Fisheries Newsletter

Number 111 (October – December 2004) *ISSN 0248-076X*

Editorial

An SPC–FAO training workshop in Fisheries Management and Statistics was held in November in Fiji Islands. Training needs in this area were identified by the Strategic Plan for Fisheries Management and Sustainable Coastal Fisheries in Pacific Islands, endorsed at the third Heads of Fisheries Meeting, in August 2003.

This training workshop was designed to familiarise fisheries managers and senior fisheries officers with using fisheries statistics to help develop fisheries management policies, and to oversee the management of inshore fisheries resources. Training was intended to enhance the capacity of fisheries administrations staff to manage sustainable fisheries and to assist them in their efforts to collect, store, retrieve and analyse basic fisheries data and / or indicators for monitoring the status of fish stocks.

An additional workshop on Fisheries Legislations and Community-based Fisheries Management will be held in early April in Honolulu, USA, under the auspices of the Western Pacific Regional Fishery Management Council.

Jean-Paul Gaudechoux
Fisheries Information Adviser (jeanpaulg@spc.int)

A training workshop on Fisheries Management and Statistics was organised by SPC's Fisheries Management Section (in conjunction with the FAO Sub-regional Office), in Nadi, Fiji Islands, from 15–19 November 2004

in This Issue

SECRETARIAT OF THE PACIFIC COMMUNITY
Prepared by the Information Section of the Marine Resources Division and printed with financial assistance from France.

FISHERIES DEVELOPMENT SECTION

Technical assistance to Kosrae, FSM

In October, SPC Fisheries Development Officer, Steve Beverly, assisted the Fisheries Development Division in Kosrae, Federated States of Micronesia in rigging and deploying two fish aggregation devices (FADs). These FADs were placed in locations that were selected from previous FAD site surveys. Steve made two previous visits to Kosrae in 2000 — the first one in April to conduct FAD site surveys, and to rig and deploy FADs; the second visit was in September to conduct two FAD fishing and deep bottom fishing skills workshops. This current FAD deployment project was an extension of the 2000 project.

Most of the same crew from previous visits were on hand to help with the FAD project, including Robert Taulung, Administrator, Max Salik, Steve Palik, Roland Sigrah, Bruno Ned (Nelson Fisheries Officers course graduate), Tony Abraham, Roosten Abraham (also a Nelson graduate), and Captain Anderson Tilfas. Steve also had some help from the crew of an ongoing mangrove crab rearing project and a US Peace Corp volunteer.

Steve's first task was to inventory all supplies, and these consisted primarily of FAD materials given by the Japanese government several years ago. Steve found all the materials from 2000 untouched, except for a few missing shackles and swivels. The crew unloaded enough gear from the container to construct three FADs.

A turntable was built for uncoiling the 500-m coils of rope (Fig. 1). The crew also cleaned the shackles and swivels. By the end of the first day, five coils of polypropylene rope and one coil of nylon rope had been uncoiled and flaked out. All Samson Nylite rope connecters had been drilled to fit the shackle pins (thanks to the lathe operator at Public Works Department), and all materials had been laid out in preparation for rigging.

On the second day, the FAD mooring for Okat was rigged. This FAD would be deployed about three kilometers southwest of the old site in about 1120 m of water. It consisted of 1050 m of poly-propylene, 300 m of nylon, 10 m of chain, and 5 m of cable, totalling 1365 m of mooring length, which was about 120 per cent of the site depth. Two 14.5-kg buoyancy pressure floats were spliced into the top end of the polypropylene rope for additional floatation. The buoy system was configured using available materials: a 200-litre plastic float and an old Japanese-style Indian Ocean system to trail behind the larger float (Fig. 2). Plastic aggre-

Figure 1 (top): Turntable used to uncoil 500 m coils of rope
Figure 2 (bottom): FAD buoy system and aggregator

gator material (Fig. 2) was cut to fit on the mooring just below the upper cable. Rigging the buoy system and attaching the aggregator would be done onboard the vessel just prior to deployment. All of the line and chain were loaded onto M/V *Mutunte*. The ramp on the stern of the boat for holding and deploying the anchor block had fallen into disrepair, so had to be rebuilt before the anchor block could be loaded (Fig. 3). The 1.5-mt-anchor blocks were made by the Fisheries Division, and were larger than the ones used in the previous project.

A stainless steel welding rod (electrodes) was used instead of normal cotter pins on all safety shackles (Fig. 4). Experience in Niue and Cook Islands has shown that cotter pins tend to slip out of the holes in the shackle pins after the holes become enlarged with wear and corrosion.

The following day the crew rigged the FAD mooring for Utwe. The FAD site was about one-half kilometer from the old site in 920 m of water. The mooring was made with 1000 m of polypropylene, 150 m of nylon, 5 m of cable, and 10 m of chain, totalling 1165 m of mooring length, or a little over 120 per cent of the site depth. The crew moved one anchor block to Okat Harbour. M/V *Mutunte* was on its way to Okat to load the anchor but broke down before leaving Lelu Harbour. Tony Abraham went out in the new boat, M/V *Sinlaku* (Fig. 5), and towed M/V *Mutunte* back to the fisheries wharf. The problem had been a blocked fuel filter but it was easily fixable. During the project, it

Figure 3 (top): Rebuilding the anchor ramp on M/V *Mutunte*
Figure 4 (middle): Safety shackle with stainless steel welding rod in shackle pin
Figure 5 (bottom): M/V *Sinlaku* towing M/V *Mutunte*

was reassuring to know that there was always a backup vessel on hand for security.

The following week, M/V *Mutunte* shifted to Okat Harbour, to load the FAD anchor for the first deployment. Unfortunately, the sea was too rough, so while the crew waited for calmer weather, the FAD buoy system and the aggregator were rigged.

The next day one anchor block was loaded onto M/V *Mutunte* and secured with six Spanish windlass knots (Fig. 6). Some of the crew went onboard M/V *Sinlaku* to check on sea conditions. Captain Anderson decided that it was not safe to try a deployment because the sea was still very rough. Robert aborted the deployment on the following day as well because of rough seas.

On the next to the last day of Steve's visit, the Okat FAD was deployed in small to moderate seas at 1130 hours at 05°20.00'N and 162°52.75'E in 1120 m of water. Buoy system deployment was 0.5 nm to the west and anchor deployment 0.25 nm to the east of this position, using the straight line deployment method. After 15 minutes, the buoy system position was 05°19.67'N and 162°52.66'E. Deployment went perfectly.

On the last day of the project the weather was even better than the day before. The Utwe FAD was deployed in near perfect sea conditions at 1130 hours at 05°13.25'N and 162°57.00'E in 920 m of water. Buoy system deployment was 0.42 nm to the west and anchor deployment 0.21 nm to the east, using the straight line method. After 15 minutes the buoy system position was 05°12.86'N and 162°57.05'E (Fig. 7).

On Friday evening the Fisheries Development Division hosted Steve to a sumptuous BBQ at the gazebo in front of Kosrae Nautilus Resort. Dinner consisted of mangrove crab, lobster, fresh sashimi from the day's catch, chicken, breadfruit chips, and barbequed reef fish — all washed down with Chinese beer and topped off with a platter of Kosrae's famous dessert, fafa.

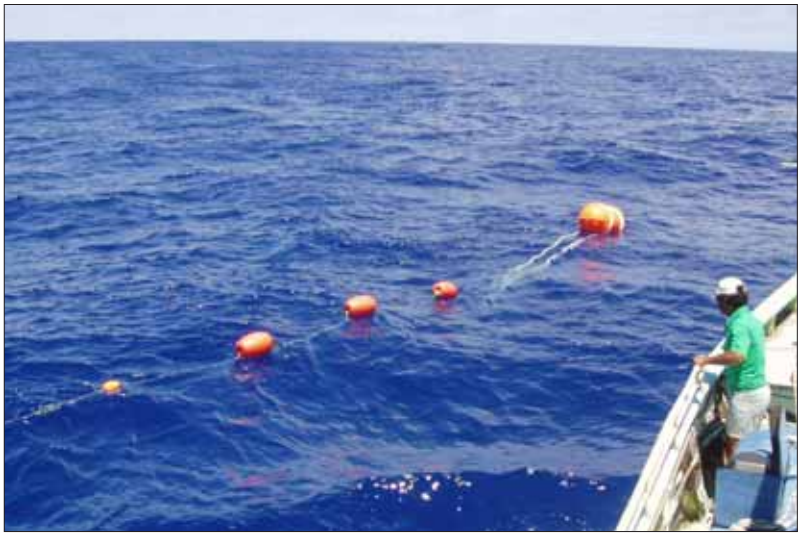


Figure 6 (top): Anchor block secured with Spanish windlass knots
Figure 7 (bottom): FAD buoy system just after deployment

On the return trip to Noumea, Steve stopped over in Tokyo and visited the Central Market at Tsukiji. He arrived at the fish market at 0400 hours to watch fish being unloaded. The biggest fish was a 330 kg frozen bluefin tuna. The auctions started promptly at 0530 hours and were mostly finished by 0545 hours. Steve followed a few fresh 150–200-kg bluefin tuna from the auction to the stalls to see how such large fish were filleted; as it turns out, it takes three men and a very long sword (Fig. 8).

Unfortunately, just one month after returning to Noumea, Steve received word from Robert that the Okat FAD was missing. Whether it was the result of poor materials (which were several years old), vandalism, fish bite,

or an encounter with a boat will probably never be known as the buoy system was not recovered. The materials were basically the same as those used for a FAD deployment in Pohnpei in 2000. In fact, the FAD buoy system used in the Pohnpei deployment was one borrowed from Kosrae fisheries. The Pohnpei FAD was on station for over 18 months and proved to be very productive (see *Fisheries Newsletter* # 95 and # 100). The staff at Kosrae Fisheries have the necessary skills to deploy another FAD on their own so it is hoped that a replacement FAD will be deployed soon. Staff have ample materials on hand for rigging at least one more FAD and have already made plans for a deployment on the southeast side of Kosrae near Lelu, where the fisheries office is located.

Figure 8: It takes three men with a long sword to loin a 200-kg bluefin tuna

Assistance provided to the National Fisheries College in Kavieng, PNG

In early October 2004, the Fisheries Development Section was approached by the National Fisheries College (NFC) in Kavieng, Papua New Guinea for urgent technical assistance. In response, Fisheries Development Adviser, Lindsay Chapman, travelled to Kavieng during the last week of October to develop a workplan for the assistance, and to draft a memorandum of agreement for the work to be done. It was also agreed that NFC would fund this assistance by paying a consultancy fee for the services provided. Fisheries Development Officer, William Sokimi, travelled to Kavieng in mid-November to start a four-week consultancy with NFC. The objectives of this project were to:

- consult with college staff, members of the local fishing association, students and other stakeholders, to conduct a review of the NFC curriculum for the Certificate in Small Fishing Operations (SFO) course;
- propose changes or additions where necessary to the curriculum for the SFO course;
- provide input and advice on the development of a system for nationally acceptable standards in the fishing industry; and
- conduct training for NFC tutors and interested fishermen in the practical fishing aspects of the SFO course to enhance their skills in these fishing methods.

The review of the SFO course was brought about by the training needs of the EU-funded Rural Coastal Fisheries Development Programme (RCFDP), and as a result, of the training already

undertaken. RCFDP had identified some areas of concern with the initial training they had contracted NFC to provide to village fishermen who had taken loans for fishing boats and equipment in their project areas. To rectify this, the SFO course was to be reviewed and modified to incorporate the criteria requested by the RCFDP administration. Refer to *Fisheries Newsletter* #100 (pages 32–36) for more information on the RCFDP.

William consulted the staff of NFC's Coastal Fishing Operations section and RCFDP administration and asked them to identify any areas of concern. Problems included poor course delivery by NFC tutors, insufficient sea time for practical fishing activities, little attention placed on post-harvest activities, and poor management of the business side of the course. The outcome of these consultations was for William to a) review the SFO course, and b) develop a separate, non-accredited three-week course that integrated materials from both the SFO course and NFC's Post Harvest Operations (PHO) course, and focusing on practical activities rather than theory. Outlines for both courses were developed and provided to NFC and RCFDP for comment, with NFC assisting in the further development of the course content.

Once the courses were sorted out, William worked with the NFC tutors to improve their fishing skills using the methods covered in the courses. This was conducted on two of the RCFDP 8.2-m dories with 12 RCFDP loan recipients attending the PHO course. The two vessels were equipped for deep-water snapper fishing and night fishing methods. An overnight trip was made off Tsoi Islands and the vessels (Fig. 9) did some trolling along the way. Both deep-water snapper fishing and night fishing with light attraction were done during this trip.

William also conducted two lamp fishing trips for NFC tutors so that they could review these methods as part of the SFO course. The trips lasted from dusk to midnight; small scads were caught and used as live bait. Spanish mackerel, barracuda and trevally were caught on the surface and in the mid-water column, and some groupers were caught during bottom fishing.

Figure 9: RCFDP 8.2-m dory on its way to Tsoi Island

Other technical assistance projects in the pipeline

Lindsay travelled to several countries in October and November to meet with respective staff from fisheries departments for future technical assistance projects.

Nauru

A memorandum of agreement was signed for upcoming assistance to Nauru. FAD materials and a deep-water echo sounder were ordered in October for this project; however, due to holdups in the supply of materials, this project will now be undertaken in early 2005 when the FAD materials arrive in Nauru. In 2005, the Fisheries Development Section will also assist with training crew on the two tuna longliners (Fig. 10) that are owned and operated by NFMRA. One vessel is operational with the other undergoing an extensive refit in early 2005, with funding assistance from Japan. The operation of these vessels will also be closely monitored in order to keep better records of all expenses, and to keep them separate from those of the fish market, which is also operated by NFMRA.

Solomon Islands

Fisheries development in the Solomon Islands is slowly recovering after the civil unrest of the last couple of years. The new Permanent Secretary of Fisheries, Mr Tione Bugotu, informed Lindsay that the main focus of fisheries at present is to upgrade and implement the Tuna Management Plan. Mr Bugotu said this was well underway. Once the plan was implemented and all the necessary procedures put in place, the Fisheries Department in the

Solomons would look at small-scale tuna fishery development as well as reviving their Rural Fishing Centres.

Wallis and Futuna

The Fisheries Department in Wallis and Futuna has commenced a FAD programme, with two FADs deployed off Wallis at present. Materials have been ordered for several more FADs for both islands. Lindsay and the fisheries staff made plans to introduce mid-water fishing methods through workshops conducted on both islands. The workshops will be held once the FADs are in place and when local fishermen have suitable vessels. Several fishermen have ordered vessels under a government subsidy scheme, with SPC providing technical assistance in 2005 when the vessels arrive.

Figure 10: NFMRA's two longline vessels

Training course

In November, Steve attended a course titled Certificate IV in Assessment and Workplace Training, which was held at SPC headquarters in Noumea. Steve and 12 other SPC staff members received certificates of qualification after completing the four-day course. The course was conducted by a consultant working for the McLaughlin Sports Training Consultancy under the auspices of the Australian Institute of Technology.

Steve will apply his newly learned skills when he plans and conducts future FAD fishing, longline fishing, and fish handling workshops.

FAD research project update

The FAD research project has officially concluded, although the Fisheries Development Section continues to work with the Fisheries Departments in both Niue and the Cook Islands in monitoring the remaining FADs, and assisting with catch and effort data collection. No project FADs were lost in the last quarter. The two project FADs off Rarotonga have been on station for 33 and 18.5 months; two project FADs off Aitutaki have been operational for 32.5 and 18.5 months; and two project FADs off Niue have been on station for 34 and 8 months.

The final report for this project has been compiled and provided to the donor, New Zealand Agency for International Development for comment and clearance. Once the report is cleared and accepted by NZAID, the results will be presented in upcoming issues of the *Fisheries Newsletter* in early 2005.

FISHERIES MANAGEMENT SECTION

SPC/FAO training in Fisheries Management and Statistics

A training workshop on Fisheries Management and Statistics was organised by SPC's Fisheries Management Section in conjunction with the FAO Sub-regional Office in Apia. The workshop was held in Nadi, Fiji from 15–19 November 2004, and was aimed at fisheries managers and senior fisheries officers. The purpose of the workshop was to familiarise staff with using statistics that could be useful in developing fisheries management polices, and for overseeing the management of inshore fisheries resources in Pacific Island countries.

The training was the first in a series of activities required under the Strategic Plan for Fisheries Management and Sustainable Coastal Fisheries in Pacific Islands, which is the regional strategic plan endorsed by the third of Heads of Fisheries Meeting in August 2003. The plan was designed to partly fulfil two of the six goals under the regional strategic plan: 1) to enhance the capacity of fisheries agency staff to manage sustainable fisheries, and 2) to assist fisheries agency staff in their efforts to collect, store, retrieve and analyse basic fisheries data and/or indicators to monitor the status of fish stocks. Topics covered to address the two goals included data collection and analysis, fisheries regulations, public awareness, involving stakeholders, fisheries management, marine protected areas, aquaculture, and the structure of fisheries agencies. All topics involved extensive participant discussion and many included practical exercises in data analysis and fisheries management. The training attracted 50 participants, of which, over 20 per cent were women

After five days of extensive sessions, it is expected that fisheries managers and senior fisheries officers are now able to use fisheries statistics as a tool to assist in the formulation of policy recommendations that help in managing fisheries resources in their respective countries.

The training workshop was made possible through financial assistance from SPC, FAO, Commonwealth Secretariat, Western Pacific Regional Fisheries Management Council, and the European Union.

Participants divided into groups to carry out practical exercises (including analysing catch and effort data, devising fisheries regulations, and developing a management plan)

TRAINING SECTION

Training booklet available now

The popular manual "Onboard handling of sashimi grade tuna" is being dusted off. The new version is now available and will be distributed to our fisheries contacts. The manual has been printed in a smaller format (A5) on glossy waterproof paper for ease of use by vessel crew members. The information contained in the manual has been updated, thanks to staff of the Fisheries Development Section. An extract from the new booklet is reproduced here. Copies are available from SPC Fisheries Training Section or SPC's website:

www.spc.int/coastfish/News

Sashimi is a traditional Japanese dish made from thin slices of premium quality raw fish. The most popular sashimi fish are the red meat species, particularly tunas and skipjacks. "Sashimi" in fact means much more than just "raw fish"; the term implies specific requirements regarding freshness, appearance, presentation, texture and taste.

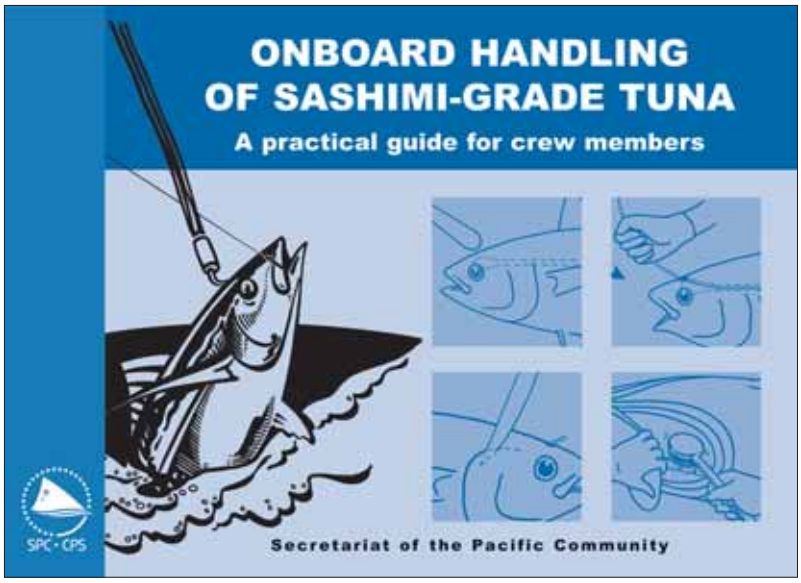
Only genuine, premium quality fish will fetch a good price on the sashimi market. Fish quality is determined by several factors, both biological and non-biological:

- Biological factors such as species, age, size, degree of sexual maturity, and the presence of parasites or diseases, are not within the fishing crew's control. The size, species and stage of sexual maturity are very important because they influence the fat content of the fish. The tuna with the highest fat content attract the best prices in the sashimi market.
- Non-biological factors are within the crew's control. They include fishing method, and handling and chilling techniques used after capture.

There are many ways of handling and packing fresh tuna, but only a few are suitable for exporting high-grade product to sashimi markets. This booklet is primarily intended for crew members on tuna longliners, and attempts to describe in detail a handling and refrigeration method that meets the exacting standards of the export fresh tuna market.

For certain stages of the handling process, alternative techniques are described because requirements may vary from importer to importer. It is therefore essential that the fishing boat operator be aware of his buyer's specific requirements.

Some fishing boat operators export to several international markets (e.g. the largest and highest-grade tuna are exported to Japan, while others are exported to Hawaii or the US mainland); crew members may therefore need to handle each fish according to its intended market.



No matter what methods of handling and presentation are requested by the buyers: Always kill, bleed and chill tuna that weigh over 25 kg as quickly as possible!

AQUACULTURE SECTION

ACIAR/SPC Kiribati Pearl Workshop, Tarawa

Since the first harvest of cultured pearls in Kiribati in August 2003, pearl industry efforts have shifted from research to commercialisation. This will not be an easy task, as pearl farmers elsewhere have discovered. More and more countries are producing pearls, prices on the world market are competitive, and diseases from intensive farming are causing losses in production. Therefore, profitable enterprises in Kiribati will require that niche-marketing opportunities are explored and that sustainable systems of management are implemented.

The objective of the ACIAR–SPC Kiribati Black Pearl Workshop was to assess the economics of black pearl culture and deliberate on various strategies for management. The findings were presented to the government Pearl Oyster Coordinating Committee (POCC) meeting that was held at the end of the workshop.

Workshop organisers included Assistant Professor Paul Southgate (James Cook University), Dr Ian Cartwright (consultant) and Mr Ben Ponia (SPC Aquaculture Adviser). Resource participants included Ms Jo Anderson, pearl industry policy adviser for Ministry of Marine Resources, Cook Islands, and Mr Masahiro Ito, project leader for the black pearl project in Micronesia. Support was provided by fisheries staff members Mr Beero Tioti (pearl hatchery manager) and Johnny Kirata (acting Deputy Director).

There were two working groups at the workshop. The first group tested the "Pearl Economic Farm Model" software, available on the SPC portal (www.spc.int/aquaculture), which models different scenarios for profitability. The second group discussed different management options, based on the experience of pearl producing countries, but also merging it with local knowledge; for example, that gained by the government Atoll Seaweed Cooperation involved in the aquaculture of kappaphycus seaweed.

The main findings of the workshop (to be published as an SPC technical report) were:

1. The minimum sized pearl farm required to make a profit is 30,000 pearl oysters. Larger farms were more profitable but required substantial financial investment. For example, for a farm with 100,000 oysters (benefit to cost ratio of 1.62; internal rate of return 28%) it is necessary to have a minimum capital investment of approximately a quarter million dollars (AUD). Annual operating costs must be about the same amount with no positive cash flow (breakeven) until year six, and a 67% chance of no profit (see figure on page 11). This farm would most likely require direct foreign investment for establishment, ideally under some form of joint venture with an I-Kiribati entrepreneur. Communities could be employed to grow the oysters from juvenile to pre-seeding sizes.

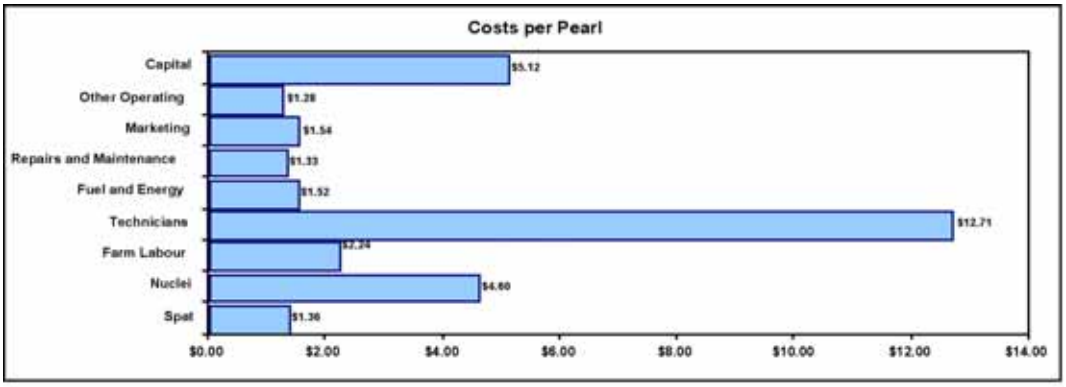
2. Culturing mabe (half round) pearls represents a relatively low-risk and low technology means of generating revenue. Beginning with this type of operation is a quicker and less expensive way to gain experience in pearl farming, and provides a quick turnover of cash. This operation lends itself to family or cooperative smaller sized farms. Mabe production is far less difficult than round pearl production and does not require the services of a seeding technician, which can account for 20–40% of cost of the round pearl.

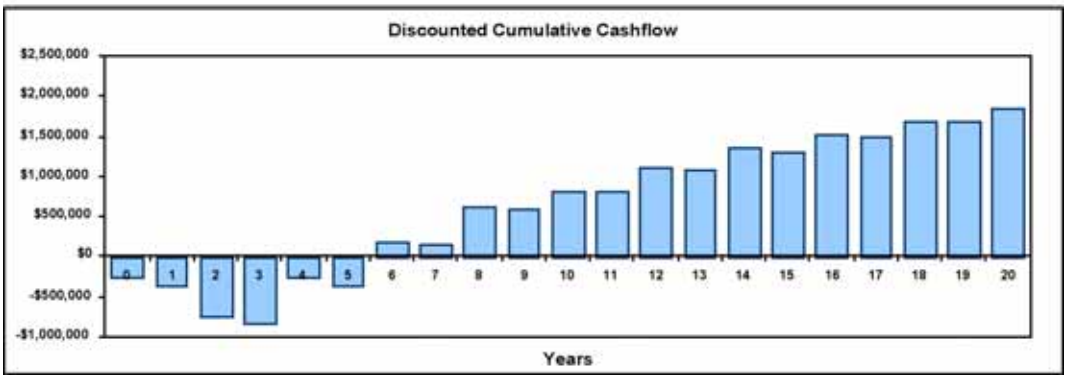
3. Workshop participants concluded that the development of the pearl industry in Kiribati required sound management planning to ensure that:
   - the environmental sustainability of individual lagoons was not exceeded;
   - the roles and responsibilities of government, communities, Island Councils and other stakeholders are clearly defined; and
   - pearl farm sites with clear rights and obligations were established for each lagoon earmarked for pearl farming, in cooperation with Island Councils and traditional leaders.

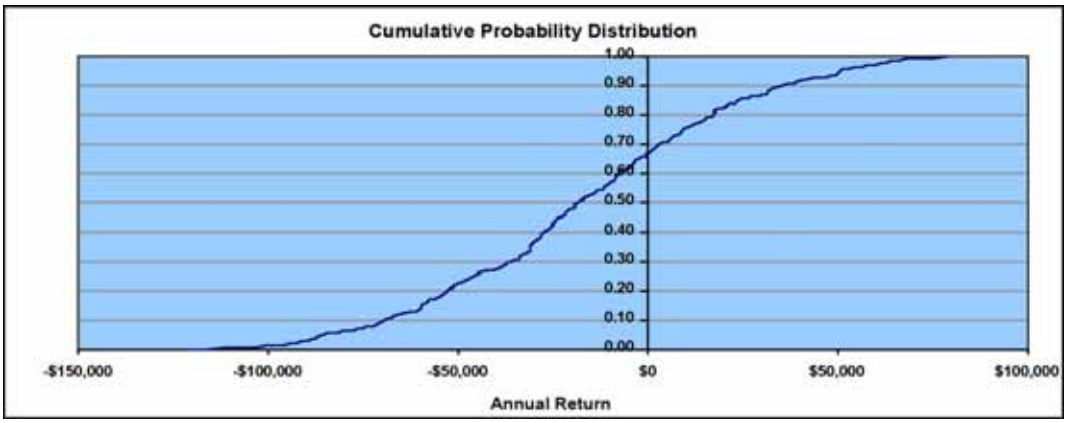
Update on progress: The first harvest produced about 200 pearls. There was a high level of "vomits" (rejection of the nucleus by the oyster) and mortality among the 1000 oysters originally seeded, which is probably due to stress. The majority of the pearls had low commercial value, although a few near round pearls of good quality were produced. The second seeding of 4000 oysters was completed in August 2003 under more favourable conditions using the seeding house in Abaiang. An estimated 55% retention rate was achieved. The hatchery has maintained a high level of production with three to four spawning runs per year, each resulting in around 1 million viable spat. These pearls

Scenario 1 - Large Pearl Farm, Private Sector Owner, Spherical Pearls (Descriptor: 100,000 oysters; wage workers)

Output summary		Economic indicators	
Annual production (pearls)	9,673	Net present value	$1,869,337
Annual gross revenue	$496,879	Annual return	$190,396
Annual production cost	$306,483	Internal rate of return	28.33%
Production cost per pearl	$31.69	Benefit - cost ratio	1.62
Revenue per pearl	$51.37		







Summary of risk assessment: 67% chance of zero profit; lowest return AUD–121,519; highest return AUD 78,677

will be ready for harvest in mid-2005. The third seeding operation, which consists of 5000 oysters, is now underway and a seeding technician from the Cook Islands has been brought in to assist.

Three experimental farms have been established on Abemama, Butaritari and Onotoa with 3000 oyster spat transferred to each site.

Top left: The blacklip pearl oyster, *Pinctada margaritifera*

Top right: Seeding operation in process

Bottom left: Mabe pearls first harvest

Third Meeting of the Regional Advisory Group on Aquatic Animal Health
23–25 November 2004, Bangkok, Thailand

SPC's Aquaculture Adviser, Ben Ponia, participated in the advisory group on aquatic animal health, which met at the Network of Aquaculture Centre in Asia-Pacific (NACA) headquarters in Bangkok, Thailand. Ben was invited to present the results of a recent SPC consultancy on import risk analysis (IRA) conducted by a team of experts led by Dr Richard Arthur. Risk analysis was completed for the proposed movement of marine prawn *L. stylirostris* from Brunei to Fiji and of freshwater shrimp *M. rosenbergii* from Fiji to Cook Islands. Whilst risk assessments generally focus on pathogens, such as diseases, the approach taken by SPC includes a strong ecological risk component. The working group was in general agreement that the IRAs adopted by SPC, using a semi-qualitative process, was fairly robust and made sensible conclusions. The IRA reports are currently under publication and will be reported on further in the next *Fisheries Newsletter*.

Feedback from the working group indicated that the World Animal Health Organisation (OIE) meeting held at SPC in December 2003 has made significant progress in raising awareness of aquatic animal issues. The Director General of the OIE has requested that the "Noumea recommendations" be tabled as an agenda item for future regional OIE meetings. One of the recommendations strongly supported by the working group is that a fisheries counterpart be nominated (alongside the chief veterinarian officers) to participate in OIE forums.

The representatives from FAO Rome and the Australian government indicated their willing-

ness to support biosecurity collaboration in the region. Food safety standards are also anticipated to be an issue of increasing importance in the near future.

The meeting was a useful insight into the Asia experiences in animal health, and was an opportunity for the Pacific to learn preventative or mitigative measures for disease outbreaks. Varied discussions took place on such issues as: the new listing system for OIE disease; mass introductions of *P. vannamei* prawn and pathogen risks to indigenous stock such as "Monodon Slow Growth Syndrome"; DAAS disease symposium 2005; economic implications of "White Tail Disease" in *M. rosenbergii*; ongoing impacts and concerns from "Koi Herpes Virus" particularly on the freshwater ornamental trade; and a proposal to form a small working group to concentrate on harmonisation of quarantine protocols and compiling a case studies of quarantine protocols.

Seventh Asian Fisheries Forum
30 November–4 December 2004, Penang, Malaysia

The Asian Fisheries Forum (AFF) is a tri-annual conference and trade show that is considered to be a premiere event for the Asia-Pacific region. This year the event attracted about 800 participants and a strong lineup of trade booths. The conference covered a broad range of topics, of which, approximately two-thirds were related to aquaculture.

SPC's Aquaculture Adviser, Ben Ponia, who participated in the forum, presented an overview of the status of mariculture in the Pacific region.

Penang is host to the WorldFish Center headquarters, and is a vibrant coastal city with many attractions. The conference provided a tour of some of the local aquaculture enterprises, including visits to the extensive caged fish farms (grouper, trevally, snapper), which target the export market of the live reef fish trade. Some cages are stocked with up to 200 kg of fish per cubic meter. Other tour highlights included a large prawn (*P. monodon)* farm and a freshwater ornamental fish operation.

Caged fish farms with groupers, trevallies and snappers

Samoa National Aquaculture Workshop
14–15 December 2004

With the growing interest in Samoa in aquaculture, a national workshop was held to seek partnerships with stakeholders and to begin the process of developing a national industry plan. Presentations were made to review the history of aquaculture in Samoa and the rest of the Pacific. Various commodities with potential for Samoa were also profiled. Group sessions were organised to identify industry priorities and the next steps required for developing the sector.

Stakeholder needs were varied, but generally the feedback was that small-scale, semi-commercial opportunities should be the main priority. Commodities such as tilapia were highly rated because there is a large domestic market perceived in Samoa and neighbouring American Samoa. Also, tilapia offers the option of being consumed by the household, similar to other small-scale farming commodities. A local species of sea urchin was identified as one of the niche products that Samoa could export, especially to the Japanese market. Trials for farming this sea urchin are currently being undertaken by a JICA volunteer.

Aquaculture may provide an opportunity for the private sector fishing industry, which is currently facing hard times, to add value to processing and export activities or to diversify their investment portfolio. One operator proposes to establish semi-intensive tilapia farming at a site where ponds were constructed in the past for a trial of freshwater *Macrobrachium* shrimp, which realised a one tonne harvest at the time.

It would be worth exploring ways to derive commercial benefits from the network of village marine reserves involved in aquaculture. For example, many of the existing community reserves are raising hatchery reared giant clams at the government hatchery. By combining the production of the village reserves it may be possible to achieve a consistent supply to meet the strong export demands of the marine aquarium trade. A central coordinator and housing facility would be required. This facility could accommodate a Fisheries Department, an NGO, or a private company.

The two-day workshop had an intensive lineup of presentations. The general consensus among participants was that the consultation was timely and worthwhile. A post-workshop review by key persons felt that the workshop provided a useful scoping exercise and that a second, more focused, workshop should follow with the aim of finalising a national plan.

The workshop was hosted by the Fisheries Department under the direction of Ms Malwine Lober. The meeting venue at the USP Alafou campus had an out-

Around 70 participants attended the workshop, which was aimed at reviewing the sectoral development and the specific commodities in Samoa

door tank displaying various types of aquaculture activities. Excellent resource materials were produced for the workshop with local expertise from Mr Lou Bell, Mr Etuati Ropati and Mr Bill Johnston from the Queensland Department of Primary Industries in Australia. Also assisting was SPC's Aquaculture Adviser, Ben Ponia. Funding was provided by the AusAID institutional strengthening project and SPC.

Eleventh Australasia/Oceania Commonwealth Veterinary Association regional meeting and workshop and other activities in PNG

SPC was invited to attend the 11th Australasia / Oceania Commonwealth Veterinary Association regional meeting and workshop in Lae, Papua New Guinea (PNG). SPC Aquaculture Officer Satya Nandlal attended the meeting and presented an "Overview of Aquaculture in the Pacific". A series of recommendations from the meeting were formulated to act as guidelines for policy-makers in the field of animal health and production.

Full participation was undertaken in all aspects of the meeting and the workshop included field trips and meetings with individuals with specific aquaculture concerns and questions. Field visits were made to Trukai (beef) farm and Mainland Crocodile Farms.

Bettie Higgins, a trout farmer in PNG, gave a presentation on her trout farm. She was very passionate in her presentation, outlining the initial development of the farm and the problems she encountered in getting it started. She met with Satya and requested assistance with her farm and was advised to contact SPC through the PNG National Fisheries Authority (NFA). Satya also visited James Kuk, Officer–in-Charge of Arap Fish Farm (a provincial farm) before returning to Port Moresby. Arap Fish Farm consists of six ponds ranging from 200–600 square meters. The water source is a bore hole, which at the time, was not used due to drought conditions. The farm does not have a regular water supply. According to James, some Chinese consultants were working on installing a pump and canal system to supply water to the farm, as well as for other activities of the farm such as rice and livestock farming. James would like to convert the present ponds into commercial tilapia production ponds and is seeking help for information on feed formulation and seedling production. James was advised that the SPC Aquaculture Section is currently addressing these issues in collaboration with Dr Paul Smith's Inland Pond Aquaculture Project for PNG.

Other Activities

Prior to participating in the veterinarian meeting, Satya took the opportunity to have a followup meeting with PNG tilapia extension officers based at Goroka and Aiyura. He also made a presentation at the Women in Aquaculture workshop at Aiyura, which was organised and funded by ACIAR.

1. Women in Aquaculture workshop — Aiyura

This workshop was held at HAQDEC Aiyura. Thirty women from four provinces attended the workshop, including staff of Aiyura station, Department of Agriculture and Livestock (DAL), and Dr Paul Smith. A presentation was made on tilapia feeding and was followed by a question and answer session with participants, staff and Dr Smith. Satya provided information and guidance on using various local ingredients to making tilapia feeds. Staff members Pita, Johnny, Solato and Alois were very keen to receive more hand-on training on feed formulation. Mr Kine, the Officer-in-Charge of Aiyura, was very pleased with SPC's involvement in training their staff in Fiji and is seeking further technical assistance.

2. Model integrated farms

An inspection of a model tilapia fish farm at Goroka Univeristy was made. The aquaculture is integrated with agriculture-farming systems and seed production for tilapia. The site has been cleared and levelled and the area completely enclosed by corrugated iron for security. A shed to store feed and other equipment stands at the entrance of the project. According to Michael Kapari, lecturer in agriculture, some university funds have been allocated for this project. Mr Kapari is seeking technical assistance in setting up this project. Two university graduate students, Donna Pearson and Rita Taraken, are carrying out aquaculture projects as part of their academic study. Pita Manipulu, the aquaculture officer based at DAL will compile a proposal for funding

3. Tilapia feed formulation

Satya visited the DAL office and examined the equipment for preparing fish feed, which includes a mixer, cookers, sieves and drying racks and other accessories. The equipment has been installed in a new shed in the back of the DAL office. Production of on-farm feeds is

Checking the quality of fish feed

underway, using fish meal, rice bran, and cooked sweet potato as the binder. This feed is being used to condition broodstock at Aiyura.

Satya provided guidance on how to make use of the coarse rice bran, a by-product of rice milled where the rice is used and the coarse bran, is left to rot. This coarse bran can be milled to fine bran and can be used as fish feed. Guidance and information was also provided on how to make mash feed for feeding tilapia fry and fingerlings as well as for broodstock and grow-out purposes. After a visit to Goroka municipal market some suggestions were made for using various agricultural by-products for fish feed formulation.

4. Meeting with trainees from the SPC/USP tilapia/prawn training workshop in Fiji 2003

After returning from Fiji, the trainees:

1. *Conducted a one-week training workshop on tilapia and carp farming at Goroka; 28 participants attended the workshop.*
2. *Conducted a one-week training for 30 participants on trout farming at Goroka.*
3. *Supervised site preparation for a model farm (integrating aquaculture/agriculture farming systems and seed production) at Goroka University.*
4. *Assisted Kotuni trout farm in site clearance and now sourcing funds for farm construction.*

5. Meeting with Dr Paul Smith, coordinator of ACIAR Inland Pond Aquaculture Project for PNG

Paul indicated the following:

- *The project is focussing on developing suitable on-farm feed technology and fertilizers.*
- *Funds have been released for the purchase of feed ingredients. Feeds have been purchased and stored at Aiyura.*
- *Equipment for feed preparation has been purchased and installed.*
- *Fingerling production of GIFT fish has commenced. Will conduct feed trials using 15 experimental ponds.*
- *Polyculture of tilapia and carp, and integrated farming will also be trialed during project.*
- *Would like to collaborate with SPC on aquaculture activities in PNG, especially in broodstock management/seed production and workshops for farmers.*

6. Meeting with the Honorable Minister of Agriculture and Livestock, Mr Mathew Siune, Biro and Pita at Goroka, DAL office

Satya provided a brief presentation on SPC's Aquaculture Section's activities in the region and in particular PNG. In his discussion with the Minister, the following points were made:

- *The Minister sought ssistance to inspect fish farms in Simbu province (about 500 in total).*
- *Rice farming has been initiated in Simbu and there is keen interest in fish farming. There is a lack of fish fingerlings and assistance is being sought from the DAL office.*

- *Bettie Higgins (trout farmer) is not willing to sell fingerlings to others, and help from DAL for fingerlings will be necessary.*
- *Pita Manipulu commented that fingerlings are produced at Aiyura and distributed via the DAL Goroka Office, but that additional funds were needed. The Minister agreed to provide funds based on Pita's request.*
- *The Minister wants to establish a distribution centre for fingerlings in his province.*
- *The Minister also stated that people should eat fish as it is a healthier food than pig meat.*

Nauru programme visit
October–November 2004

SPC Aquaculture Section staff Ben Ponia and Satya Nandlal visited Nauru in late October and early November 2004. The purpose of the visit was to conduct a National Aquaculture Planning workshop and observe fish farming activities in Nauru.

National Aquaculture Planning workshop

The workshop was requested by Mr Peter Jacobs (R&D manager for Nauru Marine Resources and Fisheries Authority NMRFA). Prior to the workshop, a visit to all possible aquaculture sites, including Buada Lagoon, was made along with a meeting with Mr Jacobs. The two-day workshop was attended by 20 participants from the government and private sectors, including members of Buado Lagoon.

Day 1 began with a presentation by Ben on the "Regional Status of Aquaculture" followed by Mr Jacobs on "Aquaculture in Nauru", which provided insight into past and present fish farming activities. Afterwards, an exercise in prioritisation of commodities was carried out in four groups, using SPC's commodity profiles as resource materials. The group exercise was facilitated by Ben and Satya. The main priority for assessing commodities suitable for aquaculture was food security. At the end of the day, milkfish, along with genetically improved farmed tilapia (GIFT) tilapia, crab, mullet, trochus and Mozambique tilapia were given highest rankings.

Day 2 involved group discussions and presentations on the prioritised commodities leading to the formulation of a five-year national plan. The plan is being compiled by SPC in collaboration with Nauru Fisheries.

The Fisheries Minister and his senior staff visited the workshop venue and were pleased with the participation of the government officers as well as the farmers in formulating their first National Aquaculture Plan.

The minister is very keen to develop aquaculture as a source of food for the Nauruan people. He briefed us on a major food security programme proposed by FAO, and also mentioned a Chinese company that was buying all the old phosphate mining structures on the island (to the value of AUD 1 million).

Field Visits

Satya made a field visit to existing milkfish pond sites, Buada Lagoon and Auobar Government Aquaculture hatchery site.

The typical backyard ponds are approximately 100–200 square meters. The ponds are shallow and some are stocked with Mozambique tilapia. Most of the ponds were not taken care of, except for Vincent Scotty's pond. Mr Scotty used to stock his ponds with milkfish fingerlings but has stopped because of poor catch rates from the wild. He now stocks wild mullet fingerlings, but the growth rate

Buada lagoon

and feed conversion ratio is poor. According to Mr Jacob, milkfish fry are no longer available from the wild due to over exploitation and predation by some local fish. In addition, some farmers were importing milkfish from Kiribati, but this had been temporarily stopped due to some misunderstanding in the transfer of funds for the payment of seedlings. Most farmers are interested in milkfish farming, which has traditionally been important for Nauruan people.

There are many derelict pools and ponds that are the result of extraction of phosphates and other activities on the island. Some of these ponds were once used for milkfish culture but are now infested with Mozambique tilapia. They have since been abandoned. Some of the ponds are inaccessible due overgrown bushes. The ponds are various sizes and with many crevices that make draining difficult, and the eradication of tilapia a major problem. The biological control of tilapia using a carnivorous species is an option.

The Buada Lagoon is the largest freshwater body on Nauru. It is owned by several groups living on the embankment of the lake. It was one of the main centres for milkfish culture in the past but this activity has been temporarily suspended due to a lack of milkfish seedlings. Because several groups own the lake, all members must agree in order to restock the lake. According to Mr Jacob, some funds were collected by the Buada Lagoon members for the purchase of milkfish fingerlings from Kiribati, however, due to internal problems, the fingerlings were not received. Mr Jacob also stated that a recent survey by the Ministry of Environ-ment and SPREP indicated presence of *E. coli* bacteria in the lake, may be due to seepage of sewers from houses on nearby banks.

The Auobar Aquaculture site (government owned) has several large concrete ponds with a shed funded by the Taiwanese government. Previously, milkfish were successfully grown in one of the tanks, although at present, the tanks are empty. The shed houses a generator with a water pump, but fittings to the intake system have not been installed. According to Jacob, the Chinese government is proposing to increase the number of ponds and improve other hatchery facilities. The site could be ideal for quarantine purposes as well as for experimenting with the breeding of milkfish and the intermediate culture of fry.

There is a need to develop a centre where milkfish (and possibly GIFT tilapia, trochus, etc.) seed production and grow-out facilities can be constructed, operated and demonstrated by NMRFA staff. This will accelerate and consolidate the development and adaptation of various culture technologies presently practised in some Pacific Island countries. This centre would also facilitate and make more effective the learning / adaptation process and serve to develop improved models and methodologies applicable to Nauruan people. An important function will be to quarantine all incoming frys from Kiribati and other countries, grow them to fingerling size, and distribute them to farmers. There is also an urgent need for hands-on training in all aspects of milkfish farming for fisheries staff as well as farmers.

PANEL RELEASES CONSENSUS STATEMENT ON RESERVES AS FISHERIES MANAGEMENT TOOLS

A seven-member panel of US scientists and policy experts has released a consensus statement on the effects of no-take marine reserves, their usefulness in fisheries management in the US, and how they may be designed, monitored, and evaluated. The statement also addresses sources of uncertainty associated with marine reserves, and recommends areas for further study. It is available online at:

http://www.nfcc-fisheries.org/consensus

Among the conclusions of the panel is that "knowledge is sufficient to proceed with the design and evaluation of reserves for the purposes of addressing primary fishery management goals." However, the panel says that further experiments designed explicitly to study reserve effects on fisheries are "urgently needed", and that important uncertainties remain for nearly all aspects of reserve planning and implementation.

Convened in June 2004 by the National Fisheries Conservation Center (an NGO), the panel was part of a two-day conference to examine several reserve-related questions, and was aided by input from modellers, ecologists, fishermen, and others. The panel consisted of individuals not currently engaged in research or advocacy in the field of marine reserves. Past issues of *MPA News* have demonstrated disputes among biologists and fisheries scientists over the limits of reserve science and the effectiveness of reserves for fisheries management (*MPA News* 5:6 and 5:7).

Source: *MPA News*, Vol. 6, No. 5, November 2004 (http://www.mpanews.org)

DIVERS FEEDING FISHES: A CONTINUING ISSUE IN MPA MANAGEMENT

The feeding of fishes and other marine wildlife by recreational divers and snorkelers remains a problematic issue for MPA managers, particularly where recreational diving and snorkelling are popular visitor activities (Perrine 1989; Quinn and Kojis 1990; Cole 1994; Zabala 1996; Hawaii DLNR 1999). Commercial dive operators often use feeding to concentrate naturally dispersed wildlife to facilitate client viewing and/or other human-wildlife interactions (e.g., touching, handling). Divers and snorkelers operating from private vessels often engage in feeding in misguided attempts to "help" or befriend animals. In either case, such practices impact both natural resources and visitor safety. My following comments focus on the resource impacts of fish feeding; human safety issues have been discussed elsewhere (Perrine 1989; Burgess 1999).

The feeding of wild vertebrate animals typically has negative impacts on "fed" individuals, as well as the ecosystems of which they are a part. Through classic conditioning, fed animals learn to associate the presence and/or activities of people with readily available food. This typically leads to characteristic suite of problems seen with a wide variety of fed species, including bears (Blount 1999), deer (Dick 1995), bighorn sheep (Oberbillig 2000), coyotes and alligators (Wilkinson 1997), raccoons and skunks (Jurek 1997), birds (Conover 1999), and marine mammals (NMFS 1994). Fishes (both sharks and bony fishes) have been shown to be generally as adept as mammals and other vertebrates when it comes to acquiring and retaining conditioned responses (Mcphail 1982). Thus, it is not surprising that as the popularity of sport diving and fish feeding soared over the past quarter-century, the same problems that have long plagued other fed vertebrates have increasingly become apparent in marine fishes as well.

Feeding negatively impacts fishes in several ways. Often, the foods provided are not types that fishes naturally encounter or are equipped to process (Perrine 1989). As a recent report (Maldives 2004) states:

> *In the majority of cases, the food that is fed to these fish is radically different from their normal diet. As a result of fish feeding, some very large humphead wrasses died after being fed dozens of eggs, while a great many soldierfish choked to death after wolfing down chicken bones. Large basses have been seen to tear little sacks of food right out of the scuba diver's hand, devouring both sack and contents.*

Even frozen fish may prove harmful or lethal; the deaths of fed dolphins have been linked to bacteria of a type frequently associated with spoiled fish (NMFS 1994).

Feeding has been shown to disrupt or alter normal distribution/abundance patterns and behaviour of marine fishes. The US state of Hawaii (Hawaii DLNR 1998) concluded, "Fish

feeding has been shown to change the species composition in areas where the practice is done regularly, and fish become much more aggressive."

Some species form disorganized swarms that surround and aggressively approach, follow, and often nip at divers (Perrine 1989; Hultquist 1997). Normally reclusive species (e.g., sharks, moray eels, groupers) may approach and follow divers even near the sea surface, making them easy targets for underwater hunters and poachers (Quinn and Kojis 1990; Cole 1994).

Fish feeding has the capacity to alter fundamental ecosystem attributes at feeding sites, with unknown long-term impacts on affected marine communities. Benthic habitat damage (including loss of gorgonian corals) has been attributed to divers feeding fishes within Mediterranean MPAs (Zabala 1996). Australian MPA managers (GBRMPA 1999) expressed concern over fish feeding in coral reef areas: "The unnatural addition of organic matter and nutrients to reef waters may have adverse environmental impacts, e.g., damage to coral caused by excessive growth of algae." Hawaiian MPA managers reported a case in which fish feeding changed the fish community and degraded water quality: "The feeding caused a naturally balanced ecosystem to turn into something of a petting zoo… so much that it is no longer considered a "normal" reef ecosystem." (Hawaii DLNR 1999)

The feeding of wildlife has long been recognized by terrestrial wildlife managers as a serious problem, and is expressly prohibited in all US and Canadian national parks and wildlife refuges, as well as many localized jurisdictions. The number of divers and snorkelers worldwide interacting with marine wildlife within MPAs now numbers in the millions annually, and the cumulative impacts of such multitudes cannot be ignored. Because the US Marine Mammal Protection Act of 1972 (as amended) formally defines "feeding or attempting to feed" a wild marine mammal as "harassment", such activities are illegal in US waters. Where MPA management goals include the preservation and/or protection of natural habitats and wildlife, these same commonsense protections should logically be extended to fishes and other marine wildlife as well.

Such regulation would best protect MPA resources. It would also bring more consistency between sound natural resource management and conservation practices in our oceans with those long established to protect wild places and wildlife on land.

Literature cited

Blount, T. 1998. Wildlife Feeding - Who Wins? Resource Management Newsletter, January 1998. U.S. National Park Service/Shenandoah National Park.

Burgess, G. H. 1998. Diving with elasmobranches: a call for restraint. Shark News (Newsletter of the IUCN shark specialist group). July, 1998. Berkshire, UK.

Cole, R.G. 1994. Abundance, size structure, and diver-oriented behavior of three large benthic carnivorous fishes in a marine reserve in northeastern New Zealand. Biological Conservation 70: 93-99.

Conover, M. 1999. Can waterfowl be taught to avoid food handouts through food aversions? Wildlife Society Bulletin 27: 160-166.

Dick, H. 1995. Feeding deer: fodder for thought. New York State Conservationist 50: 10-11.

GBRMPA. 1999. Guidelines for Fish Feeding on the Great Barrier Reef. Great Barrier Reef Marine Park Authority, Townsville (Queensland), Australia.

Hawaii DLNR. 1998. Hawaii's State of the Reefs Report–1998. State of Hawaii (Dept. of Land and Natural Resources).

Hawaii DLNR. 1999. Current Line (Newsletter, Division of Aquatic Resources): Vol. 3; No. 2 (August 1999). State of Hawaii (Dept. of Land and Natural Resources).

Hultquist, J.R. 1997. Effects of fish feeding on a coral reef. Final Research Report. University of Hawaii (Hilo) Marine Options Program, Hawaii Sea Grant.

Jurek, R. 1997. If you love them, please don't feed them. California Coast and Ocean 13: 22-23.

Macphail, E.M. 1982. Brain and Intelligence in Vertebrates. Clarendon Press, Oxford.

Maldives. 2004. "Maldives.com - Homepage of the Maldives" (www.themaldives.com). Designed and maintained by theMaldives.com (Copyright 1998 - 2004).

National Marine Fisheries Service (NOAA). 1994. Report to Congress on results of feeding wild dolphins. NMFS/Office of Protected Resources. Silver Spring, MD.

Oberbillig, D.R. 2000. Providing Positive Wildlife Viewing Experiences. Colorado Division of Wildlife.

Perrine, D. 1989. Reef fish feedings: amusement or nuisance? Sea Frontiers 35 (5):272-279.

Quinn, N.J. and B.L. Kojis. 1990. Are divers destroying the Great Barrier Reef's Cod Hole? Diving for Science 1990: Proceedings of the American Academy of Underwater Sciences Tenth Annual Scientific Diving Symposium: p.303-309. AAUS, Costa Mesa, CA.

Wilkinson, T. 1997. Biting the hand the feeds: a well-intentioned handout today could mean disaster for panhandling wildlife tomorrow. Backpacker 25 (7): 34-35.

Zabala, M. 1996. Impacto biologico de la creación de una Reserva marina: el caso de las Islas Medes. In: La Gestión de los Espacios Marinos del Mediterráneo Occidental. Inst. Estudios Almerienses. Diputacion de Almeria.

Source: *MPA News*,
Vol. 6, No. 5, November 2004,
(www.mpanews.org)

HAWAIIAN-STYLE SMALL-SCALE DEEP SETTING LONGLINE TECHNIQUE USED ON SEAMOUNTS

David Itano,
Research Associate
Pelagic Fisheries Program,
University of Hawai'i

Introduction

In general, longline fisheries for pelagic species within the Western and Central Pacific Ocean (WCPO) deploy either shallow-set or deep-set gear. So called "regular" longline gear has been estimated to hang at depths of 50–120 m while deep longline gear covered a wider range from 50–300 m — deploying four to six hooks between floats (per basket) for shallow sets and an average of 13 hooks per basket for deep sets (Suzuki and Warashina 1977). Deep longlining was introduced to the WCPO in the 1970s and is widely practiced by the major fleets to target deep-swimming bigeye and albacore tuna (Sakagawa et al. 1987). Modern tuna longline vessels may deploy more than 30 hooks per basket, and utilise a "line shooter" to set additional mainline between floats to sink the line even deeper. In contrast, typical swordfish style longline sets are very shallow with only four or five hooks per basket, and do not use a line shooter. For a detailed description of pelagic longline gear see Beverly et al. (2003) and Swenarton and Beverly (2004).

One problem with shallow-set longline gear is that it places the hooks within the upper mixed layer of the ocean, bringing the gear into conflict and potential interaction with surface fisheries; that is, subsistence, recreational and small-scale handline and troll fisheries, as well as large-scale purse-seine fisheries. Shallow-set gear also produces significantly higher interaction rates with protected or ecologically sensitive bycatch species that are easily overharvested, such as marine turtles, seabirds, marine mammals, oceanic sharks, manta rays and whale sharks. Shallow-set gear also competes with important sport and recreational species prized by surface fisheries, such as marlins, spearfish, sailfish, wahoo and mahi mahi (or dolphinfish).

In response, deep-set longline gear has been actively promoted as one means to improve targeting, while decreasing the likelihood of interactions with protected species. The importance of reducing interaction rates with protected species cannot be overemphasised. In recent years, longline fisheries have been significantly curtailed and even closed in attempts to mitigate interaction rates with marine turtles and marine mammals.

Possible solution to reducing bycatch and improving targeting

What is now considered conventional deep-set bigeye tuna longline gear uses a line shooter setting around 25–30 or more hooks per basket on mainlines stretching over 30–50 or more nautical miles (nm) of open ocean. However, hooks are still placed from floatline to floatline within each basket, producing a wide range of actual hook depths within a set. Interaction rates with bycatch species of the upper mixed layer still occur. Also, current speed and shear often shallow a set considerably, raising deep longline gear to shallow-set depths.

This paper reports on a longline system, developed in Hawaii, that attempts to increase the targeting of deep swimming species while minimising the potential for interaction with surface oriented bycatch species. It is similar to a system developed independently by Steve Beverly, Fisheries Development Officer at SPC, and trialled in Mooloolaba, Australia (see *Fisheries Newsletter* # 109). Both of these techniques were reported at the last Standing Committee on Tuna and Billfish, SCTB 17, held in Majuro, Republic of the Marshall Islands in August 2004.

http://www.spc.int/OceanFish/html/SCTB/SCTB17/FTWG-7a.pdf

Background

The Hawaii-based pelagic longline fleet operates within a limited framework, allowing for 164 transferable vessel permits for vessels less than 101 feet in overall length. Vessels are monitored by vessel monitoring system (VMS) and a federal logbook reporting system. Hawaii-based longline vessels targeting bigeye tuna set 20–40 hooks per basket on floatlines set approximately 0.8 km (0.4 nm) apart, achieving hook depths of around 91–366 m (300–1200 ft) (NMFS 2001). The majority of protected species interactions occur with swordfish targeting gear, setting only four to five hooks per basket, but interactions still occur with the deep-set gears.

However, pelagic longline gear less than 1 nm (1.85 km) in length is permitted under federal regulations to be deployed by any Hawaii commercial fishing vessel outside the permitting and regulatory framework that monitors the main longline fishery. This report discusses the development of a small-scale longline system that targets either bigeye tuna (*Thunnus obe-*

sus) or the lustrous pomfret (*Eumegistus illustris*). While this system may have limited value for large scale-fisheries, the concept may be applied to larger scales or find a direct application in WCPO's small-scale or artisanal longline fisheries.

Fishing grounds

This system was developed to target bigeye tuna and pomfrets, which are concentrated in dense aggregations over the summit of the Cross Seamount, approximately 290 km south of Honolulu, Hawaii. This particular seamount is unique among the many Hawaiian seamounts, as it rises sharply from 4000 metres to 330 metres, which is apparently the right depth for both species. The seamount summit aggregates commercial concentrations of bigeye and yellowfin tuna, forming the base for a local handline fishery. The seamount is also a primary tag and release location for Hawaii-based tuna tagging experiments (Itano and Holland 2000). Handline vessels targeting bigeye tuna over the seamount normally take small to medium sized bigeye around 7–20 kg in weight. However, larger fish are found over or near the seamount that have been targeted by Hawaii-based longline vessels.

Development of the fishing method

Hawaiian longline vessels have fished the area of the Cross Seamount for several decades, targeting large bigeye tuna on the outer seamount slopes. The offshore handline fishery developed afterwards, peaking in the late 1980s and early 1990s (Itano 1998). During the 1990s, some conventional longline vessels began to set gear directly over the seamount summit, causing gear interactions and heated conflicts with the handline fleet. A commonly seen strategy was for a longline vessel to set gear in an "S" pattern upcurrent of the seamount, hauling the gear after it had passed over the area. Although these boats caught some bigeye tuna of a similar small size as the handline vessels, they also took larger fish that were apparently unavailable to the handline boats.

In response to these observations, some handline boats began to experiment with vertical longline gear to deploy baited hooks all the way down to the seamount summit. These gears were very similar to those described by Preston et al. (1998), consisting of a single vertical line, buoyed at the top and weighted at the bottom, with branchlines snapped on from top to bottom. Catch rates of larger bigeye tuna (30–60 kg) encouraged further experimentation that continues to the present. The use of vertical longline gear gave way to the use of short sets of deep-set horizontal gear as described below.

Deep-set fishing gear

An informal observer trip was conducted by the author to the Cross Seamount from 7–14 July 2004 to observe the fishing method. Fishing took place on F/V *Double D* (Fig. 1), which was designed and built by its captain, Joe Dettling (Fig. 2). Fishing continued on the seamount for six

Figure 1. F/V *Double D*
Figure 2. Captain Joe Dettling hauling the line on F/V *Double D*, while a crew member lands a tuna

consecutive days. The primary gear type was horizontal longline sets of less than 1 nm in length. Joe explained that this gear can be quickly adjusted and set in any number of configurations and depths, but is generally set to target either bigeye tuna or pomfret. The bigeye gear is set at mid depth over the seamount summit while the pomfret gear is set deeper, just above the seamount itself. It should be noted that there are currently at least two vessels deploying this style of gear on the seamount. It is believed that both vessels use very similar gear but the descriptions here apply directly to Joe's boat only.

Bigeye longline set

The gear is very simple, consisting of a small, hydraulically driven longline reel with a fairlead mechanism, 3.6-mm monofilament mainline, flag buoys, hard plastic floats, 5-kg weights, with stainless steel longline snaps that are rigged with 2.0-mm diameter monofilament leaders that are 2 m long, ending in a tuna circle, or Japan style longline tuna hooks. Exact details of setting times and depth will not be given, as requested by the fisherman.

Setting takes place before dawn to take advantage of what is considered the peak biting time for bigeye in this area. The set consists of approximately 100 leaders snapped on the mainline using one or two floats. Figure 3 shows a tuna set with one set of floats, producing two baskets of 50 hooks each. The setting procedure for this configuration would be as follows:

1. Position vessel upcurrent of target area.
2. Deploy flag buoy #1 and pay out mainline to desired target depth.
3. Attach 5-kg weight.
4. Snap on baited branchlines, closely spaced, approximately 8–10 metres apart.
5. Attach hard buoy float.
6. Snap on more baited branchlines.
7. Attach a 5-kg weight.
8. Pay out additional mainline.
9. Attach and deploy flag buoy #2.

This procedure, depending on how many floats are used, will produce what are essentially two or three large "baskets" of gear held down by lead weights. An additional floatline can add additional depth to the set but is not normally used on the seamount due to the possibility of hooking the seamount summit. The line is normally retrieved after a short soak of two hours or so, or when the distance between floats indicates the lines are loading up with catch.

Pomfret longline set

There are several species of pomfrets (Bramidae), known locally by the generic term "monchong", that are taken as incidental catch in the Hawaii-based longine fishery. The most common species taken in open water is the bigscale pomfret (*Taractichthys steindachneri*). The larger lustrous pomfret (*Eumegistus illustris*) appears to be a seamount and deep-slope associated species and is more sought-after by the fish buyers due to its higher meat yield ratios. After the fisherman had developed the deep-set longline technique to target large bigeye tuna, it became apparent that large quantities of *E. illustris* were also found over the seamount summit. By modifying the gear slightly, Joe found that the gear could effectively target this species of monchong while also taking medium and large bigeye.

The gear is essentially the same as described for bigeye tuna fishing. However, two or more sub-surface floats are used instead of surface hard floats. These sub-surface floats are only slightly positive in buoyancy; their purpose is to keep the deeper set gear from fouling the seamount summit while maintaining the gear at depth. Another important modification to the monchong gear is the addition of more branchlines spaced very closely, and the use of smaller circle hooks. Normally, a monchong targeting set will deploy 200 hooks in the same

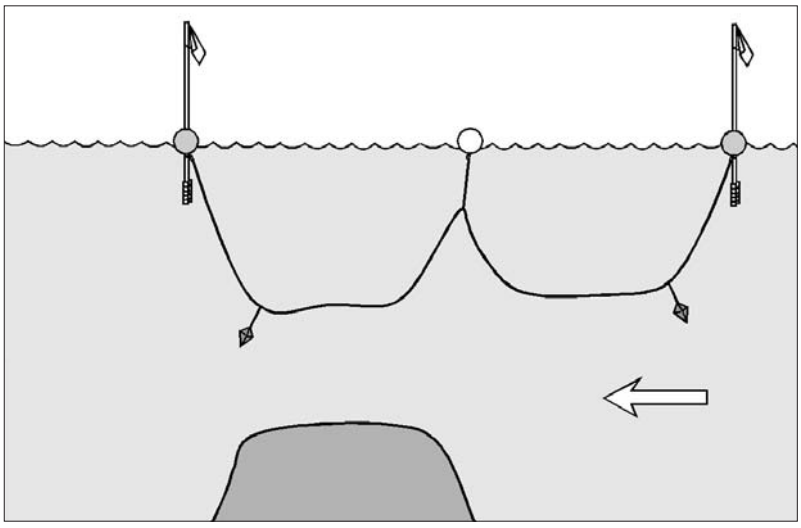


Figure 3. Bigeye targeting set upcurrent of seamount

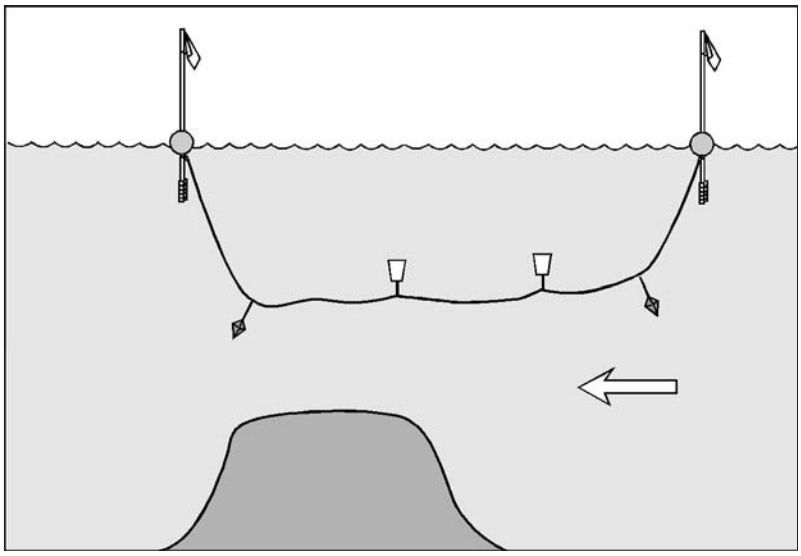


Figure 4. A monchong targeting set upcurrent of seamount

length of mainline. Figure 4 shows a typical monchong set of 200 hooks on less than 1 nm of mainline.

Catch and effort data

Catch records for the first seven months of 2004 were examined for 12 tuna targeted trips and compared with what was considered a typical monchong targeted trip from January 2003. All fishing took place on the Cross Seamount with anywhere from two to seven days of fishing per trip. Normally, four or five sets were made per day with an average of 95 hooks per set. Table 1 lists the number and CPUE of bigeye, yellowfin and monchong caught per trip. Mean catch for all 12 trips was 9.1 bigeye, 1.9 yellowfin and 1.4 monchong retained per 100 hooks set. The monchong targeting trip differed considerably for bigeye and monchong, with 2.2 bigeye, 2.0 yellowfin and 8.2 monchong taken per 100 hooks set.

These figures appear very productive, but it should be noted that the average sizes of the tuna are considerably smaller than those taken by the federally regulated longline fishery. The mean size of bigeye and yellowfin in this example was 26.9 lbs (12.2 kg) and 18.1 lbs (8.2 kg), respectively (Table 2). However, on some trips, yellowfin of a good size contributed significantly to catches; for example, the last two trips landed 68 and 46 yellowfin per trip with average weights of 34.2 (15.5 kg) and 35.6 lbs (16.2 kg), respectively.

The monchong targeting trip indicates a CPUE of 8.2 fish per 100 hooks with an average size of 11.8 lbs (5.1 kg). This size appears to be quite average or a bit low compared with the 12-trip average weight of 12.4 lbs (5.6 kg) taken on the tuna targeting trips. Reports by the fishermen indicate that some monchong targeting sets have very high catch rates of more than 80 fish per 100 hooks.

Discussion

The development of this style of gear is an example of a specialised case of targeting aggregated, structure associated tuna and seamount associated species. However, the system demonstrates a simple method to concentrate hooks within a narrow depth range with greater accuracy than is possible with conventional deep-set longline gear. The key components of the system are heavy weights after the surface floats and the use of slightly buoyant sub-surface floats interspersed with hooks within the “basket”.

A key element to the system aside from the close targeting of concentrated schools is the timing of the set. By setting before dawn, the gear takes advantage of the shallow night-time behavior of bigeye tuna and the higher biting response that is presumed to take place during the early morning hours. In this manner, the gear not only targets concentrated schools, but

Table 1. Catch and effort data from tuna and monchong targeting longline trips

Target	End date	# Days	# Sets	Hooks/set	Hooks set	Bigeye pcs	Bigeye CPUE (#/100 hks)	Yellowfin pcs	Yellowfin CPUE (#/100 hks)	Tuna CPUE (#/100 hks)	Monchong pcs	Monchong CPUE (#/100 hks)
tuna	01/14/04	6	24	95	2280	176	7.7	107	4.7	12.4	91	4.0
tuna	01/23/04	4	22	95	2090	225	10.8	82	3.9	14.7	42	2.0
tuna	02/05/04	5	20	95	1900	196	10.3	33	1.7	12.1	12	0.6
tuna	02/15/04	5	20	95	1900	236	12.4	66	3.5	15.9	14	0.7
tuna	04/08/04	5	20	95	1900	135	7.1	18	0.9	8.1	35	1.8
tuna	04/19/04	5	20	95	1900	262	13.8	6	0.3	14.1	1	0.1
tuna	05/06/04	2	8	95	760	77	10.1	9	1.2	11.3	4	0.5
tuna	05/21/04	6	24	95	2280	224	9.8	1	0.0	9.9	59	2.6
tuna	05/28/04	2	8	95	760	42	5.5	0	0.0	5.5	24	3.2
tuna	06/15/04	7	28	95	2660	285	10.7	8	0.3	11.0	31	1.2
tuna	07/01/04	7	28	95	2660	197	7.4	68	2.6	10.0	5	0.2
tuna	07/22/04	6	24	95	2280	78	3.4	46	2.0	5.4	1	0.0
Tuna total		**60**	**246**	**95**	**23370**	**2133**	**9.1**	**444**	**1.9**	**11.0**	**319**	**1.4**
monchong	01/15/03	7	28	100	2800	62	2.2	55	2.0	4.2	**229**	**8.2**

Table 2. Catch by number and weight from tuna and monchong targeting longline trips.

Target	End date	Hooks set	Bigeye pcs	Bigeye wt (lbs)	Bigeye mean wt (lbs)	Yellowfin pcs	Yellowfin mean wt (lbs)	Monchong pcs	Monchong wt (lbs)	Monchong mean wt (lbs)
tuna	01/14/04	2280	176	3112	17.7	107	11.2	91	1067	11.7
tuna	01/23/04	2090	225	3840	17.1	82	10.6	42	501	11.9
tuna	02/05/04	1900	196	4691	23.9	33	10.9	12	164	13.7
tuna	02/15/04	1900	236	4102	17.4	66	10.5	14	193	13.8
tuna	04/08/04	1900	135	3397	25.2	18	15.7	35	455	13.0
tuna	04/19/04	1900	262	7440	28.4	6	15.3	1	12	12.0
tuna	05/06/04	760	77	2344	30.4	9	14.8	4	59	14.8
tuna	05/21/04	2280	224	7728	34.5	1	59.0	59	743	12.6
tuna	05/28/04	760	42	1504	35.8	0	NA	24	312	13.0
tuna	06/15/04	2660	285	9363	32.9	8	50.5	31	367	11.8
tuna	07/01/04	2660	197	7707	39.1	68	34.2	5	68	13.6
tuna	07/22/04	2280	78	2248	28.8	46	35.6	1	10	10.0
Tuna total		23370	2133	57476	26.9	444	18.1	319	3951	12.4
monchong	01/15/03	2800	62	2352	37.9	55	18.1	229	2701	11.8

does so at the optimal time for highest CPUE. The direct application of this methodology to fishing around FADs, both anchored and drifting may be an interesting area to explore.

While the figures for average tuna size do not appear overly impressive, the fishermen report very favourable marketing results from their deep-set short longline gear. Average prices achieved by this method are considerably higher than those received from handline and troll landings. The handline fishery also catches medium and large size bigeye on the seamount, but seldom achieves a decent price for these fish. There is an ingrained prejudice against handline caught bigeye in Hawaii due to perceived quality issues resulting in short shelf life of the product and the possibility of the "burnt tuna syndrome" caused by overheating of the muscle mass. Tuna landings from the deep-set gear described here are reported to achieve much higher prices at the Honolulu United Fishing Agency auction and are considered on a par with the landings of the larger longline vessels. This is a very important consideration locally, as the system operates on a daily auction basis, and longline vessel catch is auctioned first, followed by troll and handline landings. Even if the handline boats have good quality fish, their later position in the auction almost guarantees them lower prices.

Yellowfin of a good size contributed significantly to catches

Finally, the system is very interesting to the WCPO as it demonstrates the exploitation of a formerly unutilised resource with a stable market demand. Pomfrets are found throughout the world's oceans and may represent an alternative market species for developing areas.

References

Beverly S., Chapman L. and Sokimi W. 2003. Horizontal longline fishing methods and techniques: A manual for fishermen. Secretariat of the Pacific Community, Noumea, New Caledonia. 130 p.

Itano D.G. 1998. Hawaii offshore handline fishery: A seamount fishery for juvenile bigeye tuna. Working Paper 48 to the 11th Meeting of the Standing Committee on Tuna and Billfish. Honolulu, Hawaii. 30 May–6 June 1998.

Itano D.G. and Holland K.N. 2000. Movement and vulnerability of bigeye (*Thunnus obesus*) and yellowfin tuna (*Thunnus albacares*) in relation

to FADs and natural aggregation points. Aquatic Living Resources 13(2000):213–223.

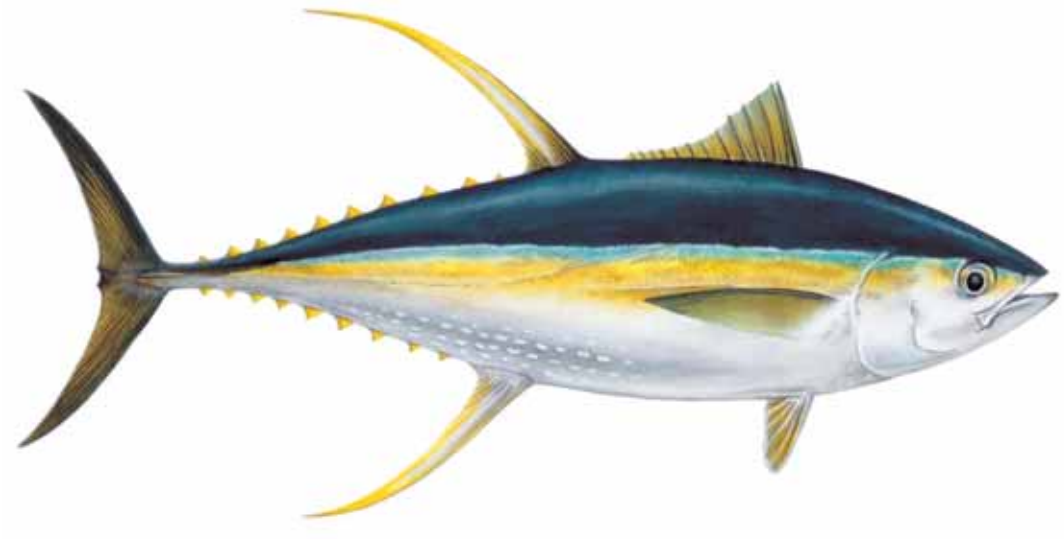
NMFS. 2001. Final Environmental Impact Statement for Fishery Management Plan, Pelagic Fisheries of the Western Pacific Region. National Marine Fisheries Service. March 30, 2001.

Preston G.L., Chapman L.B. and Watt P.G. 1998. Vertical longlining and other methods of fishing around Fish Aggregating Devices (FADs). Secretariat of the Pacific Community, Noumea, New Caledonia. 64 p.

Sakagawa G.T., Coan A.L. and Bartoo N.W. 1987. Patterns in longline fishery data and catches of bigeye tuna, *Thunnus obesus*. Marine Fisheries Review 49(4):57–66.

Suzuki Z., and Warashina Y. 1977. The comparison of catches by regular and deep tuna longline gears in the Western and Central Equatorial Pacific. Bulletin of the Far Seas Fisheries Research Laboratory (15):51–89.

Swenarton T. and Beverly S. 2004. Documentation and classification of fishing gear and technology on board pelagic longline vessels – Hawaii module. Working Paper FTWG-8. 17th Meeting of the Standing Committee on Tuna and Billfish. Majuro, Marshall Islands. 9–18 August 2004.



SPC TRAINING BOOSTS FIJI'S FRY PRODUCTION

Filimone Mate,
Fiji Fisheries Division,
Suva, Fiji Islands

Fiji's tilapia hatcheries and commercial fish farmers are now reporting significant success, thanks to collaborative work involving the skilled and trained government extension officers and farmers.

Regional cooperation in training is becoming more necessary for aquaculture development success. Training provided to seven Fiji government extension officers during the recent SPC coordinated training programme has contributed to improved tilapia broodstock management, increased tilapia fry production, and commercial farm growth.

The good news is that the effort to increase Fiji's tilapia fry production through training in broodstock management and rearing techniques has paid off, and private hatcheries that were previously dormant are now being revived and are fully operational.

Naduruloulou Station now has more than 50,000 tilapia fry, and in the recent past, the station distributed over 500,000 fry to farmers in the Central and Western Divisions. Quality brooders were also distributed to private hatcheries.

The progress on the selection of GIFT tilapia and *Macrobrachium rosenbergii* for future broodstock is encouraging. The station's Broodstock Management Unit leader, Maleli Dawai, said, "The efforts are now pursued to ensure improvement in growth and fecundity performances of the selected brooders".

The station is expected to have in stock 9000 future tilapia brooders and 3000 *M. rosenbergii*. The Freshwater Aquaculture Sector is expecting to produce 2.07 million tilapia fry from the government hatcheries, 0.69 million fry from the private sector, and about 2.75 million *M. rosenbergii* postlarvae by the end of this year.

Manasa Tumuri, an SPC-trained extension officer in the Cakaudrove Province on Fiji's second largest island reported, "There is a strong supply of tilapia fry and fingerlings now being produced at the Savusavu Montfort Technical Institute."

The institute's hatchery was established when the Dreketi Government Hatchery was closed in 2000. After its first year of operation the hatchery was closed due to a lack of technical support, funds and other resources.

However, soon after the SPC training in May 2004, Manasa said, "…a collective effort between the Fisheries Department, SPC and the Savusavu Montfort Institute resulted in the reviving of the Institute's hatchery."

Arrangements were made to have the brooders, water pump and accessories, netting materials, feeds and lime shipped from the Naduruloulou Station.

Today new fry and fingerlings are continuously produced and separate from the brooders at the Institute's tilapia hatchery.

The Savusavu Montfort ponds and the fish farms in the Cakaudrove Province contain quality fry once again. Manasa in his challenging words said, "Fiji and the Pacific BEWARE. — Expect truly quality and gourmet healthy St Peter's Fish coming out from the Hidden Paradise."

Alsake Vana, an SPC training programme participant from the Coral Coast, reported, "The land for the Sigatoka Government Tilapia Hatchery has been finalized and plans are being pursued to construct the hatchery building before the year ends."

The Naduruloulou Station hatchery team has completed the initial fact-finding exercise in establishing the hatchery, and the NRS Station Manager Jone Vasuca reported, "That they would need about FJD 3000 for this project."

Meanwhile, the fish farms in the Sigatoka area continue to receive their fry stock from the Naduruloulou Station. Alsake is expecting increased production and economic growth in the Nadroga/Navosa Provinces once the hatchery is fully operational. He said that he wants to, "prove to the communities that fish farming can be a lucrative and healthy business, as compared to the narcotic "killer" weed farming secretly practiced in the area."

Laisani Baleinacagi, our SPC training participant from the Serua/Namosi Provinces, is currently involved in the community consultation on the establishment of a 20-ha tilapia farm on an indigenous land formerly used for rice farming. This is one of the land resource bases identified in the Freshwater Aquaculture Sector's Strategic Development Plan for 2006–2014. Laisenia said, "He is going to showcase this Vunaniu Indigenous Aquaculture Project as a positive way forward of utilizing unused rice paddies for tilapia farming."

Maleli Dawai reported that the Driti Project is progressing well. The recently harvested 2.6 tonnes

with a market value of about FJD 9100. The hatchery has been upgraded and is now fully operational. The village women are planning to increase their farm size, because the hatchery is producing more than what the existing ponds can store.

Similarly, the Ba Government Hatchery is showing encouraging fry production results under the capable hands of Eloni Takali and Shashi. The hatchery has been renovated and new brooders were supplied from Nadururloulou Station. The hatchery is producing more than enough fry to comfortably cater to farmers' need in the Western Division. Eloni said, "Given more financial support from government, they can produce billions of fry because they have the warm climatic condition needed, and he had acquired the necessary knowledge through the recent SPC training".

Original text: English

Secretariat of the Pacific Community, Marine Resources Division, Information Section,
BP D5, 98848 Noumea Cedex, New Caledonia
Telephone: +687 262000; Fax: +687 263818; cfpinfo@spc.int; http://www.spc.int/coastfish