and farm management'. Its main objectives are:

1. Basic and applied scientific research on coastal fisheries;

2. Coastal aquaculture development and promotion; and

3. Coastal aquaculture training.

The visit focused on the hatchery, where different broodstocks are kept and used with mixed

Each farm has a small shed, occupying the surface of one cage, where many activities take place: preparing fish feed, repairing cage nets, cooking and surveying the farm at night . . .
[Photo: Aymeric Desurmont]

results. The only species that has been regularly mass produced is the seabass. For other species, including groupers and coral groupers, full-cycle culture has been mastered but the production of fry is too irregular to satisfy the Thai farmers' demands. The Institute has all the facilities to run training workshops but the language barrier may be a limiting factor since not many Thai people speak English.

The Marine Shrimp Research and Development Center (Thailand)

The Marine Shrimp Research and Development Center has three divisions:

1. Aquaculture Technology and Research;
2. Aquaculture Engineering and Environment Research; and
3. Diseases and Parasites Research.

Lately, it has been addressing the issue of pond waste that has become a major environmental concern in shrimp farm areas. The Center is experimenting with a closed water system, which includes small ponds used as bio-filters and 3 hp pumps used to force air through an array of small PVC pipes set at the bottom of the grow-out ponds. To limit the waste, no fertilisers are used to facilitate plankton blooms and feed is strictly controlled. When the ponds are emptied, the water goes through a series of bio and mechanical filters before being sent back to the ocean. The sludge is left to decay through the action of the sun and bacteria (to accelerate the process, bacteria are taken from the ponds, grown in the lab and sent back to the farm to be dispersed). The system is working and good growth rates have been obtained. The economics, however, still need to be fully assessed.

Cage fish farming in Thailand is a family business, children give a hand after school
[Photo: Aymeric Desurmont]

2002 AFA/SPC PACIFIC ISLAND FISHING TRAINEESHIP

by Grant Carnie,
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The second AFA/SPC Traineeship for promising young fishers from Pacific Island nations finally got under way in early January 2002, three months after the intended start date. The extraordinary events of September 11th had even spread to the Pacific and affected the original start date of the traineeship. A delay in some of the trainees getting the necessary visas because of tightened security arrangements in Australia meant that the original schedule for the programme would straddle the Christmas/New Year period and so a decision was made to postpone the start until the New Year. This ensured that the trainees could spend Christmas with their families and that those placed at sea wouldn't be compromised with boats tied up over the holiday break.

The trainees for this second programme came from Papua New Guinea, Tonga, and Kiribati, with PNG providing five of the eight young fishers. A particularly pleasing aspect for all involved in developing and implementing the programme was the commitment that Pacific Island fishing companies who had sent trainees to the first programme were demonstrating by providing trainees again, a great vote of confidence in the programme.

A review of the inaugural training programme with the trainees, AFA staff, and Michel Blanc, Fisheries Education and Training Adviser, SPC, resulted in some minor changes to the course design. This time trainees would spend more time at AFA learning fishing skills and in particular developing navigational skills and slightly less time in work placement on Australian fishing vessels. The inaugural trainees believed that future trainees would benefit from a greater emphasis on skills that could be learnt from AFA staff, utilising the Academy's impressive resources.

The trainees were again to spend two weeks at the Port Adelaide campus with accommodation provided at the nearby Fort Largs Police Academy. They arrived over a two-day period and were met at the Adelaide airport by AFA staff, who reported that they couldn't see why there had been delays in the visa process. Not one of them looked like a terrorist and in fact a happier, friendlier bunch of people you wouldn't chance to meet!

The first day involved a barbecue and induction to allow the trainees to settle in and be briefed on the programme for the coming ten weeks. The scheduled two-week training course at the Port Adelaide campus began with sea safety and senior first aid training. The rest of the time was spent developing and honing navigational skills using the Academy's newly installed wheelhouse simulator. Unlike many other simulators, this simulator was designed to represent a 22 metre fishing vessel; all the electronic equipment was of the type that the trainees were likely to see and use on a fishing vessel. The two trainees from Delta Fisheries, a prawn fishing company based in Port Moresby, felt very much at home – the simulator was based on a prawn trawler very similar to the ones they work on in PNG. AFA staff were able to set the trainees on various simulated voyages around the islands of Port Lincoln and let them test their skills in preparing, undertaking, and navigating a trip safely.

A highlight of the traineeship was a night spent at the Clipsal Powerhouse watching the Adelaide 36s, Adelaide's National Basketball League team, beat the Sydney Kings. The trainees were soon converts to the cause of the local team, barracking as loudly as anyone in the stadium, particularly as Willy Farley, an Afro-American import from the United States showed his exciting skills. The 36s went on to win the championship in April – we are sure the vociferous support from the Pacific Islanders that night in some small way contributed to the team's success!

The programme moved to the Port Lincoln campus at the end of January and the trainees were accommodated on the waterfront in the marina complex. They were able to watch at close quarters the movements of the local fishing fleet, which had to pass right in front of the trainees' apartment as they put to sea. The AFA staff also procured an aluminium dinghy for the trainees so that they could ferry themselves to class every morning and demonstrate their boat-handling skills.

The programme began with a look at local fishing vessels, processing factories, and aquaculture farms. The advantage of Port Lincoln as a magnificent seafood industry training centre was again highlighted, with

trainees exposed to Australia's largest and most diverse fishing and aquaculture port and able to see at first hand a broad spectrum of fishing, aquaculture, and seafood-processing methods. This four-week section of the programme consisted of training in radio telephony, radar, vessel handling, fishing techniques, electronic fish finding, seafood handling, and fisheries management. The course also included environmental issues, such a critical aspect of all fisheries-related training now.

The graduation barbecue for the trainees was held on the boardwalk at the Marina Hotel on 27 February, with AFA staff, local skippers and crew, and fishing company representatives joining the trainees in celebrating the completion of the campus-based training. The graduates received an AFA/SPC Pacific Island Fisher's certificate as well as statutory radio, sea safety, first aid, and radar certificates of completion.

The trainees were now ready to join their allotted Australian fishing vessel, strategically selected to expose them to a similar fishery to the one they fish in at home. Longline fishery trainees went to Cairns to join longliners from the Great Barrier Reef Tuna Company fleet; one trainee joined a dropliner/trapper based in Darwin; and three stayed in Port Lincoln with two working in the Spencer Gulf prawn fishery and one on a new, state-of-the-art pilchard (sardine) purse seiner.

The second traineeship has been another resounding success, with the trainees successfully completing what are at times challenging regulatory certificate courses. The experience they have gained through working in the Australian fishing industry, the new skills they have learnt, and the networks

***Top**: Seniti Moleni (Tonga), Livai Monina (PNG), John Taupone (PNG), and Rabangaki Tonginako (Kiribati) on one of the fishing boat wharves in Cairns, Australia*
***Middle**: Kreck Yangsai (PNG) relaxing on a tuna cage in Port Lincoln, Australia*
***Bottom**: Francis Caspar, Kreck Yangsai, Ian Gawaii and John Taupone, all from PNG, on a tuna cage in Boston Bay, Port Lincoln, Australia*

[Photos: Grant Carnie]

they have been able to develop will assist them in making a significant contribution to the future of the fishing industry in their own countries. And as the first group of trainees, they were enthusiastic and committed and demonstrated a great desire to learn new skills. They were great ambassadors for their countries and will be warmly remembered by all who came into contact with them.

***Top*: The trainees sample southern rock lobster at a live lobster processing factory in Port Lincoln, Australia**

***Bottom*: The trainees help with the daily feeding of southern bluefin tuna in Port Lincoln, Australia**

[Photos: Grant Carnie]

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