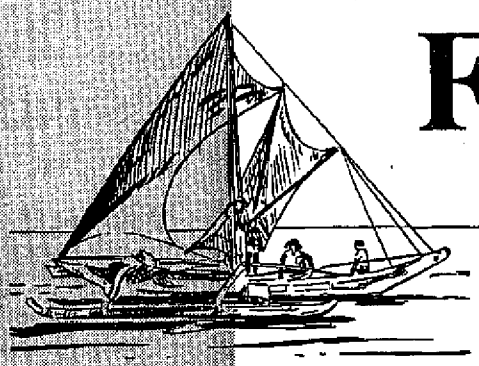
ISSN 0248-076X



FISHERIES

Newsletter

NUMBER 66
JULY — SEPTEMBER 1993

IN THIS ISSUE

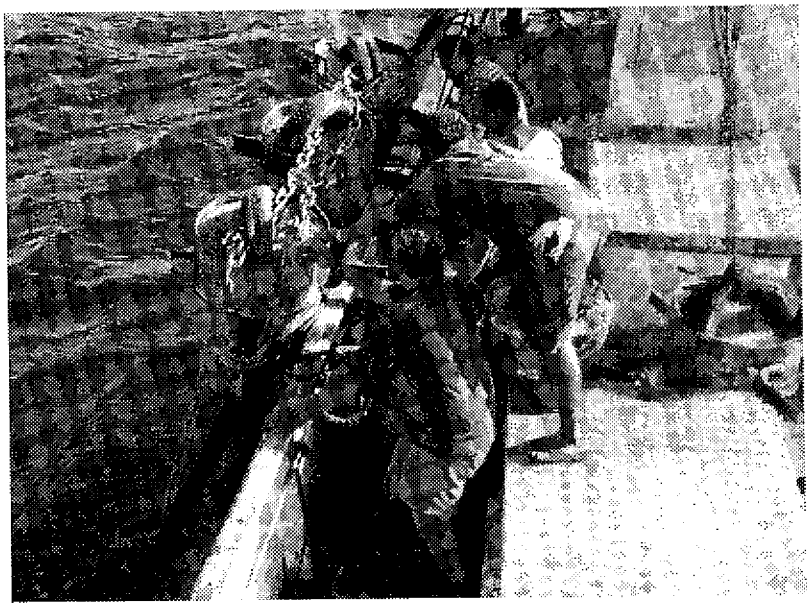


Photo: Paxton Wellington

SPC assists with FAD deployments in Fiji.

South Pacific Commission
Prepared by Jean-Paul Gaudechoux, Fisheries Information Officer

TWENTY-FIFTH REGIONAL TECHNICAL MEETING ON FISHERIES CANCELLED

The South Pacific Commission was not able to host this year's Regional Technical Meeting on Fisheries (RTMF) due to financial difficulties.

With the discontinuation of the Forum Fisheries Committee Technical Meeting, the RTMF is the only opportunity for senior fisheries officers from all member countries to meet and discuss technical aspects of fisheries development, and through the exchange of experience, ideas and information, to identify mutual needs and problems which can best be met by a regional approach.

The meeting oversees the work of the Commission's Marine Resources Programme by reviewing and commenting on existing or proposed activities, formulating new initiatives where required, and making recommendations for endorsement by the SPC Committee of Representatives of Governments and Administrations (CRGA) and, if appropriate, adoption by the South Pacific Conference.

The RTMF will now be held early in 1994. This new timing was chosen because it will:

- minimise the time elapsed since the last RTMF, thus allowing a number of issues scheduled for discussion at this year's aborted meeting to be included on the agenda;
- allow the Meeting to provide guidance to the work of the Fisheries Programme over the next year; and
- allow the recommendations from this meeting to be submitted to CRGA 20 in May 1994, and for final approval by the South Pacific Conference in October 1994.

As a consequence of the cancellation, the 6th Pacific Islands Marine Resources Information System (PIMRIS) Steering Committee Meeting was held in Suva, at the University of the South Pacific, from 8 to 9 November 1993.

(Contributor: J-P Gaudechoux)

UNDP SUPPORTS REGIONAL FISHERIES DEVELOPMENT THROUGH SPC AND FFA

For over a year now the United Nations Development Programme (UNDP) has been supporting the Offshore Fisheries Development Project within the Capture Section of SPC's Coastal Fisheries Programme.

UNDP is now considering a new submission, made jointly by SPC and the Forum Fisheries Agency, requesting financial support to a wide range of linked fisheries development activities to be undertaken by the two agencies on behalf of Pacific Island countries.

The new project, which will be executed by FFA, and implemented jointly by FFA and SPC, aims to develop national capacities in a number of areas, including: policy development; administrative and organisational management; project planning, implementation and management; and private sector promotion and support. The project will also promote regional information gathering and exchange on issues such as fishery legislation, resource research and management, and marine product marketing.

Much of the activity to be undertaken under the project involves training in a variety of fields, as well as the development of training methodologies and strategies.

The project also provides for the commissioning of studies, and the convention of a number of symposia and workshops at regional and national level. Specific activities to be undertaken during the 3-year duration of the project include the following:

- One sub-regional and three national-level workshops in organisational management training for senior and middle-level fisheries officers;
- Short periods of attachment training at appropriate regional and extra-regional organisations dealing with fisheries;
- A pilot distance education programme in technical report writing for fisheries officers;

- In selected countries, review of national arrangements for fishery management and conservation, commercial fishery legislation, business and investment practices;
- Counterpart training in project identification, formulation, implementation, management, evaluation and reporting;
- Two regional fishing industry symposia, supported by in-country studies, to identify strategies whereby public bodies can offer improved support to private sector fisheries development, and to identify training strategies in support of the private sector;
- Establishment of a regional database providing real-time information on marketing of key marine products;
- National marketing reviews and specific commodity studies;
- Attachment training opportunities in marketing, post-harvest and small business management subjects for both public and private sector employees;
- A programme of hands-on training courses in fishing vessel operation and small business management;
- Development of a standardised regional fishing deckhand training programme for implementation through national fisheries training schools and colleges;
- Production of fishery resource reviews, bibliographies, and other specialised information documents;
- Production of a compendium of fishery legislation relating to the Pacific Islands;
- Production of a comprehensive taxonomic guide relating to commercially important Pacific Island species;
- Conduct of a comprehensive workshop on inshore fishery resource assessment, exploitation and management.

After several months spent developing the proposal, the document is now with UNDP headquarters awaiting final technical review. If approved, the project will become effective as of 1 January 1994.

(Contributor: Garry Preston)

USAID CONTRACTS SPC TO IMPLEMENT PIMAR REGIONAL IMPACT COMPONENT

In August 1993, the United States Agency for International Development (USAID) formally invited SPC to submit a proposal for the implementation of the Regional Impact Component (RIC) of its Pacific Island Marine Resources Project (PIMAR).

The Commission responded with a submission which has now led to the conclusion of a grant agreement under which USAID will provide financial support to SPC's Fisheries Programme to enable it to disseminate information on PIMAR activities throughout the region.

The USAID PIMAR project, established in 1989, is a US$ 12 million project which aims to increase income-generating opportunities for men and women within the Pacific Islands through means which enhance the conservation and management of natural resources, through developing, demonstrating and making available for replication technologies and strategies which increase the benefits to Pacific Island communities from sustainable small-scale private sector uses of marine resources.

This is done through five country programmes:

- Cook Islands – development of small-scale pearl farming techniques and technologies;
- Kiribati – environmental studies and development of a lagoon management plan;
- Papua New Guinea – longline fishing trials as a preparatory phase to the development of an export-based, locally operated tuna fishery;
- Tonga – integrated bait-fishing, longlining and bottom-fish fishery development, and establishment of a bottom-fish management plan;

- Tuvalu – bottom-fish exploitation and development of a bottom-fish management plan.

All the technologies and strategies being implemented within the individual PIMAR country components have direct links or relevance to aspects of the SPC work programme.

In addition, the PIMAR philosophy of encouraging small-scale commercial fishing activities to exploit under-utilised resources further offshore, while conserving the resources of the shallower waters of the lagoons and reefs for more subsistence uses and for mariculture, parallels that of the Commission.

The PIMAR project and the ongoing marine resources development work of SPC are thus complementary and mutually supportive.

PIMAR-RIC aims to promote the dissemination of the PIMAR results through workshops, short-term technical assistance, training attachments and publications. Following detailed discussions with USAID, it became clear that many of these activities mesh closely with activities that the Commission is already involved in or planning to carry out. As a result, in order to ensure efficiency and avoid any possibility of duplication, USAID has agreed to contract SPC to undertake the following tasks on its behalf:

- Dissemination of technical and general information on PIMAR country components through regular, established SPC fishery information publications, and through the preparation of specialised technical documentation based on project outputs;
- Conduct of a regional Workshop on Black Pearl Culture Industry Development;
- Training attachments and study tours to PIMAR country projects;
- Conduct of a regional Workshop on Finfish Fishery Development and Management Strategies.

As part of the agreement, some of the USAID funding will be applied to the recruitment of an additional officer to work within the Coastal Fisheries Programme's Information Section. This position will be advertised through normal SPC channels in the near future.

(Contributor: Garry Preston)

TRAINING SECTION

1993 Nelson Course practical module held in Santo, Vanuatu

For the second time in a row, the Vanuatu Fisheries Training Centre in Luganville, Espiritu Santo, was made available to SPC as a venue for the Practical Fishing Module of the 1993 SPC/Nelson Polytechnic Pacific Fisheries Officer Training Course.

As for last year's course (see SPC *Fisheries Newsletter* # 62), the impressive facilities of the Training Centre proved ideal for this type of training: good accommodation for both trainees and tutors, modern classroom with audio-visual equipment, engineering workshop, ice machines, wet lab for fish handling and, last but not least, three training vessels in good condition for the fishing trips. SPC's tutors could not have dreamed of a better venue to run their course!

On 13 June, the 12 course participants travelled from Nelson, New Zealand, to Santo with SPC's Fisheries Education and Training Adviser, Hugh Walton. The trainees were happy to be back in the tropical islands and ready to put into practice five months of training at the NZ School of Fisheries in Nelson.

A week before the course began, SPC Masterfisherman Paxton Wellington had joined Training Centre's staff to finalise the course preparation, organise shore logistics and refit the hydraulic system on board the *Etelis*. The *Etelis*, a 33 ft VAN-1 model monohull designed by FAO, was fitted with a GPS, dual frequency echo-sounder, four Samoan handreels and trolling booms.

The other two training vessels were the 28 ft *Tabwemasana*, fitted with four handreels, and a smaller diesel-powered vessel, the *Nasiko*, also fitted with handreels for bottom fishing and trolling.

The group spent the first few days of the course familiarising themselves with the Vanuatu Fisheries Centre, making up fishing gear, attending classroom sessions—and of course the weather was fine. On Thursday of the first week, the three

Photo: Angus Scotland

A good catch from the FAD

vessels went out to the FAD for the first fishing trip, but the fishing gods had left Vanuatu. Strong trade winds of 20 to 30 knots started that day and did not stop until the end of the training!

This rough weather adversely influenced the fishing operations as each boat could only do twelve trips in a period of four weeks. Fortunately, the Santo fishing grounds proved to be as productive as expected and the combined catch for the course totalled 3,790 kg of gilled and gutted fish with a sale value of 714,000 vatu. In comparison, the total catch for the 1992 course was 3,365 kg.

The following fishing methods were successfully demonstrated: handreel bottom fishing (with a record of 380 kg of red snappers caught within two hours on the *Etelis*), bottom longlining, trolling around the FAD, and vertical and horizontal longlining. Catch highlights included a 48 kg yellowfin (the

Photo: Michel Blanc

Anare Raiwalui (Fiji) pleased with a good size yellowfin tuna caught at a vertical longline

biggest fish caught during the course) hooked by *Nasiko* crew on a vertical longline and two 45 kg swordfish caught during a night set of the horizontal longline using lightsticks and squid for bait.

Most of the catch from fishing operations was sold in Santo by the Training Centre, while a few boxes of red snappers were air-freighted to the Natai Fish Market and hotels in Port Vila. An abundance of ice from the three block ice machines installed at the Centre ensured that fish was well chilled on the boats and on shore. Fish were sold after being gilled and gutted in the small processing room at the Centre.

Although the major objective of the practical module is to train students in fishing operations and vessel operation, the bad weather which prevailed during the course obliged tutors to run more classroom lectures than expected. Although *ad hoc* in nature, these lectures proved very useful and permitted instruction in several subjects that had not been covered in Nelson. In consequence the course outline for next year's practical module will be modified to include formal classroom sessions on subjects like fisheries management, Pacific Island fishing gear technology and vessel economics. The course structure will be in line with the weather forecast, classroom sessions being organised when the weather does not allow fishing operations. With this new outline in mind, Fisheries Training Section staff have started work on the production of resource materials/course notes to support the lectures during next year's practical module.

The Fisheries Training Section is grateful to the Government of Vanuatu for hosting the course and to the Government of New Zealand, the Commonwealth Secretariat and the Commonwealth Foundation for the financial support of the overall Nelson course.

The 1994 course has already been advertised throughout the region. Dates are 14 February to 29 July 1994. Interested candidates should send their nomination forms to SPC through their respective Fisheries Divisions who will be able to arrange for official nominations of suitably qualified candidates. The closing date for official nominations is 15 November 1993.

(Contributor: Michel Blanc)

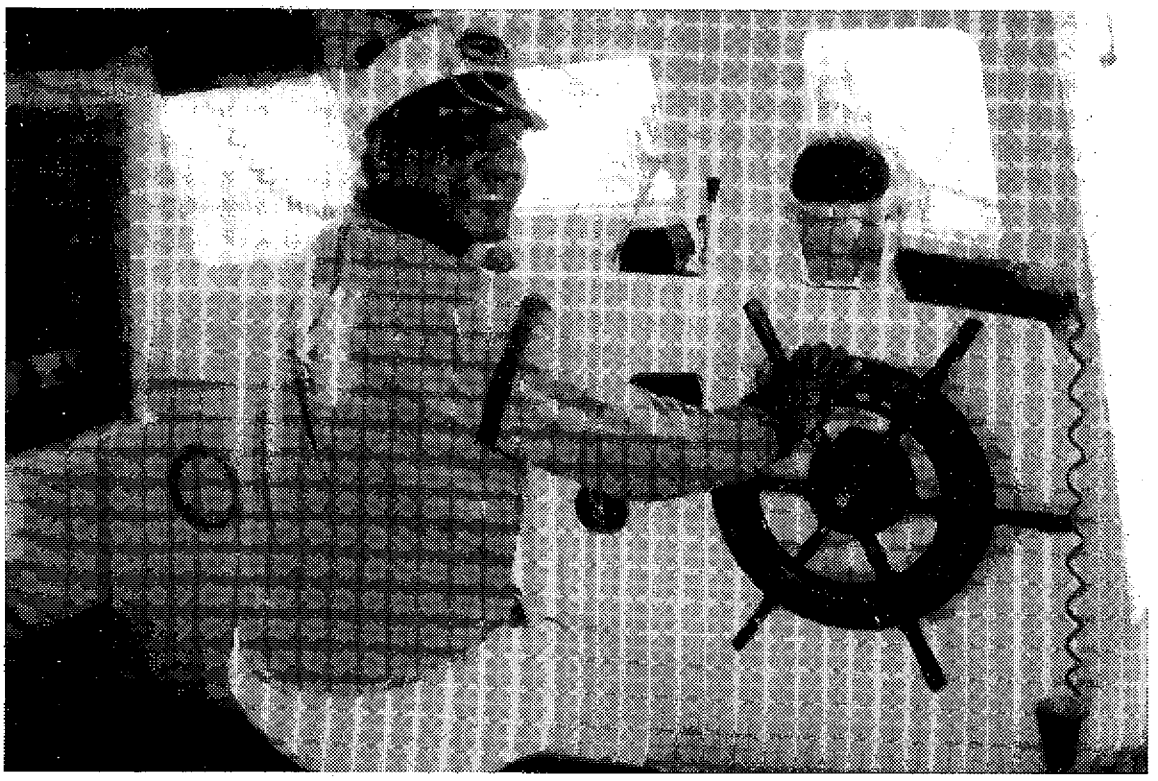


Photo: Hugh Walton

Henry Perongo from Solomon Islands wearing the *Etelis* skipper's hat

RESOURCE ASSESSMENT SECTION

Inshore Fisheries Research Project reviewed

In September, the British Overseas Development Administration reviewed two UK-funded activities at SPC: the Fish Handling and Processing Project, and the Inshore Fisheries Research Project (IFRP). This latter project is funded by a grant from the United Kingdom Government which formally expires at the end of December 1993.

The IFRP's genesis was the eighteenth SPC Regional Technical Meeting on Fisheries in 1986, which noted the importance of the findings of a Fisheries Research Needs Study, conducted by Semisi Fakahau and Mike Shephard, and in particular the 'important but unattended fisheries research needs' of most Pacific Island countries.

The meeting supported an SPC proposal for an Inshore Resource Assessment Project, but recommended that the title and range of activities be broadened to Inshore Fisheries Research.

The Project was also designed to lift the non-tuna related research load off the Tuna and Billfish Assessment Programme, and allow the TBAP to concentrate on its primary mandate.

Funding for the project took some time to secure, but the Overseas Development Administration of the UK filled the gap and project activities started at the end of 1987. The first major activity of the project, and one that seems to have been judged a great success by all who participated, was the March 1988 Workshop on Inshore Fisheries Resources.

This workshop drew together fisheries officers and resource experts from all over the Pacific to benchmark the current state of knowledge about commercially important coastal fisheries in the Pacific Islands, and provided general guidance to the IFRP on which areas of work should be considered a priority. Over 150 papers were tabled at the workshop, more than twice as many as had been expected.

In the six years since its inception, the IFRP has been involved in 52 major sub-projects, on request, and has been involved in a multitude of other advisory activities ranging from the review of scientific publications to the design of subsistence surveys. Ninety seven Pacific Islanders have been directly involved in IFRP field projects as counterpart scientists, and IFRP personnel have authored or co-authored over 50 reports and publications in addition to meeting papers, newsletter and bulletin articles. More than 180 papers have been tabled at IFRP workshops.

The 1993 British review team consisted of: Dick Beales, ODA Fisheries Adviser (who was, incidentally, the UK representative at the 1986 RTMF which led to the creation of the IFRP), David Salmon, Natural Resources Adviser of the ODA Pacific Resources Advisory Group, and Jane Tierney, Aid Attaché with the British Aid Management Office.

The team had already visited Honiara, to review the progress of ODA-funded projects with the Forum Fisheries Agency, taking the opportunity to seek the opinions of the Solomon Islands Fisheries Division along the way, then spent four days in New Caledonia reviewing both the IFRP and the SPC Fisheries Post-Harvest Project (FPHP). The review was internal to the UK Government, and no report will be published.

Although the IFRP will formally conclude at the end of 1993, activity will continue under the Resource Assessment Section of the SPC Coastal Fisheries Programme. A smooth and gradual transition into a major new project, beginning in mid-1994, is envisaged.

One of the first planned activities will be a comprehensive workshop to benchmark progress in coastal fisheries research and resource management over the six years since the first SPC Inshore Fisheries Resources Workshop. If this workshop is as successful as the first, it will provide some valuable guidelines for the most useful future directions for living coastal resource research in the region.

It is also hoped that an EC-funded joint SPC/New Caledonia/French Polynesia remote-sensing project (RSP) will be under way by the end of 1994. The SPC component of this project will come under the wing of the Resource Assessment Section, and will provide a potent additional tool to assist the section in inshore fisheries resource assessments.

(Contributor: Tim Adams)

IFRP Publications

With the Inshore Fisheries Research Project drawing to a close, travel funding for IFRP staff is becoming severely limited. This is unfortunate for the commissioning of new in-country projects, but one happy consequence is that staff have more time free for writing. The findings of several of the subprojects undertaken for SPC member countries over the past five years would be of benefit to the region as a whole, and some of these country reports are being revamped as technical reports for wider distribution. (All of these would of course be first subject to vetting and approval by the member country involved.)

There are one or two new publications on the boil, thanks to rash promises made to a certain funding body, and these should see the light of day before the end of the year.

A complete list of IFRP documents deposited in the SPC library will be published in the next issue of the SPC *Fisheries Newsletter*, and photocopies of any requested documents will be made available to fisheries administrations of SPC member governments for a certain period. Reproduction of certain of these documents may be subject to permission from the collaborating country, and a cover charge may be levied on anyone who is not an SPC member fisheries administration.

(Contributor: Tim Adams)

CAPTURE SECTION

Six new fish aggregating devices for Tokelau

Tokelau's Department of Agriculture and Fisheries recently requested SPC assistance in the initiation of a Fish Aggregation Device (FAD) programme in Tokelau. Technical support was subsequently made available through the UNDP-funded Offshore Fisheries Development Project (OFDP), which operates within the Capture Section of the Coastal Fisheries Programme.

The objectives of the programme were to determine appropriate FAD designs, conduct FAD site surveys offshore from three atolls (Fakaofo, Nukunonu and Atafu), deploy two FADs at each atoll and train local fishermen in FAD fabrication techniques.

In response, SPC provided assistance in determining appropriate FAD flotation and mooring systems. The steel raft designed by Lieutenant Richard Boy and the "Indian Ocean System" (a series of purse seine floats strung along a PVC-coated wire cable) were chosen for flotation, to be used in conjunction with catenary curve mooring systems.

The components of the mooring system were selected according to SPC specifications to ensure a long-life FAD suitable for harsh environmental conditions. Field-based technical assistance was provided from 25 July to 30 August 1993, supervised by SPC Master Fisherman, Peter Watt. He was assisted by attachment trainee Pablo Saigeldab, Fisheries Development Officer from the Marine Resources Division of Palau.

SPC electronic equipment (a deep-water echo-sounder and a Global Positioning System) was provided to conduct FAD site surveys. The equipment was fitted to the Tokelau inter-atoll vessel, *Tutolu*, which was made available for the project. FAD site surveys at each of the atolls consisted of running a series of transects offshore and recording depth and positions. Using traditional knowledge of areas where pelagic fish tend to aggregate and distance offshore where the fishermen prefer to fish, local masterfishermen (tautai) chose the FAD site survey areas. The sites with gradual slope, appropriate depth and distance offshore were selected from bathometric charts made after completion of the surveys.

One steel raft and one Indian Ocean FAD design were deployed at each of the atolls. Three local fishermen from each atoll were trained in FAD fabrication techniques, and these individuals also assisted with the FAD deployments.

A video of the Tokelau FAD deployments is currently being produced by Rudy Bartely, Information Officer for the University of the South Pacific in Western Samoa. FAD site survey, rigging and deployment will be outlined in the video, which will be made available to Pacific Island countries in the near future.

(Contributor: Peter Watt)

Good tuna catches in East New Britain longline trials

Although current industrial tuna fishing activity in the Papua New Guinea (PNG) Exclusive Economic Zone annually produces catches in the order of some 100,000 and 10,000 tonnes for purse seining and longlining respectively, none of these catches are actually landed in PNG.

The National Government in recent times has taken positive measures to foster the development of a domestic tuna industry through legislative reform, and a number of propositions to establish domestic tuna operations are under active consideration. In light of these developments the East New Britain Provincial Government has initiated a trial tuna longline fishing operation in Rabaul. The project is using a small general-purpose vessel fitted with modern monofilament longlining gear to assess and demonstrate to potential domestic private-sector interests the viability of catching, landing and marketing sashimi-quality fish.

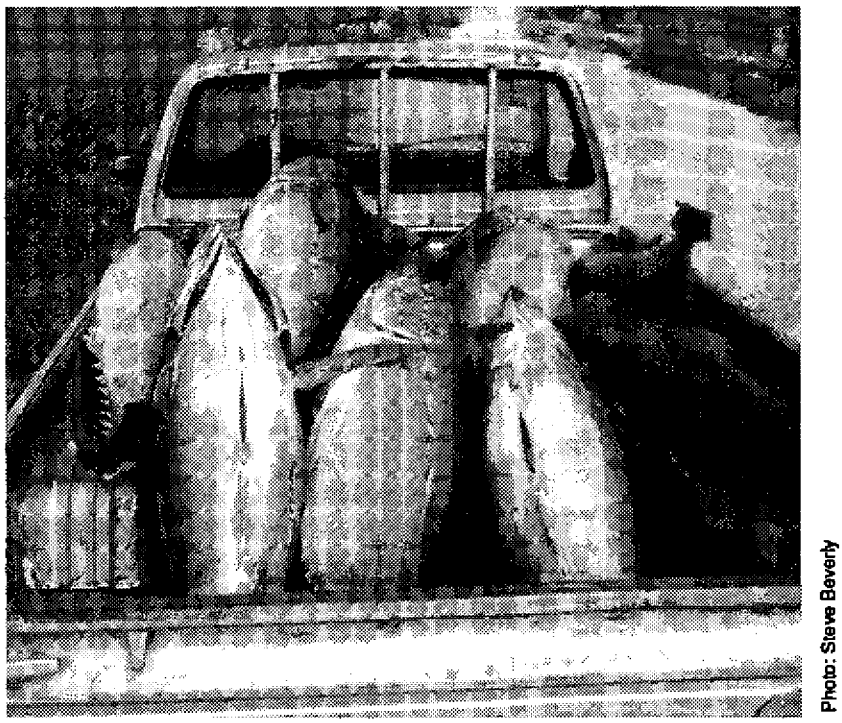


Photo: Steve Beverly

A full load of yellowfin tuna

Photo: Steve Beverly

Even sharks like sashimi quality tuna

Financial assistance is being provided for the project by USAID, under its wide-ranging Pacific Island Marine Resources (PIMAR) programme. As part of the arrangement, USAID has contracted SPC to provide field-based technical assistance which is being channelled through the Capture Section of the Coastal Fisheries Programme. The project is under the supervision of consultant Master Fisherman Stephen Beverly.

The first longlining trials began in July 1993 after months of preparation gearing up the Provincial research vessel *Kuriap*

with a monofilament longline system imported from the United States, and organising onshore infrastructures to store bait and hold fish catches.

Five longline sets of 300 to 400 hooks per set were completed during the month. The total catch was 3,089 kg of yellowfin, 283 kg of marlin and 1,585 kg of other species (including sharks). The average weight of the targeted high value yellowfin was 50 kg each. CPUE for the tuna catch was 5 fish/100 hooks or 2.2 kg per hook. This is approximately double the catch rate for longline vessels fishing throughout the region.

The catch is presently sold at local markets in Rabaul, East New Britain.

However, trial shipments of sashimi-quality tunas will soon be sent to Sydney, Australia, to research the potential for developing an export market.

(Contributor: Peter Watt)

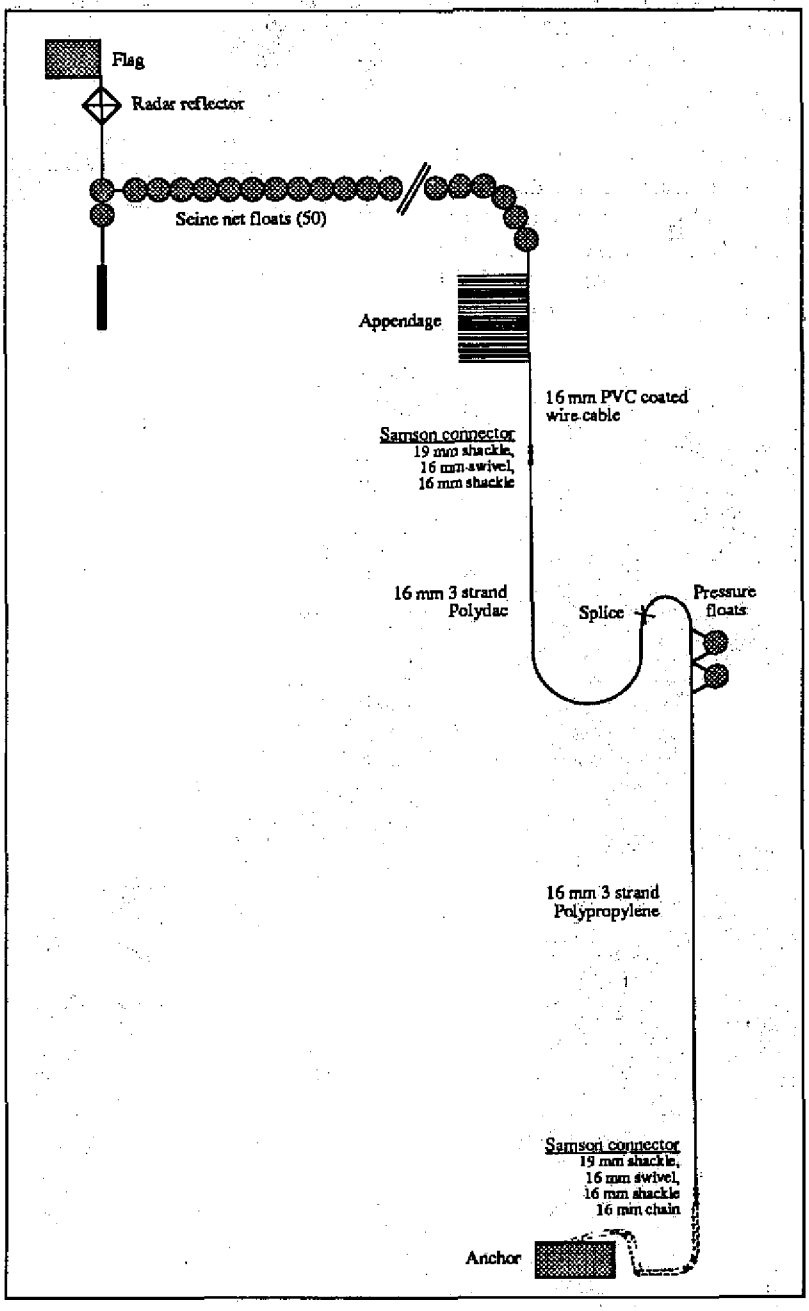
Ten FADS for Fiji.....

For the past few months SPC Master Fisherman Paxton Wellington has been based in Fiji, supervising a programme of FAD deployments that will variously provide benefits to artisanal fishermen, to the national tuna-fishing company, *Ika Corporation*, and to amateur and professional game-fishermen.

Surveys for seven FAD sites have now been completed, two in the Suva area and five in the Western Division. Bathymetric charts supplied by the South Pacific Applied Geoscience Commission (SOPAC) were used for the Suva area surveys and proved to be invaluable for choosing suitable FAD sites. Using a GPS Navigator along with these charts proved a very accurate method for site surveys.

The two FADs in the Suva area were constructed using hardware and rope already on hand. Two steel buoys were constructed locally to an approved design, consisting of a cylindrical shape 60" in diameter with a 72" mast, fitted with a flashing light (1" = 2.54 cm).

These FADs are used extensively by small-scale fishermen on weekends, as well as recreational boats. Through ongoing surveys, carried out by Fisher-



The IKA Corporation Indian Ocean design fish aggregation device

ies Division personnel, it has been shown that FAD catches landed at Nabukalou Creek in Suva are now almost equal in volume to the landings of reef fish sold at that market. (Total landings of fin-fish at Nabukalou Creek around 200 t/yr)

One of the two Suva FADs was reported missing after two months for unknown reasons. Subsequently, through the IKA Corporation, a replacement was deployed in the same place. Only two weeks after deployment, this new FAD was reported to be aggregating more fish than the other FAD on station out of Suva.

At PAFCO (Pacific Fishing Company) there is an ongoing FAD fund. A sum of F$5.00 per ton is taken from the price paid for all fish landed at the Fiji cannery, matched by F$ 5.00 from the cannery itself, and placed into an account that is to be used for FADs. Because of the large number of FADs required by an industrial pole-and-line fishery, a design that is robust, yet as cheap to fabricate as possible, is needed.

The Indian Ocean design FAD, which uses a string of 50 seine net floats, strung on a 40 m length of PVC-coated galvanised wire cable, was thus chosen. Because of the greatly reduced forces of drag with this style of raft, it was possible to use a smaller diameter 16 mm mooring line which is almost half the cost of the standard 22 mm line used for FAD moorings.

Total costing for a FAD of this design, complete with anchor, for a 1000 m site depth is around US$ 1,600.

Six FADs of Indian Ocean design have now been deployed in Fiji waters, the deepest at 2,000 m and the last one put in at 800 m. It is envisioned that when going to an area for fishing, one or two FADs will be carried by Ika Corporation vessels for deployment at the required sites. At least 10 more deployments are planned.

It was reported by the captain of the *IKA 8* that a total of 42 tonnes was caught at one of the Suva FADs over a period of four hours.

Two shallow-water FADs, in depths of around 60 m, have also been deployed by the Fisheries Division but they have not yet been in the water long enough to see how they will work.

(Contributor: Paxton Wellington)

..... And two for Tonga

Tonga's Ministry of Fisheries requested technical assistance from SPC for site surveys and deployments of two FADs around the island of Tongatapu. There have not been any FADs deployed there for around ten years.

The FADs are mainly for the use of small-scale fishermen who don't have the capability to fish the offshore seamounts surrounding Tonga. However, the larger bottom fishing boats will also be able to catch skipjack as a cheap source of bait on their way to the distant bottom fishing grounds, and recreational fishermen are expected to increase their catches.

Funding for the two FADs has been shared by the Ministry of Fisheries, the Tonga International Game Fishing Association, and two commercial companies, Alatini Fisheries and Maritime Projects.

Four moorings and associated hardware were ordered and anchors fabricated, all to specifications provided by SPC. Two fibreglass foam-filled buoys were made locally to a design previously used in Tonga.

Field-based technical assistance was given from 25 September to 4 October 1993 by SPC under the supervision of Master Fisherman Paxton Wellington, assisted by staff of the Ministry of Fisheries. Site surveys were conducted from the Fisheries extension boat, using the Commission's deep-water echosounder and GPS navigator.

Because the moorings were already on hand and made up for a depth of 1,100 m, the survey consisted of finding suitable sites at that depth. Three potential sites were found for each of the two areas. The Ministry of Fisheries chose the sites it thought would be most able to be used by small-scale fishermen.

The deployments were made from one of the Tongan Navy's landing barges. Both FADs were loaded by forklift onto the barge. The forklift stayed on the boat and was used to lift the anchors up to the side of the boat and dump them into the water, probably one of the first times a forklift has been used for an actual deployment.

(Contributor: Paxton Wellington)

TUNA AND BILLFISH ASSESSMENT PROGRAMME

Post-graduate training attachment completed

Sylvester Diake, Principal Fisheries Officer (Research) of the Fisheries Department, Ministry of Natural Resources in Solomon Islands, recently finished a nine-week attachment with the Tuna and Billfish Assessment Programme (TBAP).

Sylvester has been undertaking a Postgraduate Diploma in Fisheries at the Australian Maritime College (AMC) in Launceston, Tasmania on a scholarship from the Australian International Development Assistance Bureau.

Agreement was reached between AMC and SPC for Sylvester to undertake the project component of his postgraduate diploma at SPC headquarters in Noumea, where he worked with TBAP Principal Fisheries Scientist Dr John Hampton.

For his project, Sylvester analysed several data sets to estimate growth rates of the three most important tropical tuna species, skipjack, yellowfin and bigeye.

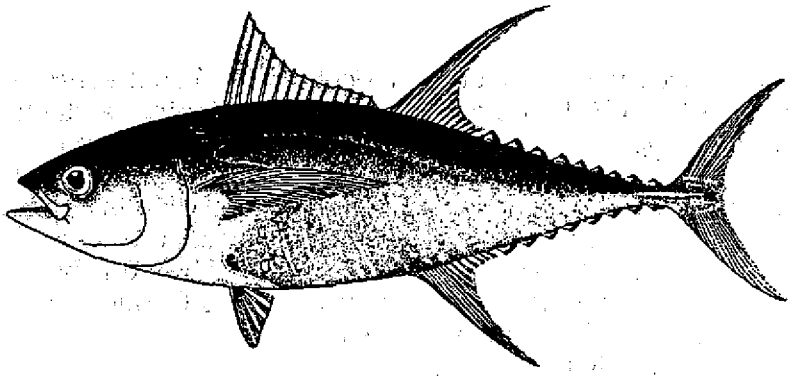
The main source of data was the recently completed Regional Tuna Tagging Project, for which approximately 4,500 skipjack, 1,500 yellowfin and 100 bigeye tag returns had sufficient information with which to carry out growth analyses. Standard von Bertalanffy and linear models were fitted to the tagging data. Von Bertalanffy models provided the best fits to the skipjack and bigeye data, while a simple linear model best described the yellowfin data.

Some preliminary analyses of yellowfin length-frequency data were also undertaken using the MULTIFAN computer package. This method appears promising, and further work is planned.

Sylvester is the first Pacific Islander to undertake postgraduate studies at the TBAP. Provision has been made for other qualified students to undertake similar attachments over the next five years under the auspices of the EC-funded South Pacific Regional Tuna Resource Assessment and Monitoring Project, due to commence in early 1994.

Prospective students from ACP countries who are enrolled or who are intending to enrol in a postgraduate university degree and who wish to undertake studies related to the work of the TBAP should contact TBAP Chief Fisheries Scientist Dr Tony Lewis.

(Contributor: TBAP staff)



Fifth Expert Consultation on Indian Ocean Tunas

The Fifth Expert Consultation on Indian Ocean Tunas was held from 4 to 8 October 1993 on Mahé, Seychelles. Formerly known as the Expert Consultation on Stock Assessment of Indian Ocean Tunas, the name was changed to recognise that discussions focus on more than just stock assessment issues. The subjects considered included a review of national fisheries; progress with research and data collection; a review of the status of stocks and tuna biology; and interactions and tagging studies.

After the opening statements, the participants presented reports concerning the state of fisheries in their countries. Participants attended the meeting from Comoros, France, India, Iran, Japan, Malaysia, Maldives, Mauritius, Pakistan, Russia, Seychelles, Spain, Sri Lanka, Taiwan (Republic of China), Thailand, and the United States. International organisations represented included the Food and Agriculture Organization (FAO), the Indo-Pacific Tuna Programme (IPTP) and the South Pacific Commission.

IPTP staff presented a report on the state of the IPTP database. IPTP is currently reviewing the

quality of all its data holdings and have found significant under-reporting of nominal catches, due to the use of gilled-and-gutted or dressed weights rather than whole weights, and/or ignoring discards. IPTP compiles catch data on the basis of FAO areas for the Indian Ocean; however, the FAO areas do not reflect the areas used by certain participating countries. IPTP was encouraged to develop its own statistical areas, which better reflect those used by participating countries. IPTP reported that as a result of the review of the quality of the database, some changes have been made to the data. All changes are being documented and they will be open to review by interested parties.

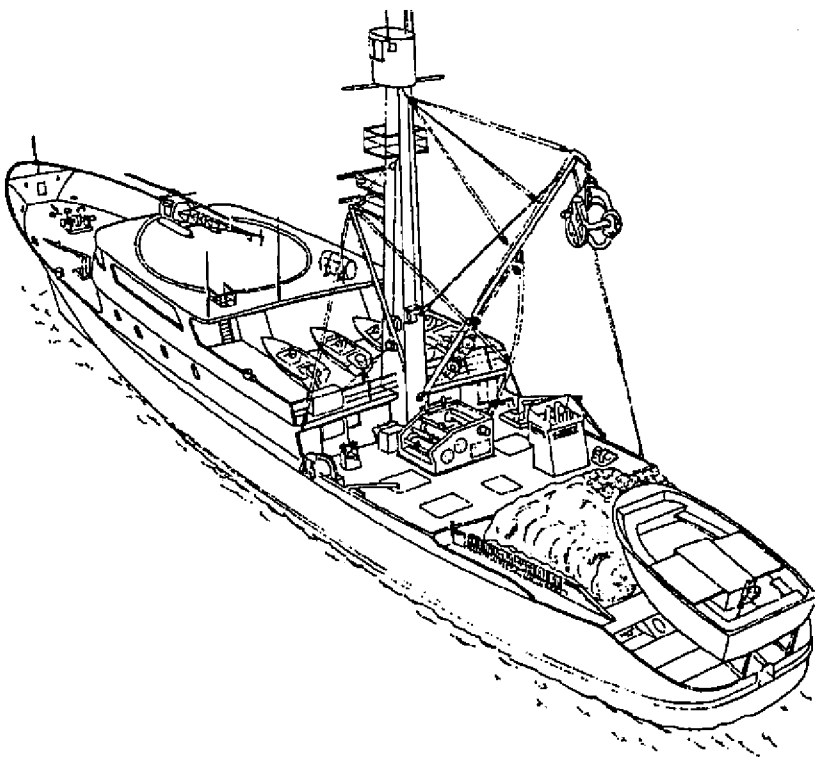
The meeting then considered the status of stocks and tuna biology, first skipjack and yellowfin, then bigeye and albacore, then small tunas. No evidence of over-exploitation exists for any species, at least on the basis of the available information. It was noted that the purse seine fishery has become more dependent on log schools in recent years, resulting in an increase in the proportion of skipjack. It was further noted that coastal longline and gillnet fisheries in the Gulf of Oman and in the Persian Gulf are expanding rapidly. No recommendations for management were made. However, it was considered that some species were nearing optimal exploitation, thus the participants were of the opinion that caution should be exercised with increases in fishing effort directed at albacore, bigeye and yellowfin tuna, as well as longtail tuna and narrow-barred spanish mackerel.

The objectives of a proposed tagging study in the Indian Ocean were discussed. The meeting decided to consider broad objectives, encompassing the estimation of population parameters and of rates of movement, in both directions, between fish available to the purse seine fishery and those harvested in coastal areas. Some operational problems were discussed. The vessel will probably be similar to the Basque pole-and-line vessels based in the Seychelles in 1981, which caught fish successfully, but which did not become established because of infrastructure problems at the time. Tagging from purse seiners will also be explored. It was agreed that tagging in coastal areas, probably from local vessels, was important. The Basque pole-and-liners successfully caught their bait on the Seychelles plateau using purse seines to catch pelagic schools. Bouki-ami will probably be attempted in Madagascar, Zanzibar and possibly other areas. The Maldives may sell bait to the project, rather than permit the project vessel to bait.

The European Community (EC) has indicated that it may be willing to support a tagging project in the Indian Ocean, but not until the proposed Indian Ocean Tuna Commission (IOTC) has been established. The IOTC may be established by the end of 1995; however, given the uncertainty concerning the availability of funding, the tagging project may not commence until much later.

The issue of by-catch and discards in Indian Ocean tuna fisheries was discussed. It was recognised that little information is currently available. It was therefore recommended that IPTP and participating countries compile all available information on by-catch and discards in the Indian Ocean, for presentation at the next Expert Consultation.

(Contributor: TBAP staff)



FRANCE SUPPORTS USP MARINE RESEARCH WORK

The Government of France has donated equipment worth F$ 200,000 to the University of the South Pacific's Marine Studies Programme. The equipment consists of two fibreglass boats of six and eight metres with engines, seven computers with a laser printer and a colour scanner, and laboratory equipment such as microscopes and spectrophotometers. These were handed over by the French Ambassador Jacques Costilhes to USP Vice-Chancellor Esekia Solofa and Professor Robin South of the Marine Studies Programme, on 5 October.

The equipment provided is in support of the Marine Studies Programme at USP in co-operation with French scientific institutions working in the region. French Ambassador Jacques Costilhes said that France intended to favour establishing links between South Pacific countries, especially Fiji, and research institutions such as IFREMER, ORSTOM or the French University of the Pacific based in French Overseas Territories. IFREMER has monitored the recent visit to Fiji, as well as to many other countries of the South Pacific of the oceanographic vessel *Atalante*. In 1994, ORSTOM's research ship *Alis* will also carry out a study concerning the Astrolabe reef around Ono Island, north of Kadavu Island.

The donation is another aspect of French co-operation in the area of marine research. A French expert was appointed to USP for that purpose between September 1992 and June 1993.

(Source: *USP Information Office*)

MANUAL FOR SOUTH PACIFIC FISHERIES LIBRARIES

Pacific Islands Marine Resources Information System (PIMRIS) Information Officer Robyn McDowell has compiled a manual for fisheries libraries in the South Pacific.

According to Ms McDowell, the manual has been compiled with three types of users in mind: people who find themselves in charge of a library and do not know what to do about it; qualified librarians working with the Fisheries Divisions; and Fisheries Officers.

She said people who have been put in charge of a library but have no previous experience in the area would be able to follow the steps and procedures set out for organising and running a library.

The guidelines in the manual are based on the standards set by PIMRIS librarians. Qualified librarians can use the manual to refer to these standards and for the practical information contained in the appendices.

Fisheries Officers may find the manual useful for ideas on the organisation of their own personal collections,' Robyn said. The manual is divided into four sections: organisation of the collection, library management, cataloguing and PIMRIS. Certain sections of the manual can also be adapted for use in other special libraries.

Printed copies of the manual are being distributed to Fisheries/Marine Resources Libraries throughout the region.

(Source: *The University of the South Pacific Bulletin*)

FOUR DIE AFTER EATING SHARK'S LIVER

Three Port Moresby children and a woman are reported to have died early in September after eating the liver of a hammerhead shark at a barbecue in Papua New Guinea's New Ireland province. Two other people were critically ill in hospital with food poisoning and eight suffered mild effects following a meal of vegetables barbecued with the liver of the freshly caught shark. The sick villagers from Semalu told PNG's *Post Courier* newspaper that shortly after the meal they started getting pins and needles in their mouths, began choking, and several lost consciousness. The worst hit were rushed to the nearest health centre but died within hours.

(Source: *Samoa Observer*)

JAPAN REFUSES TO SIGN FISHING DEAL....

Japan has refused a renewed request to sign a multilateral fishing agreement with Pacific nations. This emerged at a post-Forum meeting between island countries and a Japanese delegation led by the Japanese Ambassador to Fiji, Yasuo Hori. Island countries have been pushing for a multilateral agreement since 1988, claiming that Japanese operators play off island countries against each other when negotiating fishing agreements.

Hori told island representatives that Japanese fishing companies needed to maintain "flexibility" in arrangements with individual countries. In an opening address to the dialogue session, Hori said Japan would be increasing its contribution to the Forum from $US400,000 to $US500,000. This was apart from substantial Japanese aid to Forum island countries. "We will continue to expand our aid to the South Pacific, particularly in the form of grants and technical co-operation, which are much needed to meet expectations in the region," Hori said.

(Source: *Pacific Islands Monthly*)

....BUT MAY STILL NEGOTIATE

Japan's chief fishing deal negotiator is expected to visit the Forum Fisheries Agency in Honiara for what agency officials expect will be "fairly serious" discussions. They will be about a deal to sweeten relations between Japanese fishermen and the agency member countries.

The agency's 1992/93 report, issued at the August Forum meeting, strongly critised Japan for seemingly blocking Forum efforts to run a regional foreign fishing boat register as part of a move to regulate fishing in the region. But by the time of the report's publication the Japanese, taken aback by the antagonism their tactics were raising, were already offering a peace pipe. The Honiara discussions could lead to the sort of fruitful arrangement that now makes America's purse seiner fishermen lovable folk.

(Source: *Pacific Island Business*)

QUEENSLAND MARKET FOR SOLOMONS FISH

Fishermen in the Solomon Islands' Western Province will soon start selling their fresh seafood in Queensland, Australia. This is the result of negotiations between the Western Provincial authorities and Australian firm Pacific Air Express Limited, which has just started a direct air service to the province.

Pacific Air will be buying crayfish and trout from Gizo and Munda towns and transport them to Townsville twice a week. The company said other types of fish would be considered for the Queensland market later. The direct air service to the Western Province brings Australian tourists and fresh vegetables.

(Source: *Pacific Islands Monthly*)

FISH TESTING MARKETING PROJECT

Willie Tokataake, Fisheries official from Kiribati, said he was pleased with the local response to his one-week visit to Nauru in a bid to establish a local market for fish products from the Republic of Kiribati. "I am very happy with the visit," said Mr Tokataake, Project Manager of the Kiribati Outer Island Fisheries Project. "People have shown an interest in importing fresh fish products into Nauru."

Mr Tokataake and Kiribati Trade official Mr Kamaie Teteki met with restaurant outlets on the island. So far, the marketing list include fresh reef fish, snapper, whole cooked lobster, lobster tail, fish steak and fillets and tuna jerky, which is dried fish marketed in 50 gram packets.

Kiribati at the moment also exports fish products to two other countries. For six months now it has been exporting red snapper to Hawaii and the tuna jerky to Sydney where it is sold through duty free shops. The export of tuna jerky to Sydney began in June this year. The minimum export order on any product is 95 kgs and is supplied on demand.

The test marketing project to Nauru was funded by the Forum Secretariat.

(Source: *The Nauru Bulletin*)

"CLIMBING PERCH" THREATENS PNG FISH

Papua New Guinea and Australian government authorities have been unable to restrict the movement of the fish known as "climbing perch" found in PNG's Western Province and Torres Strait waters. The climbing perch which can live out of the water for more than three hours is threatening the ecosystem by killing and feeding on other local species of fish.

Executive manager of the Ok Tedi mine's Environment and Logistics Division, Murray Eagan says since its discovery three years ago, authorities have been unable to come up with any measure to control its existence. Fish specialists at the University of Papua New Guinea and Ok Tedi Mine say that if it is not controlled, the climbing perch could destroy local fish species as it has done in parts of South America and Asia.

(Source: *Cook Islands News*)

SAFETY AT SEA HIGHLIGHTED AFTER FISHING TRAGEDY

The death of a 52-year-old Matavera (Cook Islands) man generated concern from rescue officials and the public on basic safety measures at sea. It is believed that the fisherman and his companion were not fully equipped before leaving land. Although a radio was available on the boat, the minimum requirements such as life jackets and flares were lacking.

During a Marine Resources workshop held just the week previously on maintenance and safety measures at seas, the cost of being fully equipped was highlighted. Police Inspector G. Goldie gave the media an approximate outlay of safety equipment.

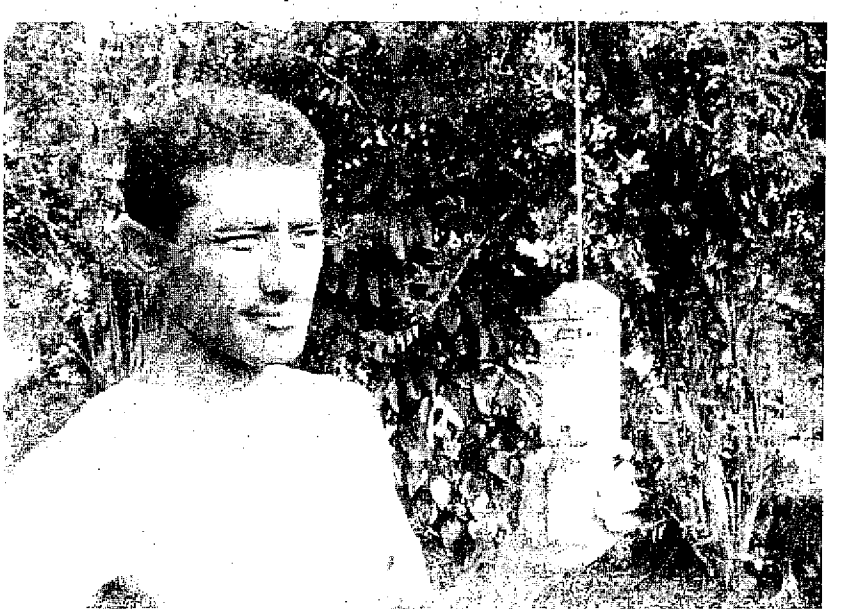
"We figured out that for between NZ$2,000 – $3,000 you could be well equipped to go out," Inspector Goldie said. He added that a 16-channel radio, a couple of life jackets, smoke markers and an EPIRB (Emergency Position-Indicating Radio Beacons) – the latter being the most expensive gear – are what fishermen should be geared with.

Harbour Master Captain Don Silk said it was unfortunate that there was no legislation for fishermen regarding safety equipment, unless they were carrying passengers. However, he said that members of the Marine Resources and Police Departments, fishermen and others have been selected to make up a working committee.

They are working on drafting a proposal to government on what safety measures fishermen should be aware of. The committee was formed as a result of the Marine Resources maintenance workshop, as those who attended it were very concerned.

Inspector Goldie said that it was recommended that before any small boat goes about a mile out of any land sight, they should have a life jacket, oars and sufficient water. He said that would also apply to people travelling between Manihiki and Rakahanga as mishaps had happened in the north, where people travelling in small boats between the islands disappeared. A party of four people was lost off Manihiki/Rakahanga in November last year. In the same year Rarotongan fisherman Duke Vakatini went missing. Some years ago fisherman Duncan Bertrum was also reported missing.

Inspector Goldie said if the basic safety measures were taken, "you can save yourself and the country a lot of expenses. Each



A 121.5/243 (old style) EPIRB

time we get called out, we are looking at about $500 an hour to run the *Kukupa*." He also said that it takes time for the patrol boat crew to be called together as they are scattered everywhere on Rarotonga.

The local airline (Air Rarotonga) is then called in for aerial surveillance. About $800 per hour is spent for a small plane, and about $1,500 for a big plane. "If we go further out, we get the Orion (aircraft) in, you're looking at about $25,000 per hour, from the time they leave base until the time they get back," Inspector Goldie said. "So it's a very, very expensive exercise."

Harbour Master Captain Silk said that those who turn up to workshops on marine safety are those who have always been aware of dangers at sea, and are usually fully equipped, while some fishermen simply do not bother about safety measures at sea.

When seminars on safety are held, those who should attend are the ones who never do. The ones who do turn up are already aware of the problems they might face.

"Fishermen will not realise the danger until it happens," Captain Silk said, "so always be prepared."

(See "Public education for safety at sea" by H. Walton, page 32)

(Source: *Cook Islands News*)

CHIEF FISHERIES OFFICER WANTED IN NAURU

The Department of Island Development & Industry of the Republic of Nauru is currently seeking a Chief Fisheries Officer, who will be responsible to the Secretary for Island Development and Industry for the daily effective co-ordination and supervision of the Fisheries Section.

The overall objective of the position will be to ensure effective administration, co-ordination and carrying out of fisheries policies and functions of the Fisheries Section. More specifically the Chief Fisheries Officer's duties will be:

- Plan, co-ordinate and implement fisheries' policies, programmes and projects to ensure optimum utilisation of living marine resources within the 200 mile EEZ;
- Identify development opportunities and establish priorities, strategies and programmes for government assistance;
- Provide technical expertise, training and advice to fisheries officers to ensure effective application of research, development, licensing and enforcement programmes;
- Prepare and provide budgetary and funding requirements for fisheries programmes and activities;
- Identify, formulate and advise the Secretary for IDI on policies affecting fisheries' development, utilisation, conservation and management within the 200 mile EEZ;
- Co-operate, consult, and liaise with the regional fisheries organisations (FFA & SPC) and institutions on all matters concerning research, surveillance, development, training and management of fisheries and marine resources;
- Represent Nauru in technical meetings concerning fisheries matters;
- Ensure proper accountability, maintenance and repair of all the assets of the Fisheries Division;
- Prepare reports on meetings and programmes implemented by the Fisheries Section;
- Carry out such other duties as directed by the Secretary consistent with the above.

The candidate must be a graduate of either a degree or diploma in Fisheries Science and or other relevant qualifications as may be acceptable to IDI. The candidate should have extensive administrative and practical experience in policy formation, as well as the ability to plan, co-ordinate, implement and monitor fisheries programmes.

The salary is envisaged to be between A$ 18,348 and 19,968. Other benefits include tax free salary, free housing, electricity, water and medical expenses.

If you are interested in this position please address all correspondence to:

Mr Felix Kun, Secretary
Department of Island
Development & Industry
Republic of Nauru
Fax: (674) 3422

AUSTRALIAN FISHERIES RESOURCES

The Australian Bureau of Resource Sciences and the Fisheries Research and Development Corporation have just released *Australian Fisheries Resources*. This book focuses mainly on resources, but it also includes information on the Australian fishing industry, fishing gear and the environment. More than 350 contributors from all parts of Australia helped put the information together.

This 'resource atlas' is divided into six chapters. The first chapter presents an overview of Australia's fisheries resources, industries, products, markets, management, and research.

Chapter 2 describes the major characteristics of Australia's open ocean, coral reef, coastal and freshwater habitats. It concentrates on aspects which influence the distribution and abundance of fisheries resources and also addresses some key challenges in the conservation of fish habitats.

The information presented in Chapter 3 is extracted from *Commercial fishing gear in Australia*. It is not intended to be a comprehensive review of all fishing gear used in Australia. It does, however, cover the main fishing methods employed to catch those species of commercial importance that are included in the book. The chapter contains five sections: nets, hook and line, traps and enclosures, miscellaneous methods, and fishing vessel electronics.

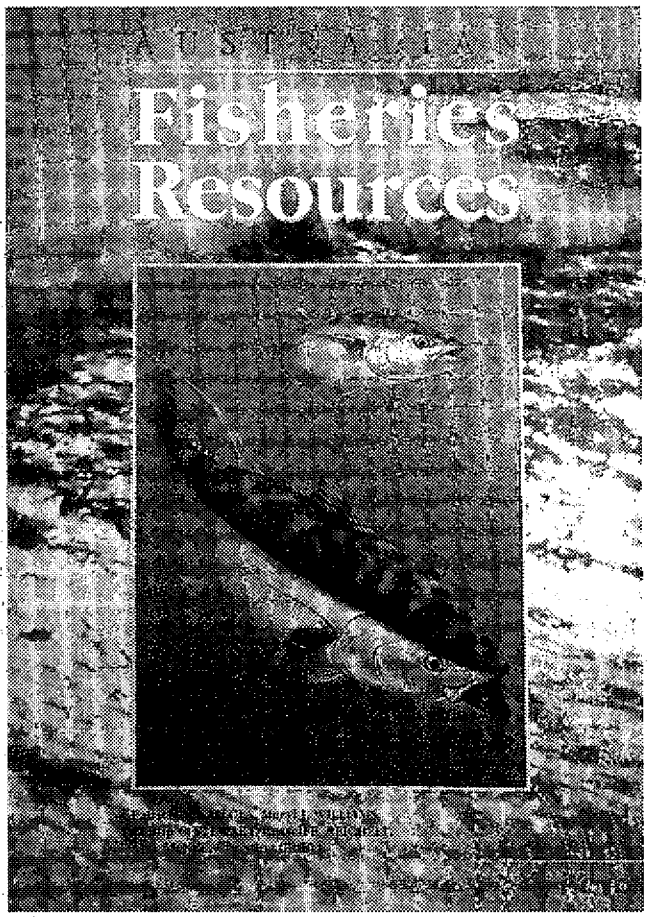
Chapter 4 covers post-harvest technology, domestic marketing of fish, fish exports and imports, fish quality characteristics and handling and seafood in human nutrition.

Chapter 5 provides technically accurate details (distribution, breeding, growth, feeding, harvesting and management) where they are known on more than 140 species which are caught in quantities greater than 100 tonnes or valued at more than A$ 1 million.

Chapter 6 presents species of which annual catch is less than 100 tonnes or valued at less than A$ 1 million. The species presented in this chapter are primarily of commercial rather than recreational significance. Some of the species mentioned are taken regularly as by-catch. Others have only recently been recognised as a potential fishery or aquaculture resources and their production is low.

The authors of this very comprehensive document are considering publishing the next edition in CD-ROM format. The distribution maps are already being transferred to a Geographic Information System from which they will be available for further analysis.

If you are interested in ordering *Australian Fisheries Resources* (422 pp., A$ 120) contact the Bureau of Resource Sciences, Fisheries Resources Branch, P.O. Box E11, Queen Victoria Terrace, Parkes ACT 2600, Australia (Fax: 61 6 272 4014).



ACIAR UNDERWATER VISUAL CENSUS PROJECT - PHASE II

The second phase of a project to develop underwater visual census (UVC) methodologies for surveying coral reef teleost fishes got under way recently with a workshop in Fiji.

The project is funded by the Australian Centre for International Agricultural Research and, like most ACIAR initiatives, is a collaborative effort, involving the Queensland Department of Primary Industries, the Fiji Fisheries Division and the Solomon Islands Fisheries Division. Project co-ordinator is Melita Samoilys of QDPI.

The workshop, held at the Media Centre of the University of the South Pacific, was attended by project staff from QDPI, Fiji and Solomon Islands, and by representatives of the Forum Fisheries Agency, the SPC Fisheries Programme, and Papua New Guinea Division of Fisheries and Marine Resources.

Dr Michael King organised the discussion phase, which was to bring participants up to date with the results of Phase I of the UVC project, to run through the basic principles of UVC methodology (particularly sampling design and field methods), and to explore the methods that would be used to gather catch per unit of effort information from any fisheries on the UVC-surveyed stocks.

The main focus of Phase II is to develop UVC into a tool for practical fisheries stock assessment.

Phase I refined and validated the methodology of UVC itself, determining what sizes of transects or point-counts were most appropriate, what groups of fishes were most accurately estimated by UVC methods, and how much time needed to be put into observer training to estimate fish sizes underwater and accurately identify species etc.

Phase II will use these optimised methods to estimate the abundance and biomass of certain species and species-groups at selected study sites in Solomon Islands (based at Seghe) and in Fiji (based at Ba), and compare the UVC results with estimates derived from more 'traditional' methods of assessing finfish populations.

It is not expected that UVC will supplant other methods of stock assessment, but that it will provide another weapon in the armoury of fish scientists who are asked to provide estimates of the size of stocks. Scientists working on invertebrates have always enjoyed an advantage over their brethren working on fish because they can observe and count the animals directly, and do not have to rely on second-hand information filtered by the selectivity of a fishing-hook or net, or winkled out of a reluctant fisherman.

UVC is familiar to all invertebrate biologists, but the work of this project is to account for the extra mobility of fishes, and thus to enable direct observation of reef-fishes to be used for stock assessment with a good degree of statistical confidence. Ultimately, the aim is to make that methodology accessible to Pacific Island fish scientists.

UVC methods are likely to be particularly useful for:

- assessing populations that cannot be fished or sampled destructively, e.g. within marine reserves, or for certain marine space usage compensation cases;
- assessing non-cryptic, moderately large body-sized, reef-associated fishes;
- assessing species caught by spear-fisheries;
- validating catchability co-efficients for certain fishing gear, and thus enabling estimation of absolute stock size trends from historical CPUE data; and
- even, *objectively* assessing tourist-diving potential, since tourists will see exactly the kinds of fish that are most amenable to UVC assessment.

The three-day discursive phase of the workshop was followed by three days of practical work, performing actual UVC trials. The original intention, to do this work at USP's Dravuni field station in the Great Astrolable Reef, was aborted by bad weather and the team did most of their diving in more sheltered water close to the entrance to Suva Harbour.

This was a most useful workshop for the project, and will be followed up by another workshop next year in Solomon Islands to discuss the first year's results and plan further. Mike King, brought in as co-ordinator and consultant trainer, displayed his usual explanatory expertise, and provided workshop participants with a sneak preview of his forthcoming textbook on fisheries biology (to be published by Fishing News International).

Future news of the UVC project will be published in occasional articles in this newsletter, and those requiring further information should contact either Melita Samoilys (project co-ordinator) or Hector Fuentes (project biologist) at Northern Fisheries Centre, Queensland DPI, Cairns, Qld 4870 (fax: (003) 834766).

(Contributor: Tim Adams)

Photo: Hector Fuentes

Participants in ACIAR/UVC workshop in Suva on 6 September 1993 (Back row, left to right: Hector Fuentes (QDPI), Krishna Swamy (Fiji), Peter Ramohia (Solomon Isl.), Andy Richards (FFA), Augustine Mobiha (PNG), Tim Adams (SPC), Jon Leqata (Solomon Isl.). Front row, left to right: Melita Samailys (QDPI), John Aini (PNG), David Die (QDPI), Mike King (AMC), Ben Tikomainiusiladi (Fidji))

AN UPDATE ON ACIAR-SUPPORTED FISHERIES RESEARCH ACTIVITIES IN SPC MEMBER COUNTRIES

by B. R. Smith
ACIAR Fisheries Programme
Cronulla, NSW, Australia

Introduction

The Australian Centre for International Agriculture Research (ACIAR) was established in 1982 to encourage and support collaborative research directed at solving key agricultural problems in developing countries.

ACIAR's definition of agriculture is a broad one which embraces renewable natural resources: land, water, soil, agriculture, forestry and fisheries.

ACIAR aims to improve natural resource management through the study of relevant problems inhibiting sustainable development. Basic to the ACIAR approach of using scientific collaboration as a means of giving aid is the idea of working in partnership so that all parties derive mutual advantage. These benefits can come in a number of ways – as new food production technologies, improved natural resource management strategies, and through a strengthening of national research institutions.

The ACIAR Fisheries Program has been active in the Pacific Islands since 1984, with activities directed principally at several key inshore resources of importance throughout the region. All projects have involved collaboration with national fisheries divisions, and emphasis has been given to the enhancement of national capacity to assess and monitor exploited stocks, and to prepare appropriate management advice for the consideration of policy makers. The scope of the research activities outlined below emphasises the importance ACIAR ascribes to the Pacific Islands, a commitment reinforced in recent years by the adoption of a more flexible small project approach to the needs of the smaller countries, and by linking more effectively with regional technical agencies (SPC and FFA) to explore promising regional initiatives.

Report on projects/activities

The aims and outputs of ongoing or recently concluded ACIAR activities in the Pacific are briefly outlined below, together with comments on several new initiatives which may be of interest to readers.

Tuna Baitfish Research Project (Fiji, Kiribati, Solomon Islands)

This project, co-ordinated through CSIRO Division of Fisheries (Dr Steven Blaber), began in 1986 with research in Solomon Islands and the Maldives. It was expanded to incorporate work in Kiribati in 1989 and Fiji in 1991 and will be completed during 1993.

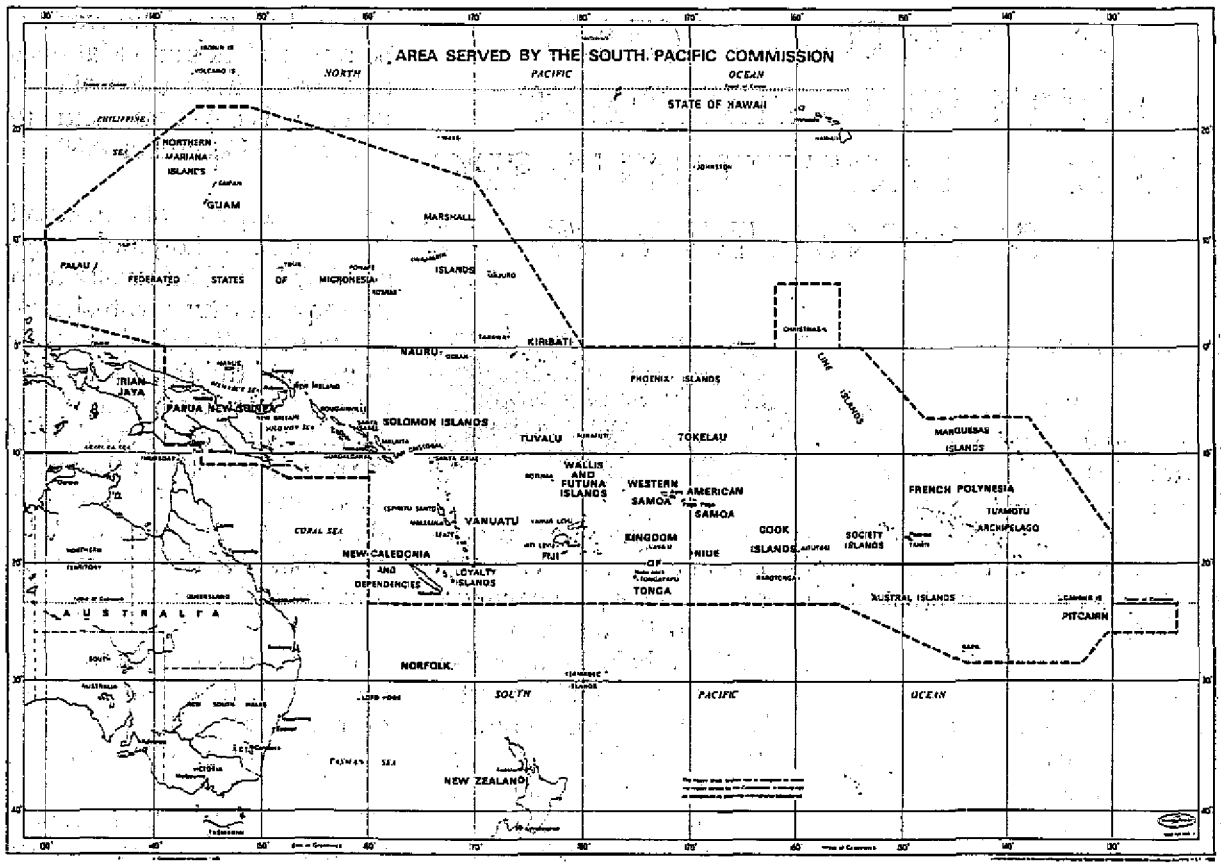
The first phase of the work in Solomon Islands and Maldives culminated in an International Baitfish Workshop held in Honiara in December 1989.

The second phase of the project involved collection and analysis of biological information on the important tuna baitfish species of Kiribati and Fiji in order to provide the basic scientific data necessary for rational management and conservation of the resource, both for the traditional owners, and in order to allow continuing maintenance of supplies for the commercial tuna fisheries.

The work in Kiribati and Fiji is now complete. All information from the Kiribati study has been analysed and published as an ACIAR Technical Report (Number 24). It includes a comprehensive review of all past work in Kiribati on baitfish as well as stock assessments, baitfish biology, and recommendations for improvements to the fishery.

Results from Fiji are currently being analysed and prepared for publication, and were comprehensively discussed and reviewed at a final project meeting in Fiji in August 1993.

They include information on the biology of selected species of baitfish, levels of interaction between reef fisheries and baitfishing, the significance of the bycatch of non-target species in baitfishing operations, and the analysis of all existing data for stock assessment purposes.

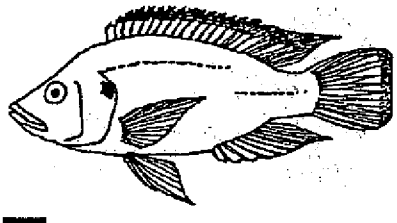


Area served by the South Pacific Commission

In addition, surveys have been undertaken of a range of new baitgrounds with a view to publishing a 'Bait site atlas'. A poster about baitfishing and its interrelationships with other fisheries is being produced (in collaboration with the SPC Media Unit in Suva) for educational purposes.

Genetic identification and stock improvement of tilapia (Fiji and Malaysia)

The introduction of the first tilapia species, *Oreochromis mossambicus*, into Malaysia and Fiji was aimed at providing food for human or livestock consumption.



While this initial experience with tilapia was less than successful in both countries, it did lead to the more recent introduction of *O. niloticus* breeds which have proven more effective.

Unfortunately poor management of broodstocks and the probable introgression with *O. mossambicus*, and earlier introductions have contributed to the low productivity of the present stocks in both countries.

Commissioned through the Queensland University of Technology, Centre for Biological Population Management, (under A/Prof. Mike Capra), this project focuses on the genetic characterisation and evaluation of existing strains to provide the basis for an informed choice of the best-performing strain(s) as broodstock for future production.

By pooling the resources of the three countries involved, it seeks to achieve a rapid improvement in tilapia culture in the region and foster technology transfer between the participating nations in the field of fish aquaculture.

Early work is progressing well but some delays have occurred in Fiji as a result of cyclone-induced flooding of ponds at the Naduruloulou Research Station: this caused intermingling of the different strains and required some effort to re-establish validated stocks.

Genetic characterisation of existing tilapia stocks in Fiji is largely complete and genetic markers are now available for each of the four recognised strains: *O. niloticus* Chitralada strain, *O. niloticus* Israel strain, *O. mossambicus*, and red tilapia

(*O. niloticus x O. mossambicus* hybrid).

These markers will allow careful monitoring of the stocks and can be used to diagnose mixing of fish between stocks or active introgression of one stock into another. A handbook based on this work has been prepared for use in future work in Fiji and Malaysia.

Currently in Fiji, only the Chitralada strain of *O. niloticus* is being propagated for fry distribution to farmers. Experiments are being established at Naduruloulou to compare the performance of the four existing stocks under identical culture conditions. Identifying the best strains will pave the way for a genetic improvement programme which is expected to increase fish production on a sustainable basis. The growth evaluation trials will begin in October-November this year and will continue until 1995.

Application of Underwater Visual Census to assessing coral reef fish stock in the tropical Pacific (Fiji, Solomon Islands)

The goal of this project is to develop an appropriate and robust stock assessment method for general use in Pacific Island countries and on the Great Barrier Reef.

The first phase of the study (1989–1992) established the value of underwater visual census (UVC) as a quick and efficient means of enumerating reef fish species that contribute to fin-fish fisheries of coral reefs in the Pacific, thereby providing a quantitative basis for monitoring fish densities over time and for comparison between areas.

The UVC method is relatively quick, non-destructive, and has the potential to incorporate assessments of habitat type and condition for environmental monitoring, and to provide supplementary data on sedentary fauna e.g. clams, beche-de-mer, etc. Perhaps most significantly, UVC methods make appropriate use of one of the strengths of Pacific Islands fisheries staff, namely their knowledge of reef species, fish behaviour, and developed skills in size estimation from many years of subsistence fishing. The non-destructive feature of the method is significant not only from a conservation perspective, but also because much of the research occurs in traditional fishing areas. Fishing rights owners are much more inclined to grant permission to work in their reef areas if fish are not extracted.

This second phase activity, again supervised by QDPI scientist, Ms Melita Samoilys, will extend the earlier work by investigating the use of UVC surveys in conjunction with more conventional fisheries data collection methods e.g. questionnaires, trial fishing, etc. to assess stock status.

The project aims to provide a stock assessment survey method that can (i) identify what reef fish resources exist, (ii) determine whether stocks are under- or over-fished, and (iii) provide estimates of available catch on a sustainable basis.

In doing so, the project will also train collaborating Pacific Island fisheries staff in stock assessment research and demonstrate its importance in formulating fisheries management plans. Training will be strongly emphasised in this phase of the project with a comprehensive series of workshops planned, which will also be open to fisheries personnel from several other Pacific Island countries.

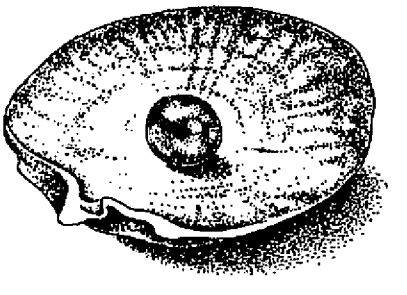
A manual will be produced and it is intended that the stock assessment method, if successful, will be broadly applicable throughout the Pacific Islands.

Pacific Island Pearl Oyster Resource Development

The above proposal is now in the final stages of project development. It has benefited from extensive consultation with interested parties throughout the Pacific and within Australia, a process in which the active involvement of SPC has been particularly helpful.

This has resulted in a redesign of the project to one less ambitious in scope, with a primary focus on the management and rehabilitation of severely depleted or relict pearl oyster populations (including optimisation of wild spat recruitment/collection, the investigation of simple lagoon- and land-based larval and juvenile culture systems).

A sub project will look at the application of modern veterinary surgical techniques to the process of bead insertion, and pearl oyster management. The project will involve scientists from James Cook University, Kiribati, Fiji and Solomon Islands, the latter through a linked activity with ICLARM/CAC. SPC will remain actively



involved in the work of the project, particularly with respect to the co-ordination and dissemination of information to interested countries in the region.

Processing of novel tuna products in small Pacific Island countries

Initiated in early 1992, this joint initiative between ACIAR and the SPC Post-Harvest Fisheries Project began with two linked desk studies into product concepts and the marketing potential for tuna-based products from the Pacific Islands. Building on this, two parallel product development studies were commissioned through the University of New South Wales (UNSW) and Queensland Department of Primary Industries/International Food Institute of Queensland (QDPI/IFIQ) respectively to investigate several promising product formats.

The results of this work were reported at a one-day consultative meeting held in Sydney in February 1993; this was attended by participants from four Pacific Island countries (Kiribati, Tuvalu, Marshall Islands, Tokelau), and representatives from a wide range of interested organisations (SPC, AIDAB, South Pacific Trade Commission, IFIQ, UNSW, Murdoch University) as well as private industry.

The major outcomes of the meeting were:

- an agreed action plan to guide future activities in support of national tuna product development initiatives in the Pacific islands; and
- the establishment of an SPC/ACIAR working group to co-ordinate activities as identified in the action plan and to encourage the wide dissemination and takeup of the ACIAR research results.

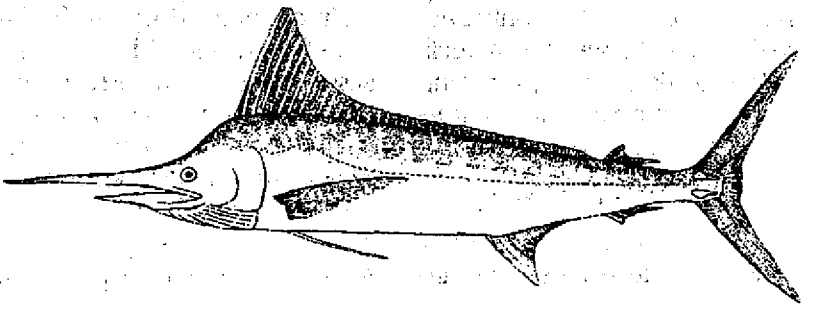
Subsequently, support has been given for the preparation of an improved packaging format for Kiribati, and the conduct of preliminary marketing trials to assess the effectiveness of this new packaging in target markets (e.g. airport departure boutiques). The series of small studies funded to date has been very productive, and hopefully will facilitate and support further development action within the involved Pacific Island countries.

Billfish study (Papua New Guinea, Solomon Islands, Vanuatu)

This study was undertaken in response to a request from Solomon Islands to ACIAR for assistance in the development of gamefishing tourism, with emphasis on billfish. Similar requests followed from Papua New Guinea and Vanuatu. An early requirement for assessing the potential for such development is a determination of the distribution and seasonal occurrence of major gamefishing species in local waters. ACIAR approached Dr David McB Williams of the Australian Institute of Marine Science (AIMS), based in Townsville, North Queensland, to carry out the study. AIMS, in collaboration with the SPC Tuna and Billfish Assessment Programme, had a strong billfish research programme in place which had access to the kind of data required for such a regional study.

The primary output of this research is a 'Coral Sea Rim Gamefishing Atlas' which aims to provide the best possible scientific background for those wishing to develop gamefishing in the region (from the Equator to 20°S and from 140° to 170°E). The atlas includes a regional picture of detailed bathymetry, weather patterns, water currents, synopses of our present understanding of billfishes (black, blue and striped marlin and sailfish) and detailed monthly charts of billfish species by the Japanese longline fishery. This information allows direct comparisons of catch rates in different areas of the region by season and provides the kind of environmental data that entrepreneurial gameboat skippers might find useful to help target their efforts.

In May 1993, Dr Williams presented his findings to government officials and interested parties in the gamefishing fraternity at public meetings in Papua New Guinea, Solomon Islands and Vanuatu to obtain local feedback. Dr Williams also consulted with SPC scientists in as to the wider implications of his work.



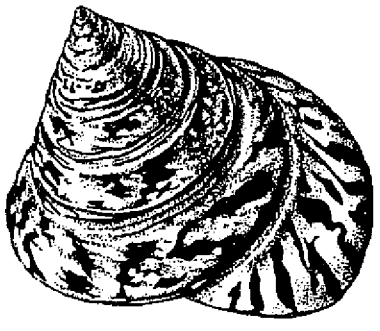
The final, multi-coloured version of the atlas will come out during the second half of 1993 and will be available from ACIAR or AIMS to interested individuals. Apart from some revision of the text including more complete descriptions of the figures, the final version will include: country summary figures; a key to identifying the different species; a description of how to tell the sex of a billfish; and an example of a recommended billfish catch sheet for the game-fishery.

Study of the trochus fishery in Aitutaki (Cook Islands)

The concept of this two-year pilot study was developed during the SPC Workshop on Trochus Resource Assessment (Vanuatu, May 1992) and subsequently formally endorsed by the 23rd RTMF. The study was funded by ACIAR in response to a joint approach from the Cook Islands Ministry of Natural Resources and the South Pacific Commission.

This research, co-ordinated through the SPC Inshore Fisheries Research Project, takes advantage of the unique experimental situation existing with the Aitutaki trochus fishery.

In August 1992, Warwick Nash (Department of Primary Industries & Fisheries, Tasmania) and Dr Tim Adams (SPC Senior Inshore Fisheries Scientist) led a 10-person team in a month-long intensive stock assessment exercise overlapping the short trochus harvest at Aitutaki.



Scientists from Vanuatu, Solomon Islands and Rarotonga from the 1991 SPC workshop took part in the exercise, alongside Aitutaki fisheries staff. This exercise, described in a forthcoming SPC/ACIAR technical report, tested three different methods of estimating the abundance of trochus for an approximately equivalent expenditure of survey effort.

'Traditional' strip transect methods were compared with mark-recapture and change-in-ratio (of different shell sizes before and after the harvest) methods. It was found that, for this type of fishery where harvesting is limited to a very short season and where a good percentage of the harvest can be monitored for marked shell returns, the mark-recapture method is preferred. Mark-recapture estimates of abundance were an order of magnitude more precise than those estimated by transects. The method is more robust than the change-in-ratio method and requires less survey effort.

A welcome and very useful outcome of this work will be a practical handbook on trochus stock assessment methodology now in draft form. The Cook Islands Ministry of Marine Resources is continuing this work with regular surveys of the mark/recapture study sites to monitor growth, mortality, and recruitment rates at different points in the lagoon. This project has achieved much for little, the multi-country collaborative approach providing many practical benefits both to the individual scientists involved, the host country, and to the region as a whole.

Assessment of subsistence fisheries (Fiji)

The importance of subsistence fish catches in Pacific Island countries is well recognised, but for most countries quoted figures for annual harvests are at best educated guesses, often based on survey data many years old and of variable quality.

This six-month project, which began in June 1993, will build on past CSIRO experience with bait fishing projects in Solomon Islands and Fiji, and aims to develop and refine a simple questionnaire-based sampling methodology, in collaboration with Fisheries Division staff, which can provide a reliable first estimate of subsistence catches.

At the end of the project, it is anticipated that Fiji Fisheries Division staff will be trained and capable of further refining this initial assessment by expanding coverage of the data collection.

Follow-up to ACIAR Giant Clam Mariculture Project

A successful and productive seven-year commitment by ACIAR to clam mariculture research concluded during 1992.

The first phase project (1984–87) demonstrated the technical feasibility of culturing giant clams and provided the first reliable information on the status of wild stocks. The follow-on project (1989–92) continued this work, with greater emphasis on the development of culture technologies appropriate to village farmers in South-East Asia and the Pacific Islands.

To assist partner countries to derive full benefit from this re-

search, a number of follow-up activities have been undertaken since termination of this project:

- a one-day seminar on giant clam mariculture was held in association with the 7th International Coral Reef Congress in Guam (25 June 1992);
- ACIAR co-funded (with IDRC) an ICLARM organised Giant Clam Genetics Workshop in Manila, Philippines, 13–19 June 1992;
- a practical training attachment in giant clam hatchery technology (6 weeks) was arranged for Cook Islands technician, Mr Noo Mataiti, at ICLARM/CAC in Solomon Islands in March/April 1993. The wholehearted co-operation and assistance of ICLARM/CAC staff with this training is gratefully acknowledged;
- publication of three practical manuals – *The Giant Clam: An Ocean Culture Manual, The Giant Clam: A Hatchery and Nursery Culture Manual,* and *The Giant Clam: An Anatomical and Histological Atlas;*
- publication of a book dealing with socio-economic issues associated with giant clam mariculture: *Giant Clams in the Sustainable Development of the South Pacific,* edited by Professor Clem Tisdell, which reports on the work of the linked ACIAR Clam Economics and Marketing Project.

New initiatives

Several new project proposals are under development and while at an early stage of consideration, there is a reasonable expectation that, if approved, activities would begin during the 1993/94 financial year.

- Trochus stock enhancement

A joint study between the Vanuatu Fisheries Division and James Cook University has been proposed to investigate the processes occurring when juvenile trochus are released onto the reef, with a view to determining the most favourable release conditions (habitat, size at release, density, etc.) which ensure satisfactory (optimal) survival and growth rates. The eighteen-month study would involve comparative juvenile release and predation studies at several locations in Vanuatu and at Orpheus Island near Townsville.

- A study of the biological characteristics of serranid spawning aggregations relevant to their use in management.

This project concept originated from the Forum Fisheries Agency, and proposes to link ongoing studies of coral trout spawning aggregations on the Great Barrier Reef (QDPI, under the supervision of Ms Melita Samoilys) with an intensive investigation of known grouper aggregations in Palau, under the supervision of Dr Bob Johannes.

The goal of this work would be to develop a simple inexpensive aggregation monitoring strategy for use in the management of grouper fisheries. It is anticipated that, if successful, the approach would have wide application throughout the Pacific and other tropical reef areas, and may also be suited to other types of exploited reef finfishes.

COASTAL FISHERIES PRODUCTION IN THE SOUTH PACIFIC

by P. Dalzell
South Pacific Commission
Noumea, New Caledonia

Introduction

Statistical information on catches of tuna in the South Pacific is well documented and reported in the South Pacific Commission's Tuna and Billfish Assessment Programme's (TBAP) quarterly bulletins (e.g. TBAP 1993). By contrast, fisheries production from the coastal zone has not been so well documented. Individual countries have produced annual catch statistics of varying degrees of accuracy, but no serious attempt has been made to document these and other data to estimate total inshore fisheries production and the value of landings.

Some estimates of total fisheries production have been made on a per country basis in the past, either from simple guesses (Van Pel 1961) or from incomplete statistics (Crossland & Grandperrin 1979). Further, the Food & Agriculture Organization (FAO) of the United Nations includes annual summaries of fisheries production for the Pacific Islands but again these are of varying accuracy and may group offshore tuna catches with coastal fisheries landings.

One of the objectives of the Fisheries Programme's Inshore Fisheries Research Project (IFRP) has been to improve the reporting of statistical data from the coastal fisheries of the South Pacific. Reviews of ciguatera fish poisoning in the Pacific by Dalzell (1992, 1993) included information on nominal subsistence and commercial fish landings and landings from reef fisheries. A summary of this information was published in the Commission's *Fisheries Newsletter #62*. These initial estimates provided the impetus to try and thoroughly document the coastal fisheries production from the South Pacific in detail, including the nominal values of the landings.

The offshore tuna landings from the western and central Pacific amount to over 1,000,000 t/yr (TBAP 1993) with a nominal value of a billion dollars. Landings from the coastal zone are more modest, however, they have much greater social and economic impact on the residents of the Pacific Islands. Further, estimates of fisheries production are likely to be of interest to workers in a variety of disciplines such as health, planning and coastal zone management.

Methods

As far as possible, estimates of landings have been taken from documents such as annual reports, technical reports or other papers published between 1989 and 1992.

Most countries have some estimate of commercial fisheries production and these are usually published in some form of technical document. Information on landings prior to 1989 was used in some instances where recent landings data were not available. Documented estimates of subsistence fisheries production were usually not available or, at best, guessed at. In some cases subsistence fisheries production had to be estimated from nutritional data as the product of per capita food consumption and population size. In the few instances where no estimate of subsistence fisheries production was possible for a given country, either from published or unpublished sources, then the FAO figure was used (FAO 1991) as a nominal total and subsistence production estimated as the difference when commercial landings were subtracted.

Results and discussion

The estimated mean annual catch volumes and values from the different sectors of the inshore fisheries in the South Pacific between 1989 and 1992 are given in Table 1, while the subsistence and commercial catches by country are summarised in Table 2.

The total coastal fisheries production in the South Pacific during the early 1990s was estimated to be about 105,000 t/yr, worth US$ 244,500,000 (Table 1). The population of the South Pacific region is about 6,500,000 people giving an annual per capita consumption of 16.1 kg. If the large inland population of 2,700,000 in Papua New Guinea is discounted from the population figure, then the annual per capita consumption is about 27.6 kg.

Subsistence fisheries production was estimated to be about 80,000 t/yr, worth US$ 161 mil-

Table 1: Summary of the mean annual coastal fisheries production in the South Pacific between 1989 and 1992

Catch	Weight (t)	Value (US$)
Commercial reef and deep slope fish	10,476	26,034,723
Commercial pelagic fish	4,419	14,708,216
Commercial estuarine fish	1,586	4,280,170
Commercial crustaceans	1,903	15,343,502
Commercial beche-de-mer	1,715	12,363,779
Commercial mother-of-pearl	2,147	8,688,686
Total commercial catch	24,608	83,345,938
Subsistence catch	80,474	161,175,747
Total fish catch	105,082	244,521,685

lion. In most instances, the value of the subsistence catch is based on the average figure for commercial fish landings. Commercial fisheries landings amount to about 24,600 t/yr, worth US$ 83,345,938. Added to this is another US$ 44,000,000 from the production of 0.8 t of pearls in French Polynesia and US$ 7,370,000 from shrimp farming in New Caledonia. The disparity between the total commercial catch and the sum of the individual components from commercial fishing is due to landings of unspecified organisms such as molluscs and echinoderms.

Forty per cent of the commercial fisheries production comes from fishing on coral reefs and on the deep reef-slope, although only about 5 per cent of this catch is from the deeper waters beyond the reef.

The other major components of the commercial catch are pelagic fishes such as the tunas and related species, and molluscs harvested for mother-of-pearl. This latter group includes trochus (*Trochus niloticus*), greensnail (*Turbo marmoratus*), blacklip pearl oyster (*Pinctada margaritifera*) and goldlip pearl oyster (*Pinctada maxima*); annual harvests of these molluscs are worth US$ 8,700,000.

Molluscs as a group are an important component of commercial catches in the Pacific Islands. David & Cillauren (1988) estimated that over 800 t of marine molluscs were collected from the shallow reefs and lagoons of Vanuatu. About 1,350 t of molluscs, worth US$ 525,000 are sold annually through markets in Fiji, while 790 t of molluscs and cephalopods, worth US$ 1,170,000, form almost 25 per cent of the commercial catch in Kiribati.

Beche-de-mer production amounts to about 1,700 t annually with a value of over US$ 12,360,000. Beche-de-mer refers to the dried product after holothurians have been harvested and represents only a fraction of the original weight of harvested animals. On average, 90 per cent of the weight of holothurians is lost in the processing from the live animal to the dried product.

The estimates of fisheries production are the most accurate that can be obtained at present in such a desktop study, and are a 'snap-shot' of fisheries production at the start of the 1990s. Some countries, such as Fiji and the American territories, have very well developed monitoring and survey programmes for estimating commercial fish production.

However, in almost all countries, the estimates of subsistence fisheries production must be computed empirically. This has been accomplished from dietary data where information has been recorded directly on per capita consumption of fish or more commonly on the frequency of fish and shellfish consumption. Such information is collected during national nutritional surveys and epidemiological surveys, periodically carried out by government health departments. Such approaches are likely to be the only practical and cost-effective method of determining subsistence catches.

According to Van Pel (1961), the annual total inshore fisheries production from the South Pacific at the end of the 1950s was about 31,400 t/yr. In 1979, the Commission's Fisheries Programme compiled a detailed directory of the status of the fisheries sector in each country and territory in the region (Crossland & Grandperrin 1979). The estimates of fisheries production for each location were variable in quality, but using these as a basis for a global figure for the region, then the estimated annual total volume landed during the mid-1970s was about 55,100 t. If it assumed that these figures are reasonably accurate, then fisheries production has tripled in the last thirty years while the human population has doubled from around 3,000,000 in 1960 to 6,000,000 in 1990.

The estimates of fisheries production used here are summa-

rised from a database from which it is possible to present the landings information as a single page summary or profile. An IFRP technical report that includes coastal fisheries production profiles for each SPC member country is currently in preparation and will hopefully be published in the first half of 1994.

Bibliography

Crossland, J. & R. Grandperrin. 1979. Fisheries directory of the South Pacific Region: No. 1. South Pacific Commission, Noumea, New Caledonia, 33 pp.

Dalzell, P. 1992. Ciguatera fish poisoning and fisheries development in the South Pacific. Presented at the IVth International Conference on Ciguatera Fish Poisoning, 4-8 May 1992, Papeete, Tahiti, French Polynesia, 13 pp.

Dalzell, P. 1993. Management of ciguatera fish poisoning in the South Pacific. Presented at the International Workshop on Ciguatera Management, Queensland, Australia, April 1993. Memoirs of the Queensland Museum (in press).

David, G. & E. Cillauren. 1988. A survey of village subsistence fishing in Vanuatu. Paper presented at the 26th Congress of the International Geographic Union, 21–26 August 1988, Sydney, 15 pp.

FAO. 1991. Yearbook of Fishery Statistics, 1989. Food and Agriculture Organization of the United Nations, vol. 68, 516 pp.

TBAP. 1993. Regional tuna bulletin: First quarter 1993. Tuna & Billfish Assessment Programme, South Pacific Commission, Noumea, New Caledonia, 50 pp.

Van Pel, H. 1961. A guide to South Pacific fisheries. South Pacific Commission, Noumea, New Caledonia, 72 pp.

Table 2: Mean annual susbstistence and commercial production from coastal fisheries for the countries and territories of the South Pacific between 1989 and 1992

Country	Subsistence fisheries production (t)	Value (US$)	Commercial fisheries production (t)	Value (US$)	Total fisheries production (t)	Value (US$)
American Samoa	215	814,238	52	178,762	267	993,000
Cook Islands	858	3,047,683	124	314,491	982	3,362,174
Fed. St. of Micronesia	6,243	11,237,400	646	1,502,296	6,889	12,739,696
Fiji	16,200	40,117,924	6,503	18,979,880	24,703	59,097,804
French Polynesia	3,180	12,432,000	2,891	15,573,555	5,999	28,005,555
Guam	472	1,935,632	114	433,894	586	2,369,526
Kiribati	9,084	13,373,667	3,240	4,770,000	12,324	18,143,667
Marshall Islands	2,000	3,103,213	369	714,504	2,369	3,817,717
Nauru	98	219,600	279	628,605	377	848,205
New Caledonia	2,000	7,344,417	1,033	4,832,410	3,033	12,176,827
Niue	103	471,504	12	54,720	115	526,224
Northern Marianas	202	826,685	120	493,601	322	1,320,286
Palau	750	1,805,192	736	2,412,071	1,486	4,217,263
Papua New Guinea	21,014	42,028,000	4,966	22,096,708	25,480	64,124,708
Pitcairn Islands	8	16,000	0	0	8	16,000
Solomon Islands	10,000	8,405,660	1,150	4,343,811	11,150	12,749,471
Tokelau	191	104,509	0	0	191	104,509
Tonga	933	1,901,208	1,429	2,806,641	2,362	4,707,849
Tuvalu	807	657,781	120	97,811	927	755,592
Vanuatu	2,045	1,953,360	467	1,507,712	2,512	3,461,072
Wallis and Futuna	862	4,310,000	138	1,285,400	1,000	5,595,400
Western Samoa	3,281	5,070,074	219	319,066	3,500	5,389,140
Total	80,474	161,175,747	24,608	83,345,938	105,082	244,521,685

DEVELOPMENT OF A NOVEL TUNA PRODUCT IN KIRIBATI

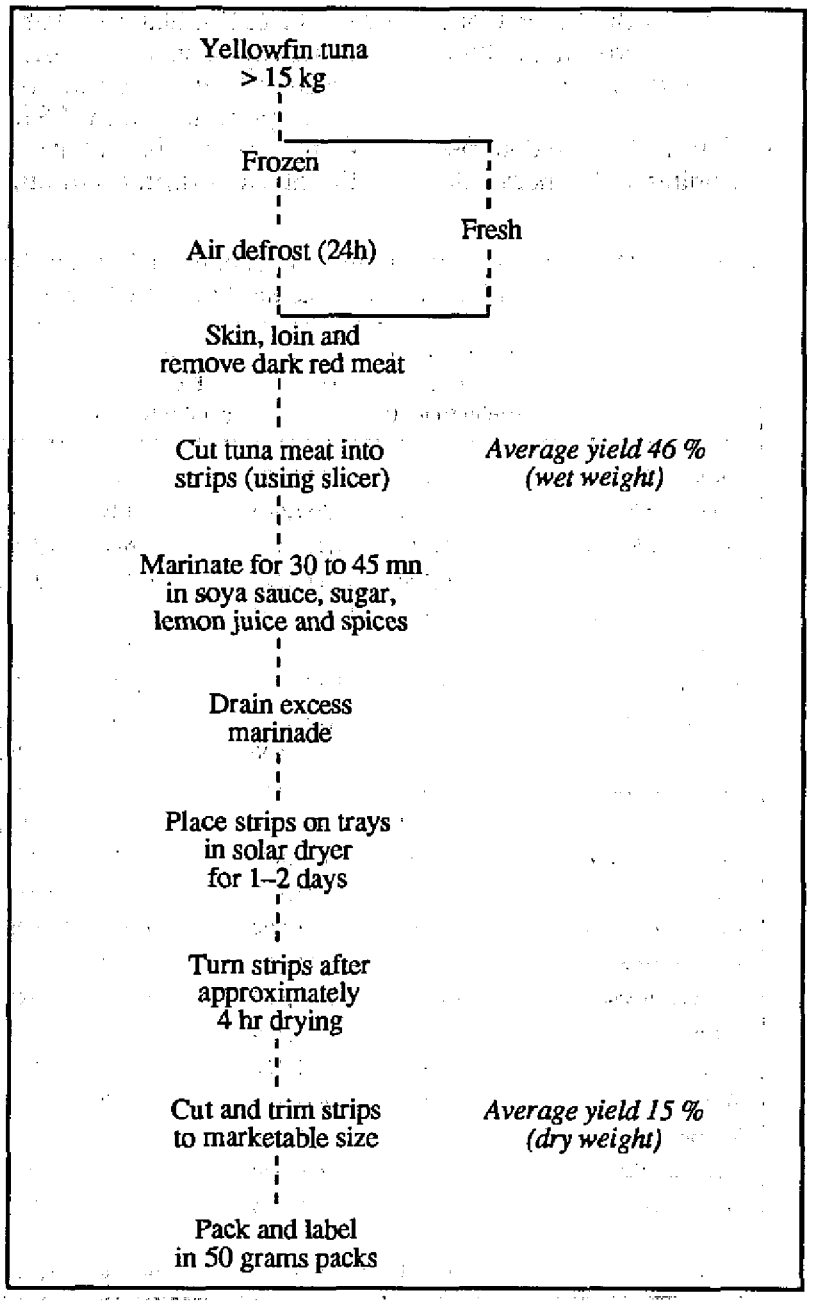
by S. Diffey
Outer Island Fisheries Project
Tarawa, Kiribati

The Outer Island Fisheries Project (OIFP), which has centres on three outer islands in Kiribati, started operating in 1987 as an extension of the national fishing company's (Te Mautari Ltd) tuna pole-and-line fishing operations, supplying frozen tuna in bulk for canning. Two reviews of the project in 1990 expressed concern at the economic viability of this type of operation, geared to blast-freezing tuna landed from an artisanal fleet, particularly given increased fuel prices and a decline in the world market price for tuna destined for canneries.

These factors, together with a change in management, prompted a rethink of the objectives of the project, the subsequent diversification of its operations to include the processing and marketing locally of reef-fish, and a look at alternatives for marketing tuna. As part of the diversifying process, the project refurbished a previously disused fish market on Betio, South Tarawa, in late 1991. It is here that the tuna jerky processing and marketing trials began in March 1992, following technical advice from SPC's Post-Harvest Fisheries Advisor.

The idea of producing tuna jerky is to utilise and add value to bulk frozen or fresh tuna landed at the project's three outer island centres, which is then shipped to our fish-market in Betio for processing. Generally only yellowfin tuna (*Thunnus albacares*) above 15 kg are used in order to maximise return on yield. The result is a value-added product which is both easy to produce, utilises a plentiful resource, is convenient to store and has wide market appeal.

The technology used in the production of tuna jerky is not only simple, but is also an improvement on existing methods of fish preservation used in Kirbati (on the outer islands particularly) which traditionally involves the salting and sun-drying of fish surplus to daily requirements. The key steps in the process are shown below.



Development of this product has been confined to using yellowfin tuna, as opposed to skipjack tuna, because the latter has a higher oil content (leading to rancid odours in the dried product), is more prone to worm infestation in the meat, and has a darker red meat which produces a poorer textured product on drying.

Yield rates are also considerably higher using a large yellowfin tuna. The average yield of the meat to be marinated is 46 per cent, dependent on both how well the fish has been bled following capture and how well it is loined and sliced. Yield of the finished dried product from the raw material averaged 11 per cent during the initial trials but more recently has been improved to 15 per cent.

The solar dryer used in the process was designed to suit local conditions, incorporating ideas from literature research and previous experience, and was built for a total cost of A$170, excluding labour (total 40 man hours).

The concept of solar drying uses the sun to heat the air inside the dryer and create an airflow by convection, as opposed to simple sun drying, which relies on radiant heat. It allows the product to be dried quicker and avoids the problem of insect infestation. The solar dryer is able to dry approximately 2.5 kg of finished product at a time, equivalent to an input of 17 kg of raw material.

On days with clear skies and a light 10 knot wind i.e. ideal drying conditions, the temperature inside the solar dryer is consistently 10–15°C above the ambient temperature of between 32–34°C. The marinating of the tuna is timed such that drying can begin by 0800hr, and provided there is no rain (when the relative humidity would be 100 per cent so no natural drying would occur) continues through to 1700hr; a total of 9 hours per day.

Experience has shown that it takes at least 12 hours i.e. 1.5 days, given ideal drying weather, to produce a stable product with water activity (Aw) below 0.7 (in order to inhibit bacterial spoilage). The texture of the product is also enhanced during drying as a result of the high drying temperatures, given the fact that tuna meat starts 'cooking' above 40°C. In order to minimise any possibility of spoilage, partially dried jerky is stored overnight in sealed containers packed in ice.

In order to speed up the drying process to within one day, the OIFP has considered the option of installing a simple heat collector, made of perspex and timber and fitted to the air inlet, which would then pre-heat the air (reportedly by up to 5°C) before it enters the dryer.

Another improvement, which would also have the added advantage of enhancing the drying time on overcast days, would be to install at the air inlet a heating element and electric fan, with a thermostat to regulate the temperature. At a cost of approximately A$ 500 for the equipment plus running cost, any such addition can only be justified if it could be accommodated in the product's selling price.

The economics of developing this product require that the raw material, in this case yellowfin tuna, is relatively low in price. In the case of Kiribati the local market price is A$ 0.75/lb (A$ 1.65/kg). All of the raw materials for the product can be obtained locally, although for our export-quality jerky we use one particular brand of quality soya sauce, imported in bulk from New Zealand.

The cost of producing our brand of tuna jerky, based on the local marketing cost, has been calculated per kg of finished product (dried weight) as shown in the box below. This is equivalent to a manufacturing cost of A$ 1.11 per 50 gram pack; with an 8 per cent mark-up the local selling price is pitched at A$ 1.20/packet.

For the export market, extra packaging costs would be incurred, including the use of 'Ageless' oxygen absorber sachets and sophisticated labelling. This should be more than compensated for by increased financial returns, bearing in mind that similar jerky products (made from beef) retail in Australia for approximately A$ 100/kg.

Labour (5 hours @ A$ 1.20/hour)	A$ 6.00
Fish cost (at a dry weight retrieval rate of 15%)	A$ 11.00
Marinade (using a wet weight retrieval rate of 46% and marinade absorption rate of 9.5%	A$ 2.69
Equipment depreciation/misc. expenses	A$ 1.00
Packaging and labelling (20 x 50 gram packs)	A$ 1.50
Total cost 1 kg dried product	A$ 22.19

The recipe used for the marinade has been a key variable in developing this product, and is now based on the following ingredients: soya sauce (500 ml for each 3 kg of tuna – wet weight), brown sugar (20 per cent by weight of the marinade) and lemon juice (which being acidic helps to break down the proteins in the meat and thereby help the marinating process). In addition various herbs and spices are used to flavour the final product. Proximal analysis of earlier samples of our product by the International Food Institute in Queensland gave the following results:

Moisture content	18.0%
Ash	10.0%
Fat	1.0%
Salt	10.0%
Protein	61.0%
Total	100.0%

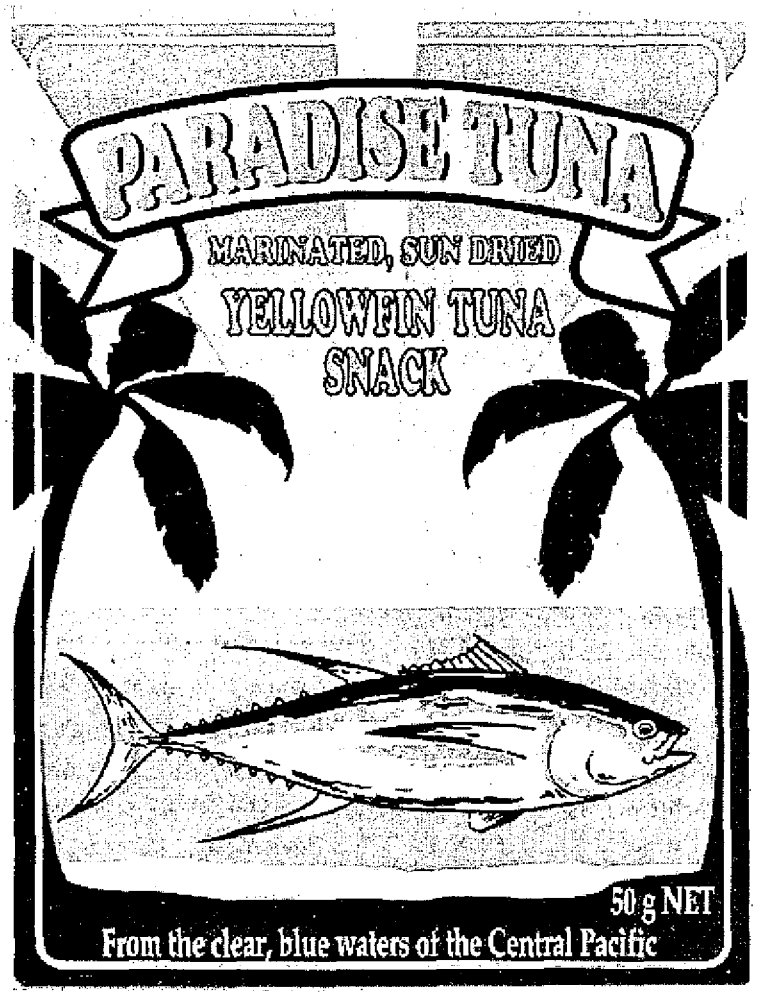
Since these results were obtained the OIFP has sought to reduce the salt content to below 5 per cent by reducing the marinade time from overnight (12 hours) to 45 minutes, in order to avoid the problem of 'salting out', a phenomena observed during trials where salt crystals collect on the surface of the product during storage. Not only does this detract from the appearance of the product, but it could also be mistaken for mould by a consumer.

Additional analysis of our samples of product indicate a mercury content of 0.36 mg/kg (on a dry weight basis), which is below the limit set for seafood products in Australia of 0.5 mg/kg.

Bacterial counts for faecal coliform, yeasts/moulds, staphylococcus and *Escherischia coli*/*E. Coli* also indicate no major problem with respect to Australian food health regulations. Close attention to good personal hygiene and recommended fish handling practices at all stages of the production process is of vital importance to ensure that these standards are maintained and to help prevent spoilage. As a final check, all of our product is subject to quality control inspection prior to packaging and sale.

Encouraged by our efforts to develop a dried tuna product, the OIFP was invited to participate in a series of meetings earlier this year in Australia organised and funded by ACIAR (the Australian Centre for International Agricultural Research) and SPC. Attended by representatives from four Pacific Island countries (Kiribati, Tuvalu, Tokelau and Marshall Islands), the meetings provided an opportunity to review the fundings of a number of projects aimed at developing novel tuna products for small Pacific Island countries.

Armed with the results of two product development research projects and a marketing desk study, all funded by ACIAR, the OIFP has, during the past few months, refined our original product type for export. Sophisticated packaging and labelling has been designed with the assistance of a marketing consultant, who will also be conducting marketing trials planned for later this year, aimed initially in Australia at airport duty free stores and at the hotel market.



PUBLIC EDUCATION FOR SAFETY AT SEA

By H. Walton
South Pacific Commission
Noumea, New Caledonia

During 1993 the Commission's Training Section received several requests from fisheries administrations to provide assistance in developing safety at sea awareness programmes, not only for fishermen, but also for the general public.

Many readers will recall Mike McCoy's 1991 report for the UNDP/FAO Regional Fishery Support Programme on Safety at Sea Issues in Pacific Island Artisanal Fisheries and the subsequent review of the report during RTMF 23.

The report estimated that in the 16 Pacific Island countries surveyed, more than 50 people each year lose their lives as a result of accidents at sea, with some 330 incidents of small boat distress situations reported annually. A brief calculation estimates the average at one incident per country every 18 days.

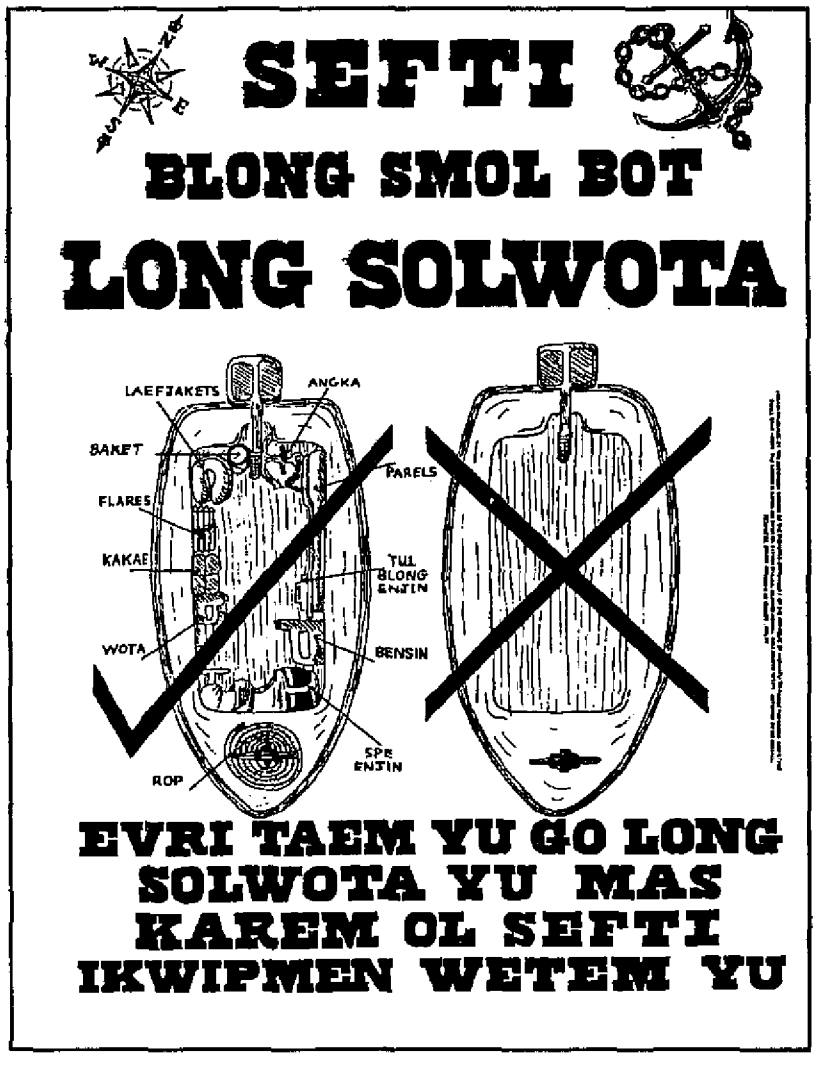
Without trying to put a price on the grief and sorrow of family and friends when a loved one is unexpectedly lost or drowned at sea, the cost in dollar terms may vary from the fuel and time required for concerned villagers to mount a search and find or rescue overdue persons, to the enormous cost of Search and Rescue (SAR) co-ordinated programmes with aeroplanes, patrol boats, and a network of personnel. There is no real way to accurately gauge the financial cost of distress at sea to Pacific countries, but it is safe to assume that it is a cost we could do without.

There can be no doubt that the best way to make small boat fishermen and mariners safety-conscious is to have each one spend some time clinging desperately to an overturned boat in a rough sea, with time to contemplate all the small things they could or SHOULD have done to avoid getting into the situation they are faced with.

From an educational point of view, it is the ultimate in learning by experience! This is obviously not a realistic option, but there is certainly some merit to McCoy's conclusion that public awareness of safety at sea through education and publicity, reinforced over a long period of time, offers the best chance for improvement.

With most fisheries administrations oriented to management and development issues and limited by budgetary constraints, it is difficult to see safety issues as a department priority.

To date, most safety-related training and education in this area has been either as a component of a more general training course or as a short-term public awareness programme



such as a series of newspaper articles, a radio programme or the production of a poster. The Vanuatu small boat safety poster (see page 33) is an excellent example of this type of approach to safety. The message is simple and easy to understand and the cost of production is minimal.

A similar graphic approach was used in the safety section of the SPC Handbook #28, *Trolling Techniques for the Pacific Islands*. The comprehensive use of graphics provides clear and simple safety messages and lessens the language problem arising from the use of English texts. The SPC document can also form the basis of cheap and simple safety at sea displays with enlarged photocopies of graphics and text.

If safety at sea promotion can be undertaken cheaply and with minimal effort, why then do we continue to experience problems with small boat safety and why do most fishermen and small boat mariners continue to ignore the most basic elements of small boat safety?

Perhaps a part of the problem is the 'hero' image promoted for fishermen and mariners who survive accidents at sea. Instead of chastising survivors for taking foolish risks, going to sea unprepared, or incurring thousands of dollars of Search and Rescue costs, the media and the public welcome them as heroes who have battled the sea and won. It is worthwhile to ponder how heroic the survivors would be if they were personally responsible for the Search and Rescue costs.

One of the main excuses offered by fishermen for ignoring safety requirements at sea is the expense associated with safety equipment. Very few small boat fishermen can afford lifejackets or flares or an auxiliary engine so most seem content to go without any safety equipment at all.

On a recent visit to Micronesia, I had the opportunity to conduct a visual survey of more than 100 outboard-driven small boats, mainly Yamaha speedboats, in town for market day. Not one boat carried a secondary means of propulsion and not one lifejacket or safety device was seen.

Curiosity prompted me to ask a number of boat owners whether there was a problem with boats running out of fuel or getting lost and the answer was inevitably, yes there is a problem!

So what steps can be taken to make small boats safer and how can fishermen be convinced to take a more responsible attitude to safety?

The major point to stress is that basic safety is not expensive or time-consuming in terms of fisherman's preparation. The most obvious first step is simply to let somebody on shore know when and where you are going and what time you plan to return. If you do have a problem, at least there will be somebody on shore to raise the alarm when you do not return on time.

Being prepared for a problem does not mean you have to carry expensive lifejackets or flares, or own a VHF or SSB radio, or an expensive auxiliary engine.

The basics are simple.

Something to help you float should your boat sink or capsize. A well-sealed empty plastic container with some line attached could keep you afloat till rescue services arrive.

An alternative means of propulsion should you run out of fuel or have an engine problem. A single oar could make the difference between days drifting at sea and making it home, but better still, the FAO emergency sail rig offers two oars which

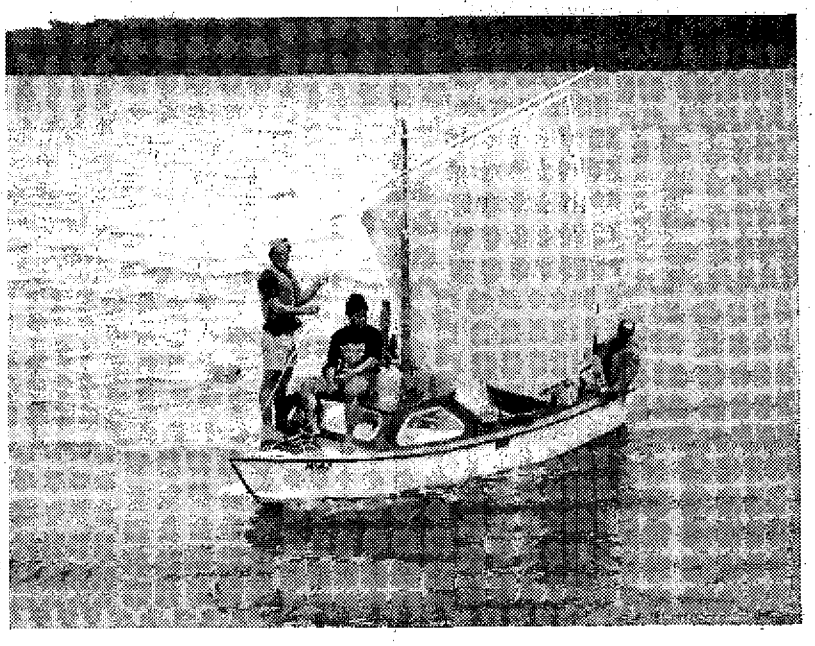


Photo: Michel Blanc

1993 Nelson Course students during a 'Safety at sea' exercise

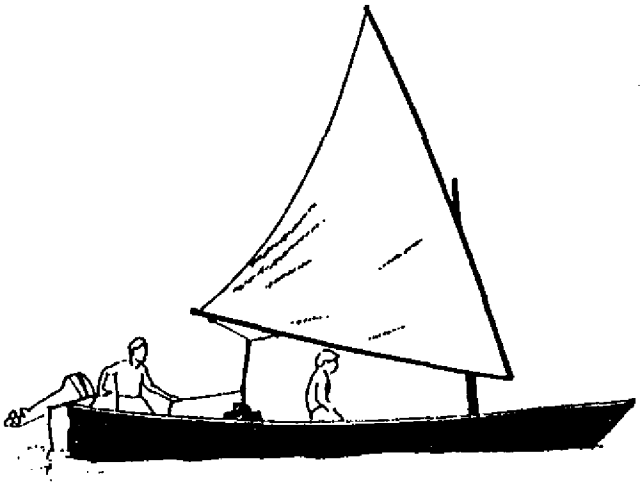
double as a mast and a sturdy sail which will carry you out of danger without hours of paddling.

A means of attracting attention does not necessarily mean an expensive radio but could be as simple as a mirror or a bright piece of material to act as a flag.

Of course, any sensible fisherman will always carry spare fuel, drinking water, a torch, a toolkit, a compass, spare ropes and anchor, particularly if venturing outside the barrier reef. The simple safety considerations noted above, if heeded by all fishermen, would no doubt ensure a dramatic decrease in the number of incidents of Search and Rescue or loss of life in Pacific small boat fisheries.

Some countries have chosen to regulate and pass into law safety requirements for small boats. All boats must be registered and random patrols by inspectors ensure that safety equipment must be carried. The problem is of course enforcement and the associated cost, so the only practical alternative seems to be, as concluded by McCoy in 1991, that the promotion of public awareness through education and publicity, reinforced over a long period of time, offers the best chance for improvement.

As a graduate of the school of fishermen who learned about safety the hard way, sitting atop my overturned boat, I have learned to take education on small boat safety very seriously. I fully agree that public education is the only way we will see an improvement in the region's small boat safety record. The SPC Fisheries Training Section is keen to hear from readers interested in aspects of public awareness in this area and would like to assist with national initiatives in production of displays, radio programmes, posters, videos, or any aspect of improving the region's very poor record of small boat safety.



Original text: English

South Pacific Commission, B.P. D5, Noumea Cedex, New Caledonia
Telephone: 26-20-00 - Cable: SOUTHPACOM NOUMEA - Telex: 3139NM SOPACOM - FAX: (687) 26-38-18

South Pacific Commission
SEAFOOD POISONING REPORT FORM

Please fill in the answers to the questions completely. Tick the boxes where appropriate.

Details of person filling in report form:

Name _____ Job/ Position _____

Contact address _____

Date: _____ Signature _____

Poisoned person's details:

Name _____ Sex (M/F) _____ Age (yrs) _____

Address _____

Details of the seafood that caused the poisoning: *(tick all the boxes that apply)*

Type of food	Where caught	How preserved	What eaten	How eaten
Fish ☐	River ☐	Fresh, no ice ☐	Head ☐	Unprepared (raw) ☐
Crab ☐	Mangrove ☐	Fresh, iced ☐	Flesh ☐	Marinated ☐
Lobster ☐	Beach ☐	Frozen ☐	Skin ☐	Cooked ☐
Other crustacean ☐	Reef patch ☐	Salted ☐	Liver ☐	
Gastropod* ☐	Lagoon ☐	Dried ☐	Roe ☐	
Bivalve* ☐	Outer reef ☐	Smoked ☐	Other organs	**How many others**
Other mollusc ☐	Open sea ☐	Pickled ☐	(specify)	ate this meal? _____
Other (specify)	Other (specify)	Other (specify)	☐	felt sick? _____
☐	☐	☐	☐	were admitted _____
Unknown ☐	Unknown ☐	Unknown ☐	Unknown ☐	to hospital? _____

What is the local name of the seafood? _____

What is the English name of the seafood? _____

Name of vendor or restaurant (if bought) _____

Name of place it was caught (if known) _____

When was the food eaten? Date _____ Time _____

When did you first feel sick? Date _____ Time _____

* *Gastropods are one-shelled seafoods like snails, trochus, conches, etc.*
Bivalves are two-shelled seafoods like clams, mussels, cockles, oysters, etc.

Symptoms: *(tick all the boxes that apply)*

Burning or pain when touching cold water ☐	Pin pricking sensation on touching water ☐	
Tingling or numbness sensations ☐	Strange taste in mouth ☐	
Difficulty or pain in urinating ☐	Skin itching or redness ☐	
Difficulty in breathing ☐	Excessive salivation ☐	Fever or chills ☐
Difficulty in walking ☐	Excessive sweating ☐	Headache ☐
Difficulty in talking ☐	Diarrhoea ☐	Joint aches ☐
Eye irritation ☐	Vomiting ☐	Muscle cramps ☐

Medical data:

Pulse _____ Blood pressure ____ / ____ Pupils _____

In case of death:

Date of death _____ Autopsy findings _____

Other information

_____

_____

Please return this form to: *South Pacific Commission, P. O. Box D5, Nouméa CEDEX, New Caledonia*

THANK YOU