

FISHERIES NEWSLETTER

NUMBER 52
JANUARY — MARCH 1990

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Original text: English

SPC ACTIVITIES

INSHORE FISHERIES RESEARCH PROJECT**Review of field research activities, Vanuatu**

During a two-week visit to Vanuatu the research activities of the Fisheries Department and the Institut français de recherche scientifique pour le développement en coopération (ORSTOM) were reviewed. Particular emphasis was given to the village-based deep bottom fishery; changes in the infrastructure of this fishery necessitated changes in the sampling methods employed. Discussions were held to determine the most effective methods of data collection to satisfy both research requirements and those of extension officers who need to determine the efficiency of development programmes.

Other important resources included in the review were trochus and other pearl shells, beche-de-mer and coconut crabs. Apart from the pearl shells, little is known about the scale of exploitation of these resources. It was apparent, however, that information does exist in various forms but requires effort to be devoted to its collection and assimilation. Problems also remain to be resolved in estimating the total production of the bottom fishery. It was recommended therefore that the Fisheries Department consider dedicating manpower to the collection and compilation of statistical information on Vanuatu's fisheries resources. With the improved database, it will then be possible to undertake analyses that will lead to a more rational approach to management.

Development of fishery statistics system, Tuvalu

An advisory visit was made to Tuvalu in response to an outstanding request to the SPC Fisheries Programme for a review of Tuvalu's fisheries statistics collection activities. The existing statistical system was established some years ago, with substantial SPC inputs, and the Commission has attempted to provide support and technical advice to this and related activities in other countries when possible. The review provided advice to the Tuvalu Fisheries Division on the ways in which data collection activities could be extended to outer islands and permitted a financial and economic analysis of the operations of the Tuvalu share-fishing fleet, which operates with substantial government support.

FISHERIES INFORMATION PROJECT**SIG Information Bulletins**


The concept behind Special Interest Groups (SIGs) is to establish networks of individuals working in similar subject areas, so as to encourage the sharing of information and ideas in the region. The first two Information Bulletins for SIGs, on beche-de-mer and pearl oyster, have now been produced.

The SIGs are being established in response to the needs of Pacific Island fishery scientists and development workers, as expressed at the SPC Workshop on Pacific Inshore Fishery Resources in March 1988 and at the 21st Regional Technical Meeting on Fisheries in August 1989. In both cases, representatives of the Commission's 22 Pacific Island member countries and territories urged SPC to become more active in the collection, repackaging and dissemination of information on the key fishery resources of the region, as a step towards reducing the problems of isolation and poor communication faced by fisheries workers in the islands.


As a first step, SPC circulated questionnaires on the establishment of SIGs to the fisheries establishments of the region and beyond. The questionnaire responses were used to gauge the relative interests of different subject areas to Pacific Island fishery workers, and to identify individuals who might provide technical information.

As part of the support offered to each SIG, SPC will undertake to circulate literature, technical materials, and correspondence relevant to the interests of group members on an occasional basis, mainly in the form of this type of bulletin. In return, SPC asks group members to keep it informed of their own activities in the subject field, and to send it single copies of any material or information that may be relevant to the interests of other members of the group.

The first Information Bulletins on beche-de-mer and pearl oysters give group members an idea of the type of information we hope to include, and provide a stock-take of currently available bibliographic information relevant to the interests of the group. A list of SIG members is also given to facilitate preliminary contacts between members.



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PEARL OYSTER

INFORMATION BULLETIN

NUMBER 1
FEBRUARY 1990

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ABOUT THE PEARL OYSTER SPECIAL INTEREST GROUP

Outings and visitors to the inaugural edition of the Pearl Oyster Information Bulletin. This newsletter is the work of, created and managed by the Pearl Oyster Special Interest Group (SIG). The Group has been established with the aim of providing co-operative research and information exchange between pearl oyster experts in the Pacific, and outside the region.

Most of us who work in the Pacific Islands have, at one time or another, felt frustrated by our isolation in our respective countries and fields. Communication difficulties have been recognized as one of the principal constraints on fisheries research in the Pacific. The SPC Workshop on Pacific Island Fishery Resources held in Noumea in early 1988, identified the establishment of SIGs such as this one as an appropriate means of addressing this problem. Parties involved in the formation of this particular group were joined by the recent SPC Regional Technical Meeting on Fisheries, held in Noumea in August, 1989. The meeting highlighted the long-standing interest in pearl oyster development among Pacific Island countries, and encouraged the primary formation of a pearl oyster research and development group.

The Pearl Oyster SIG is pleased to inform you of its first issue. Do you want to find out what specialists for materials other (or you) are doing? Thinking about this, signing a much more recent survey? Read on, please!

There is a lot more to a successful pearl oyster industry than just the fish and the shell. The project is managed by the South Pacific Commission (SPC), the South Pacific Forum Fisheries Agency (SPFA), the University of the South Pacific (USP), the Pacific Islands Development Centre (PIDC), and the South Pacific Regional Commission (SPRC). Funding is provided by the International Centre for Economic Development (ICED) and the Commission of the European Communities (CEC).

The aim of PIRIS is to improve the availability of information on pearl oysters to those in the region, so as to support fishery development and management. PIRIS will provide a forum for the exchange of information, including the collection and distribution of information, the provision of technical assistance, the provision of training courses, the provision of research and development support, and the provision of technical assistance and training to island countries.

The first issue of the *Pearl Oyster* Information Bulletin

TUNA AND BILLFISH ASSESSMENT PROGRAMME

Solomon Islands Tuna Tagging Project, Cruise 3

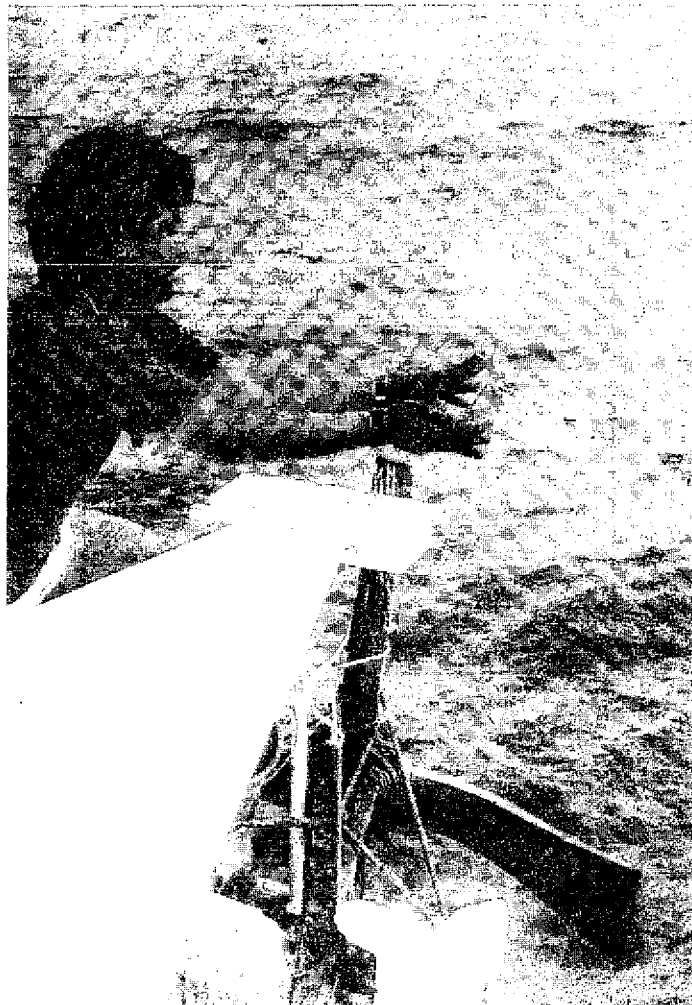
During the Tuna Tagging Project's third cruise, two trips were made on the pole-and-line vessel *Soltai 6*, on 15—23 March and on 23—27 March 1990. A total of 1,241 skipjack (84 per cent), 232 yellowfin (16 per cent) and one bigeye was tagged during the cruise, bringing the total for all three cruises to 5,798 fish, including 5,386 skipjack, 411 yellowfin and one bigeye. Of the 18 schools from which fish were tagged, seven were associated with anchored FADs; 46 per cent of the fish tagged were from schools associated with anchored FADs.

The fourth and last cruise, utilising a Soltai pole-and-line vessel, is tentatively planned for June/July 1990.

Regional Tuna Tagging Project

Fishing by the Regional Tuna Tagging Project in Papua New Guinea during January and February targeted two areas, northern waters bounded by 1°-2°S and 145°-152°E, and the western Solomon Sea. During this period, 5,931 yellowfin, 5,238 skipjack and 401 bigeye were tagged and released.

The vessel operated in Solomon Islands waters during March, returning to Papua New Guinea in April. By early April, a total of 14,451 fish had been tagged, including 7,637 yellowfin, 6,265 skipjack, and 440 bigeye. The high proportion of yellowfin, 53 per cent, as desired under the project objectives, has been maintained by directing fishing at high probability areas of yellowfin occurrence, such as seamounts, anchored payaos and logs.



Release of a tagged skipjack tuna

After fishing in Papua New Guinea, the vessel will move north of the Equator to the EEZs of Palau and the Federated States of Micronesia. Later in the year, it is hoped to visit the Philippines and Indonesia, where the aim of tagging will be to study the degree of interchange between tuna in the waters of those countries and tuna in the SPC area.

Fisheries treaty with the United States

Two meetings on the fisheries treaty between the United States and certain Pacific Island nations were held in Port Moresby, Papua New Guinea in February. The Second Annual Consultation Meeting of Pacific Island Parties was held on 22—23 February, while the Second Annual Consultation, Parties to the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America, was held on 26—27 February. The first meeting was attended by representatives of Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Solomon Islands, Tonga, Tuvalu, Vanuatu, Western Samoa, the Forum Fisheries Agency and the South Pacific Commission. The second meeting was attended by representatives who had been at the first meeting and the United States delegation, which included officials of the U.S. Department of State, the U.S. Department of Commerce, the U.S. Embassy in Port Moresby, the U.S. Tuna Foundation, Bumblebee Seafood and Zee Enterprises.

The first meeting, restricted to Pacific Island nations party to the treaty, addressed a number of issues concerning implementation of the treaty, including implementing legislation, payments and distributions, administration overview and budget, data provisions and reporting requirements, port sampling, observer programme, and provisional treaty lines.

The meeting with the United States delegation resulted in a record of agreement, which included the following points:

- The parties considered ways to address the problem of non-reporting experienced by some countries, especially in respect of zone entry and exit reports, and agreed on measures to improve communication in this regard;
- The United States undertook to institute procedures for reporting of trans-shipments in the Treaty Area;
- The parties discussed and agreed on several measures which would improve the operation of the observer programme;
- Reports of vessels fishing in closed areas will be given to United States authorities as early as possible. Prompt investigations will be facilitated by the United States. Fishing in closed areas is considered to be a serious offence by both sides;
- It was agreed that a base price of US\$ 825 per short ton would be used for the price indexing calculation to determine licence fees during the term of the present Treaty.

It was also agreed that the next consultation would take place in mid-March 1991, at a venue to be determined at a later date.

Second Consultation on Arrangements for South Pacific Albacore Fisheries Management

The Second Consultation on Arrangements for South Pacific Albacore Fisheries Management was held on 2—7 March 1990 in Honiara, Solomon Islands. The meeting was attended by representatives of American Samoa, Australia, Canada, Cook Islands, Federated States of Micronesia, Fiji, France (represented by French Polynesia, New Caledonia, and Wallis and

Futuna), Japan, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Papua New Guinea, Palau, Republic of Korea, Solomon Islands, Tokelau, Tonga, Tuvalu, United Kingdom (Pitcairn), United States of America, Vanuatu, Western Samoa, the South Pacific Forum Fisheries Agency and the South Pacific Commission. Observers attended from the European Community, the Regional Fisheries Support Programme of the Food and Agriculture Organization of the United Nations and the United Nations Development Programme.

After discussion of proposals put forward at the First Consultation, held in Wellington, New Zealand in November 1989, proposals made by the delegations from the Pacific and proposals made by the delegation from Japan, the meeting noted several common elements likely to provide a good basis for further discussion on the management regime. Some of these were as follows:

- The regime would cover the South Pacific albacore stock and should encompass its entire geographic range.
- There should be two main components of the management regime: a management body and a scientific advisory group. There should also be secretariat services to support both bodies.
- The management body should have the following functions:
 - consider advice from the scientific advisory group;
 - adopt management measures, taking into account advice from the scientific advisory group, which might include catch limits, catch allocations, closed seasons, closed areas, fishing effort, gear restrictions, and size limits;
 - within guidelines laid down in the management regime, establish other means for the effective management of the stock, which would include information and reporting requirements and which might include surveillance and enforcement;
 - adoption of the budget for the management regime.
- The functions of the scientific advisory group should include:
 - planning, co-ordination, and support of scientific investigations;
 - collection, analysis and evaluation of all relevant information and data;
 - reporting to the management body on the results of investigations and the status of the stock;
 - providing advice to the management body, as requested.
- Minimum data requirements for assessments of the South Pacific albacore stock are:
 - effort and catch by species (including non-target species) for the longline and all surface fisheries in the South Pacific, stratified by five-degree square and by month;
 - size composition of albacore for each gear type, stratified by five-degree latitude and ten-degree longitude and by month;
 - estimates of incidental mortality associated with all fisheries, such as dropouts and discards;

- biological data relating to growth rates, natural mortality rates, recruitment, seasonality of spawning, stock structure and migration, and the distribution in relation to oceanographic features.
- The secretariat support should include:
 - collecting and disseminating relevant data;
 - servicing meetings of the management body;
 - servicing meetings of the scientific advisory group.
- Appropriate measures will need to be agreed upon to meet the costs of the management regime.
- An effective dispute settlement mechanism should be included.

As an interim measure, the South Pacific Albacore Research Group will be utilised as an interim scientific advisory group. SPC will serve as the secretariat to the scientific advisory group. Data will be provided to SPC by all fishing parties in an agreed format. SPC, on behalf of the scientific advisory group, will compile all data and make them available for distribution to nominated members of the scientific advisory group on request.

It was also agreed that the next consultations would be held at SPC headquarters in Noumea, New Caledonia, on 17—23 October 1990 and would be preceded by a meeting of the scientific advisory group on 9—12 October 1990.

REGIONAL FISHERIES TRAINING PROJECT

Extension Training Project

The comprehensive exercise in extension training initiated in 1987 continued through 1989 with the operation of a two-week course in Vanuatu in August, and concluded in January 1990 with an in-country course in French Polynesia. The programme comprised a four-week block course to train trainers and ten subsequent in-country courses.

All participants in the initial block course were brought together again in March 1990 for a one-week Extension Development Workshop, during which they critically reviewed the extension training project and made recommendations for the future development of extension and extension training, both within their individual countries and regionally.

Costs for all elements of this comprehensive three-year project in extension training have been met by the International Centre for Ocean Development, with the exception of the Fiji course, whose costs were met by the FAO/UNDP Regional Fishery Support Programme, and the French Polynesian course, which was funded by SPC.

DEEP SEA FISHERIES DEVELOPMENT PROJECT NOTES

While the Gear Development Sub-Project continues in Tonga and Kiribati, final preparations are being made for former SPC Masterfisherman Pale Taumaia to travel to Wallis and Futuna on behalf of the project.

This will be Pale's second visit to the Territory to demonstrate deep-bottom fishing techniques. He will spend time on both islands working with village fishing groups. Although Pale is not a French-speaker, his command of the Tuvaluan and Samoan languages allows him to communicate effectively with both Wallisians and Futunese.

NEWS FROM IN AND AROUND THE REGION

TUVALU GETS NEW SHIP FROM JAPAN

(Source: *Pacific Islands Monthly*)

A new extension vessel, the MFV *Manau*, was received by the Tuvalu Fisheries Division in November as part of the Fisheries Communities Development Project, whose main source of funding is the Japanese Government.

At the handing-over ceremony, Chief Fisheries Officer, Sautia Malualofa, outlined the overall project and introduced the dignitaries present. Acting Secretary to the Minister of Natural Resources and Home Affairs, Mose Saitala, received the vessel on behalf of the Government of Tuvalu.

Keiji Tominaga, representing the Japanese contractors, Sumitomo Corporation, said he hoped the vessel, in conjunction with other aspects of the project, would have a direct impact on the economy through increased catches, increased employment opportunities (both on the vessels and in the islands) and the adoption of more efficient techniques appropriate for the requirements of commercial fishing.

Formalities were concluded by a blessing of the vessel from the Tuvalu Church pastor and presentation of the prize for the name competition. The name MFV *Manau* was chosen because it is the name given to traditional fishing craft and means 'many uses'. The 17-metre extension vessel has a service speed of nine knots with a cruising range of approximately 500 nautical miles. The propulsion engine is a 240 horsepower diesel operating at 1,900 rpm. Fish hold capacity is about eight cubic metres.

The vessel is expected to activate fisheries in the outer islands and service them by carrying repair tools for fishing boats, spare parts and extra fishing gear. At present the commercial fisheries infrastructure is based solely in the capital, Funafuti.

Sautala said that technology transfer in itself will not further the cause of smaller islands unless it can be demonstrated that there is ultimately some commercial benefit from it. He warned that technology transfer could well create further dependency upon more developed nations and donor countries, as well as other sectors of the Tuvalu economy, if Fisheries Division staff failed to meet the challenge presented by new vessels with high-technology equipment.

Six smaller training vessels were presented to Tuvalu earlier this year by the Japanese Government, completing Phase I of the overall four-phase project. Three of these were damaged in trans-shipment and a fourth when it was trapped beneath the fisheries wharf during a rising tide. Technicians from Sumitomo Corporation were in Tuvalu to check the new ship and help local tradesmen to repair the damaged vessels.

The third phase of the project involves improvements to the Funafuti Fisheries Centre. It is expected that construction work will begin soon. The final phase will see construction of a Fisheries Centre on Vaitupu island and upgrading of the Vaitupu access channel.

HELP STOP THE PLASTIC TIDE

(Source: *Australian Fisheries*)

The Western Australian Government is mounting a campaign to discourage pollution of Western Australia's aquatic environment. Western Australia's Fisheries Minister, Gordon Hill, said plastic pollution was especially targeted because it had a harmful effect on marine life and was a boating hazard.

'Plastic pollution, such as bait bags, old fishing lines and six-pack yokes, can seriously injure sea birds, seals, turtles, dolphins, sharks and other fish', said Mr Hill. He added that apart from causing suffering to the animals, the injuries can make them more aggressive, which presents safety problems for Western Australian beachgoers.

Mr Hill said plastic pollution often caused problems for pleasure boats and fishing vessels. 'Plastic bags sucked into water intakes of outboard motors or fishing line tangled around propeller shafts can effectively incapacitate a boat', said Mr Hill.

Commercial and recreational fishermen and other people using the aquatic environment are to be encouraged to dispose of their litter in bins on shore. 'Western Australia is renowned for its relatively pristine aquatic environment', said Mr Hill. 'It is a key selling point in the marketing of Western Australia's seafood and an important attraction for tourists.'

The public awareness campaign will comprise advertisements and a series of anti-pollution posters distributed to tackle-shops, amateur and professional fishing associations and boating clubs.

'HIDDEN AGENDA' ON PATROL

(Source: *Islands Business*)

Australia's Pacific Patrol Boat programme is proving a boon for islands nations fending off foreign fishing pirates. But its 'hidden agenda' is that it is also providing Australia with incomparable new information about the region which might be seen as its first line of defence.

Originally, it appeared that it might be a matter of a few jobs for Freemantle in Western Australia, where the vessels are built, a little nautical ceremony to hand over the keys, and a farewell wave as the vessels sailed north over the horizon. In fact, the A\$ 65 million (US\$ 53 million) programme today arguably carries as much practical value for Australia's defence as the newly approved \$5 billion Anzac frigates.

The idea germinated 10 years ago, following a joint swing through the South Pacific by Australian and New Zealand defence experts. Then the newly independent nations were anxious to profit from the 200-mile Exclusive Economic Zones emerging from the United Nations' Law of the Sea debate, with fish, especially tuna, as their major resource, in some cases their single renewable resource. However, little transpired until October 1983 when new Australian Prime Minister Bob Hawke attended his first South Pacific Forum meeting, handily in Canberra. As host, he needed an initiative or two — and the patrol boats were dusted down off the shelf.

Class born

A team travelled around the region seeking views on the type of boats required. The Pacific Patrol Boat class was born from this survey and tenders sought. The winner was Australian Shipbuilding Industries. A dozen boats were ordered by the Australian Government, and a training programme was launched, via the Maritime College at Launceston in Tasmania and the College of Advanced Education at Freemantle.

In 1985, the Australian Cabinet agreed to spend A\$ 65 million on the project: about A\$ 3 million per boat and the rest on spare parts and training. Papua New Guinea is to receive four boats and the others are going — or have already gone — to Vanuatu, Solomon Islands, Cook Islands, Western Samoa, Tonga, the Marshall Islands and Federated States of Micronesia.

Australia had sought to keep maintenance costs to the lowest level consonant with vessels that could police the islands' vast territories; in the case of Kiribati, which like Tuvalu finally

decided to turn the offer down for lack of local funds, an ocean economic zone larger than the entire United States.

Officers

With almost every boat have gone a Royal Australian Navy lieutenant commander and two chief petty officers, attached to the local police or defence force, whichever operates the boat. Their initial term is two years, but already requests to extend have been readily agreed to by Australia, since Island crews, once trained, have become very marketable, keenly sought by commercial shipping companies.

The programme involves supply of two years' spares and the first major overhaul, but Australia has also helped supply fuel and lubricants in certain cases such as the Cook Islands. Australia has decided to take a different tack from usual aid programmes that have a built-in expiry date. Support is likely to continue for many years.

The reason is that the money is considered well spent and Australia's salesmanship and patience well rewarded.

The boats already enjoy a high profile in the countries which own them; they are widely known as 'the Australian patrol boats', and some countries are considering asking for more. The boats have already made a number of arrests of unlicensed foreign fishing vessels. Such a means of enforcement has real economic significance.

They provide a range of civil functions, especially in emergencies, and their engines can generate enough power for most small Island towns (Majuro, capital of the Marshalls, depended on a motor from a stranded World War II submarine for four decades).

The Australian personnel know which vessels are sailing in and out of the waters. Australia is also establishing, for the countries, a chain of maritime operations control centres with communications equipment to co-ordinate information from aircraft, ships and from coastal waters.

The patrol boats all operate the same type of radio, and can communicate on the same wavelength.

SEAVANEX WANTS GOOD QUALITY TREPANG

(Source: *Vanuatu Weekly*)

A promoter of quality beche-de-mer (sea cucumber or trepang), Mr Jean Liou, who is based in Noumea, will be visiting beche-de-mer stations throughout Vanuatu to brief collectors on good quality production.

In Port Vila, he will be working with the trepang station at Erakor, formed by Sea Export Vanuatu (Seavanex).

Sea Export Vanuatu, a company formed last year for exporting beche-de-mer, had stations in the Maskelynes, Santo, Emae, Gaua and Pentecost. Unfortunately, the stations on Pentecost and Santo have been closed; Emae will close very soon.

However, Seavanex's General Manager, Mr Daniel Joli, told *Vanuatu Weekly* this week that another three stations will be built before long. Two further stations will be built at Erakor (one on the mainland and the other at a site to be negotiated with villagers from Eratap) and a third at South-West Bay, Malakula.

Some of the trepang the company has bought has been collected from the Maskelyne Islands. Mr Joli admitted that the quality from Malakula was quite poor so he had to stop trading there. He said that he had so far visited the Maskelynes four times, in the hope of improving the quality of trepang on the islands, but with little result.

Currently, the company uses fire-wood to dry beche-de-mer. The new station to be built at Erakor will be using gas stoves. Seavanex's Manager said that this will produce a better quality product since the heat will be concentrated.

Seavanex has already provided employment for about 200 citizens. Mr Daniel Joli said he is awaiting an invitation from land owners on Epi to undergo a survey for beche-de-mer on that island.

FAO PACIFIC ISLANDS FISHERIES CONSULTANCIES

(Source: R.Gillett — FAO/UNDP)

During the period January 1986 to December 1989, 123 consultancies and staff missions were carried out either directly by FAO South Pacific fishery programmes or indirectly through regional organisations. The following tables summarise this work for the year 1989. Reports for the regional missions are available from the FAO/UNDP office. Enquiries for country-specific reports should be made to the country concerned.

1. FAO/UNDP Regional Fishery Support Programme (year 1989)

Area	Consultant/Staff	Work
Regional	Michael	Observe albacore fishing activities on southern troll grounds
Regional	Bahlman	Conduct computer training course
Regional	Mamaloni	Assist with practical training course portion of SPC/Nelson course
Regional	Gillett	Investigate fishery development potential of flying-fish
Cook Islands	Gillett	Compile fisheries bibliography
Cook Islands	Paulo	Carry out decapтерus fishing trials
Cook Islands	Savins	Advise on boatbuilding
FSM	Paulo	Carry out decapтерus fishing trials
Marshall Islands	Gillett Wright	Carry out trochus survey at Bikini and Enewetak Atolls
Papua New Guinea	Savins	Advise on boatbuilding

Tokelau	Gillett	Transplant trochus to the northern atolls (in association with the FAO South Pacific Regional Aquaculture Development Programme — SPRADP)
Tonga	Paulo	Carry out decapтерus fishing trials
Tuvalu	Gillett	Transplant trochus to northern atolls (in association with SPRADP)

2. FAO/South Pacific Aquaculture Development Project (year 1989)

Area	Consultant/Staff	Work
Regional	McHugh Trono	Advise regional workshop on seaweed culture and marketing
Cook Islands	Tanaka	Advise on giant clam hatchery
FSM	Shang	Carry out economic assessment of aquaculture development
FSM	Hickman	Carry out feasibility study for green mussel farming
Fiji	Shang	Carry out economic assessment of aquaculture development
Fiji	Young	Assess mass mortality in shrimp farming
Kiribati	Trachet	Conduct milkfish smoking trials
Palau	Trachet	Carry out giant clam smoking trials
Palau	Tanaka	Assess brackish water culture development
Papua New Guinea	Hickman	Carry out feasibility study for green mussel farming
Solomon Islands	Hickman	Carry out feasibility study for green mussel farming
Solomon Islands	Delaune	Carry out stock survey of gavid shrimp and feasibility study of shrimp farming
Tokelau	Braley	Carry out stock assessment of giant clams and pearl oysters
Tonga	Foscarini	Carry out stock survey of winged pearl oysters and feasibility study for pearl culture

Vanuatu	Hickman	Carry out feasibility study of farming green mussel
Vanuatu	Nash	Assess trochus hatching facilities
Vanuatu	Foscarini	Advise on rehabilitation of trochus hatchery
Western Samoa	Foscarini	Assist setting up giant clam nursery

SHELL EXPORTS TO BE BANNED

(Source: *PNG Post-Courier*)

Exports of beche-de-mer and shells from Papua New Guinea may be banned soon. The ban would come into effect as soon as the Government approves a submission by Fisheries and Marine Resources Minister Allan Ebu. Mr Ebu announced last week that he was contemplating the move because of abuse of export permits.

'Currently we do not issue beche-de-mer and shell export licences but rather issue permits by our inspectors in the provinces, and we believe there has been a lot of malpractice in this exercise', he said. 'If Cabinet approves my submission, I will ensure that only 100 per cent nationally-owned companies, operating from areas where these resources are found, will get first preference to apply for export licences.'

He said he would issue only a few licences, to avoid over-exploitation. Fisheries Secretary John Natera also confirmed that there was a lot of exploitation and added that there should be some restrictions. 'Expatriate trade-store owners in certain areas of Papua New Guinea are buying items from local people and exporting them', he said. 'They are making big money and the local fishermen are getting only a few toea.' He said this point was also raised in a national fishing council meeting in Rabaul.

Mr Natera said the council was looking at restricting the harvesting of sedentary species, including the sizes of the species to be harvested.

A NEW FISHERY LANDS DOLLARS

(Source: *Islands Business*)

Rich stocks of deepwater snapper and sashimi tuna have prompted a rush to the fishing grounds in eastern Fiji. Fishermen who for years have struggled in the export business are today counting more dollars than ever.

One of the first to work the untapped area was Fiji-born Grahame Southwick, who after 14 years of fishing in the Tasman Sea switched to the South Pacific in 1980. Today his company is Fiji's biggest exporter of frozen fish. However, as Southwick and about a dozen other local operators begin hauling in big catches, they are worried by the danger that the fishery could be wiped out by a growing fleet of foreign-owned boats.

Southwick said he originally detected big stocks of deepwater snapper in Fiji's offshore waters in 1982. About a year later, he found the sashimi (bigeye and yellowfin) tuna. But his attempts to penetrate the competitive North American and Japanese markets were foiled by cheaper fish from the Philippines and Indonesia. Six years later, Fiji is poised for a major boom in the exporting of both snapper and sashimi fish.

Southwick explained that the sashimi longline fishery did not develop until late 1988. Then a 'break-through in technology and the strength of the Japanese yen, coupled with a realistic devaluation of the Fijian dollar made a previously marginal operation profitable'.

Fiji's exports developed better than those from Western Samoa and Tonga because of the 33 per cent devaluation in 1987 and the more regular flights from Fiji to Japan and the United States. Western Samoa and Tonga are also trying to compete in these markets. But the lack of airline services is one of the main drawbacks for the fish traders, Southwick said.

Limits

Southwick, as president of the Fiji Deep Sea Fishermen's Association, is spearheading moves to restrict foreign vessels entering Fiji waters. The Fiji Government Fisheries Department is limiting the number of foreign vessels fishing alongside the 17 boats from the three main local companies: Fresh Fish (Fiji) Limited (a subsidiary of Southwick's Wasawasa Fisheries Company), Feeders Fiji Limited and Tasu Fishing Company. It is concerned about an influx of foreign 60—120 ft vessels, outnumbering the 30 ft local boats. It fears that unless the stocks of snapper and sashimi tuna are managed, the species could be wiped out in a few years.

Fiji's Director of Fisheries, Surendra Sewak, said that growth has to be slowed to a reasonable level, both to prevent economic collapse and to give small-scale local fishermen a chance to join in the fishery before the resource is wiped out by the 'big boys'. He added that the sashimi tuna fishery, particularly, is still developing and needs to be protected. 'What we are looking at is a gold-rush and we are on the brink of disaster before the sashimi fishery establishes itself', said Sewak.

Deepwater snapper and sashimi tuna are in demand in Hawaii, the United States and Japan, where the bigeye and yellowfin tuna are a staple. Sewak said the top-quality Fiji snapper fetch around F\$ 13 to F\$ 20 (US\$ 8.84 to US\$ 13.80) and sashimi tuna from F\$ 10 to F\$ 60 (US\$ 8.84 to US\$ 41.00) per kilogram in the two key markets. These are also supplied by Tonga, Western Samoa, the Philippines and Indonesia.

Fiji's exports of snapper alone were worth around F\$ 3 million (US\$ 2.04 million) in 1989, but figures could easily double or even treble in 1990. About 600 t were sold in 1989, though Sewak believes the fishery could comfortably produce around 1,000 t every year. 'That is the maximum sustainable yield', he said. 'We estimate that if we take out 1,000 t a year, it could replenish itself fairly well, but once you start fishing more than that it could mean depletion before we realise it.' He added that the Fisheries Department believes the current fleet is capable of hauling out up to 2,000 t in a year, which would not allow for replenishment.

Southwick thinks fishing of snapper should be restricted to 750 t a year.

Sewak said because of the high prices paid for sashimi tuna, the boats have been targeting bigeye and yellowfin tuna in recent months. He said the danger there is that if too many boats fish sashimi tuna, the stocks could be soaked up within two or three years. 'And if the sashimi tuna export market collapses, these boats will all have to go back into snapper fishing.' He said the way around the problem is to spread about 40 licences a year between those fishing specifically for sashimi tuna or snapper. The three local firms want licences to be frozen at the current level of 40 a year.

Law

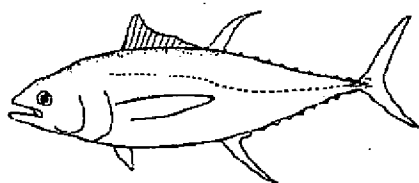
The new law:

— limits the number of vessels, both small and large;

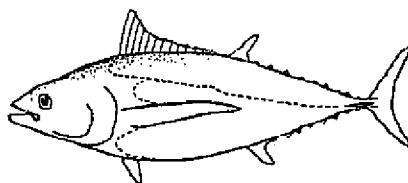
- limits the catches of deepwater snapper;
- requires large longline vessels to fish away from the reef edges.

This, argues Sewak, will ensure that the 'more vulnerable inshore resources are not over-fished'. The Fisheries Department is also alarmed by the foreign longline vessels catching marlin and swordfish in grounds commonly used for gamefishing, a tourist sport that is growing. Fiji hosts three major international gamefishing tournaments every year. 'We need to protect the tourist industry', Sewak said.

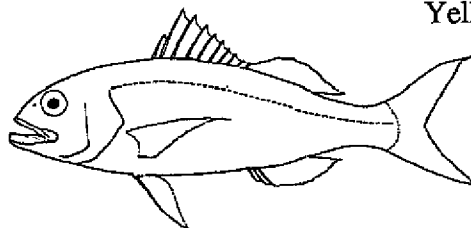
THE TARGETS



Bigeye

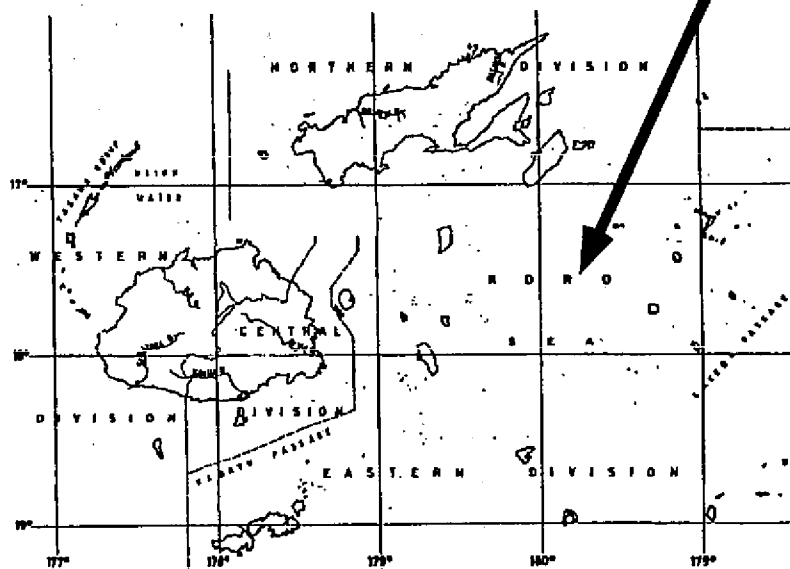


Yellowfin



Red Snapper

THE FISHERY



FIJI

Sewak admits the old licence regulations under the Fisheries Act of 1942 were too open. 'A fisherman could fish as much as he wished, whenever he wanted.' For decades, obtaining licences to fish in Fiji waters was not difficult because the Department was anxious to develop commercial fishing. 'In those days there were so many virgin stocks and the idea was to encourage an industry out of fishing', Sewak said.

Until two years ago, few foreign vessels showed interest in Fiji waters, apart from the Taiwanese, Japanese and South Korean boats contracted to fish for the local fish processor, Pacific Fishing Company. The main thrust in the high-priced sashimi tuna and snapper industries has come from Australian and New Zealand fishermen lured by the tax-free incentives offered by Fiji's post-coup government in its efforts to create employment. The number of small and large vessels fishing for snapper and sashimi tuna rose from virtually none in early 1987 to 40 at the end of 1989. Each boat employs an average of about six or seven Fiji fishermen.

Freeze

But Sewak said that the fisheries officials in Fiji are annoyed by foreign boat operators entering Fiji waters without notifying the Department. 'Investors seem to take it for granted that we will issue a fishing licence to everyone.' The government had been considering a freeze on licences for several months. Sewak said other Pacific Island governments, especially Tonga and Western Samoa, 'must do the same if they don't want to see their stocks dried up'.

Meanwhile, Southwick and company face even more local competition. The Fiji Government-owned fish canner Pacific Fishing Company, at Levuka, plans to join the hunt—and begin exporting frozen sashimi tuna too. It will use the Asian boats which already supply it and the fleet of the Government-owned Ika Fishing Corporation. That, says Southwick, underscores the need to keep out of the foreigners.

BOTTOMFISHING SURVEY BRINGS BENEFITS TO FISHERMEN

The Division of Fish and Wildlife (DFW), upon requesting technical assistance from the South Pacific Commission (SPC) to develop the local fishing industry, has undertaken a deepwater bottomfishing survey and training project in the waters of the Northern Marianas Islands off the islands of Saipan, Tinian and Rota.

Canadian Masterfisherman, Peter Watt, who has over seven years experience developing bottom longline fishing with the SPC in Vanuatu, was brought in to apply his expertise to locating potential bottomfishing grounds and has progressed to taking groups of local fishermen out on the DFW boat and training them in various bottomfishing techniques. Interested local fishermen were taught how to read charts, identify good fishing areas and triangulate, or determine one's position using landmarks and subsequently set the appropriate course to a desired location such as a pinnacle or reef mount.

They were also taught an innovative, yet simple, technique of anchoring in deep water whereby the anchor is floated to the surface upon retrieval. Participants also learned how to use a fathometer or depth sounder to determine depth, type and contour of the bottom and also how to recognise schools of fish.

They were introduced to the efficient and inexpensive SPC bottomfishing reels which they could make themselves with materials available from any hardware store. The training also included deploying and retrieving bottom longlines and participants were given a booklet, developed by Mr Watt, which explained the materials needed, assembly and technique of longline fishing.

According to the project's co-ordinator, Fisheries Biologist Cal Falig, there has been a decline in bottomfishing in Saipan due to economics—fishermen have turned to tourist charters and pelagic trolling to earn their living. However, he also pointed out that longline bottomfishing could be potentially profitable when used in combination with trolling or other fishing methods.

The project was hampered by bad weather which passed through the Commonwealth during the past few months but the training is scheduled to resume in the summer when the weather is calmer. Interested local fishermen should watch for upcoming notices to sign up for future training sessions.

THE FIGHT FOR FISH

(Source: *Islander*)

There is no doubt that the fishing industry has an important economic impact on Guam. Between the two largest commercial fishing operations, the tuna purse seiners and the longline sashimi vessels, the industry injects millions annually into the local economy and is growing rapidly. But what about Guam's domestic and recreational fisheries and fishermen? Are they sharing the wealth?

Lawrence Zuanich's Zee Fishing Company maintains a fleet of 13 U.S. purse seiners operating out of Guam which fish for tuna and skipjack. The boats have an average capacity of 1,500 t of fish, which take the crew two or three months to catch. The fish is off-loaded in Tinian and shipped to canneries. A Tinian cannery is proposed in the future.

Since the crew members are largely foreign, a popular misconception is that the tuna boat business is self-contained and does not provide much economic benefit to the island. However, also under the Zuanich family umbrella are a cold storage facility, a helicopter company, a salt-producing operation, chandlery and fuel sale services. An ice plant is nearly completed.

Zuanich offers his own brand of canned tuna, Z Best, to the local market and has diversified into tourism with sightseeing and fishing charters. These shore-based businesses supporting the fishing industry provide a source of employment for Guam residents, whose salaries go into the local economy.

Zuanich said the combined companies could gross as much as US\$ 100 million annually and each requires large amounts of support from other Guam businesses. Those sentiments are echoed by figures from the Division of Economic Development and Planning at the Department of Commerce. According to Commerce, the main economic impact of the purse seine fleet on Guam is revenue from reprovisioning, fuel purchases, repairs and crew leave, which has been estimated at US\$ 70,875 for U.S. purse seiners per each port call.

Foreign purse seiner expenditure was estimated at US\$ 23,825 per port call, exclusive of fuel purchases. No exact study has been done since 1985, but Commerce officials say it is reasonable to estimate that the industry pumps US\$15 to US\$20 million a year into Guam's economy. Although purse seiners account for nearly 200 port calls to Guam annually, their numbers are dwarfed by the fastest-growing segment of Guam's fishing industry: the longline tuna vessels.

Longliners fish for yellowfin or bigeye tuna, using a succession of baited hooks on a long fishing line. The boats vary in length and have a capacity of from 19 to 59 tonnes, although they are usually filled only halfway to avoid spoilage of the catch. The catch is treated with the utmost care, because after preparation at Guam's port the meat will be air-freighted to Japan for the lucrative sashimi market, where it sells for a hefty US\$ 10,000 or more a tonne. Meat that is not of top quality is freighted to canneries or offered to the local market. Most of the longliners trans-shipping on Guam are from Japan and Taiwan.

The growth in the number of longliners visiting Guam has been nothing short of phenomenal in the past three years, says William Fitzgerald, chief of Economic Development and Planning at the Department of Commerce. He says that there are now 130 to 160 vessels, which made no less than 842 port calls during fiscal year 1988. And for the first eight months 1989, 647 longliners called at Guam, according to figures from the Harbormaster's Office at the Port Authority.

Since the crews are foreign and the bulk of the product flown off-island, the longline industry's economic contribution to Guam has not yet been accurately gauged. Statistics from 'A study on trans-shipment practices in Guam and Tinian', prepared in 1989 for the South Pacific Forum Fisheries Agency, estimate the long-time industry injected about US\$ 1,120,000 into the Guam private sector in 1988 for payments to contractors to prepare and package the tuna. Air-freight paid was about US\$ 5,250,000 for the year.

According to the study, it was not possible to obtain voyage accounts of the agents or other records of services, supplies or crew advances to determine the amount of economic benefit from those sources.

However, Jesse Iwashita, President of Guam Kashyu, Inc., which maintains 17 longline fishing boats, says the longliners' economic impact is significant and should not be underrated. President of the recently-formed United Association of Tuna Exporters, Iwashita says the members of his association alone, representing 71 boats, 'injected close to US\$ 20 million into Guam's economy in 1988'.

He offers no specific breakdown to support his claim but gives as examples a wide variety of expenditures: airline cargo fares, port, wharfage and dockage charges, tugboat services, labour, repairs, equipment, fuel, ice, food and medical and recreational expenses by crew members. Iwashita says that since the longliners benefit Guam's economy, the Government and the public should support their presence. 'We'll stay here as long as the Government of Guam wants us here and at the same time gives us co-operation and support,' he says.

At present, the Government seems to be adopting a 'wait and see' attitude. Although he acknowledges conflicts with the domestic fisheries, Fitzgerald agrees that the longliners are economically beneficial to Guam. 'Guam has to be very sensitive about this. The whole industry could over-night move over to other islands at a cheaper price', he says.

A move by the industry to other islands seems unlikely at present, however. Because of Guam's desirable geographical location and supporting infrastructure such as sufficient port facilities and frequent airline flights, all indications are that the thriving purse seiner and longline businesses will be around for a while, unless the migratory tunas change their minds and decide to move elsewhere.

But at what cost to Guam's small-scale local fishermen? Are they feeling the squeeze from the big boys? Or are they more dependent upon local marketing and the sporadic nature of the catch? The answer may be: 'Both'.

Ask any fisherman at the Agana Boat Basin if the tuna seiners and longliners have had an effect on the amount and the marketing of his catch and he will respond with a resounding 'Yes!' It is obvious local fishermen are not too pleased about the presence of the larger vessels.

There have been several complaints of illegal fishing within Guam's 200-mile Exclusive Economic Zone, depleting local fish supplies (most tuna boats have permits to fish within the adjoining territorial waters of the Federated States of Micronesia and there are some areas where Guam's EEZ is truncated due to the proximity of the FSM).

The fishermen also resent competition from the large operations in marketing fish locally, which drives the price of fish down. 'Most of the big fish we used to catch and land here are gone.

The banks we used to frequent out here just don't have the fish they used to have', says Joe Tenorio, who has been fishing off Guam for 19 years. Fishermen started to feel the impact of the larger vessels in 1984, he says.

He claims he has spotted both longliners and tuna seiners fishing illegally, but 'we don't have the personnel to go out there and seize those boats. They can pick up their nets in split seconds'.

Tenorio says that for himself, as well as the vast majority of local fishermen, fishing is only a hobby. Although at one time he fished almost daily and was considering making it his livelihood, it is difficult today to cover gasoline costs and operating expenses, much less make a living, he says.

'The amount of fish has gone down drastically', agrees Peter Plummer. Plummer, however, has found a more lucrative fishing venture in charter sports-fishing.

With 12 full-time charter boats and new boats coming in, the charter business is growing steadily as a tourist attraction and offers an alternative to fishermen who desire a guaranteed income for their efforts. According to Plummer, Guam charter rates are higher than those in Hawaii and the fishing is often better.

'I've had people who fished Hawaii and caught nothing; then they come over here and get a marlin the very first time out', he says.

To be successful in charters it is essential not only to be knowledgeable about good fishing grounds around Guam but also to be connected to at least one tour agent, Plummer says.

'You can't do anything in business without Japanese tour agents. You can't make a living on military or local charters', he says.

Although they say they feel the bite of the bigger fishermen, the small boat operators and charters actually caught more fish off Guam in 1988 than in 1987, according to statistics from the Aquatic and Wildlife Resources Division of the Department of Agriculture. However, the 1988 catch was divided among more boats, decreasing individual output. 1989 studies are being compiled.

According to Aquatic and Wildlife's annual report for Fiscal Year 1988, trolling catches of all major species except blue marlin were higher in 1988 than in 1987. Bottomfishing catches also rose, but the increase was attributed to greatly increased participation. Bottomfishing resources off Guam are considered to have reached the limit of their potential, according to the report.

A major portion of the fish caught by small operators is marketed to the Guam Fishermen's Co-operative at the Agana Boat Basin. The non-profit organisation has about 120 members, who have first priority in selling their fish to the Co-operative, says general manager Kwae Yun Ha. Less than a dozen members are full-time commercial fishermen.

Payment for the fish is based upon supply and demand and therein lies the major problem faced by Guam's domestic fishermen: marketing.

At times there are gluts of fish currently in season, bringing down the price the Co-operative is able to offer. At other times local fishermen cannot supply enough and the Co-operative is forced to buy fish from the longliners or seiners to cover operating costs, Ha says.

The Co-operative also suffers severe price competition from fish imported from the Philippines, Palau and the Federated States of Micronesia; rejected fish from the longliners and seiners which enter the local market; and even from local fishermen themselves attempting to get a bit more money for their efforts.

Although Ha says he cannot compete in price with imports, the Co-operative maintains a steady clientele of knowledgeable buyers who are guaranteed a good product.

'Local people like local fish. My price is a little higher but the fish is fresher', Ha says.

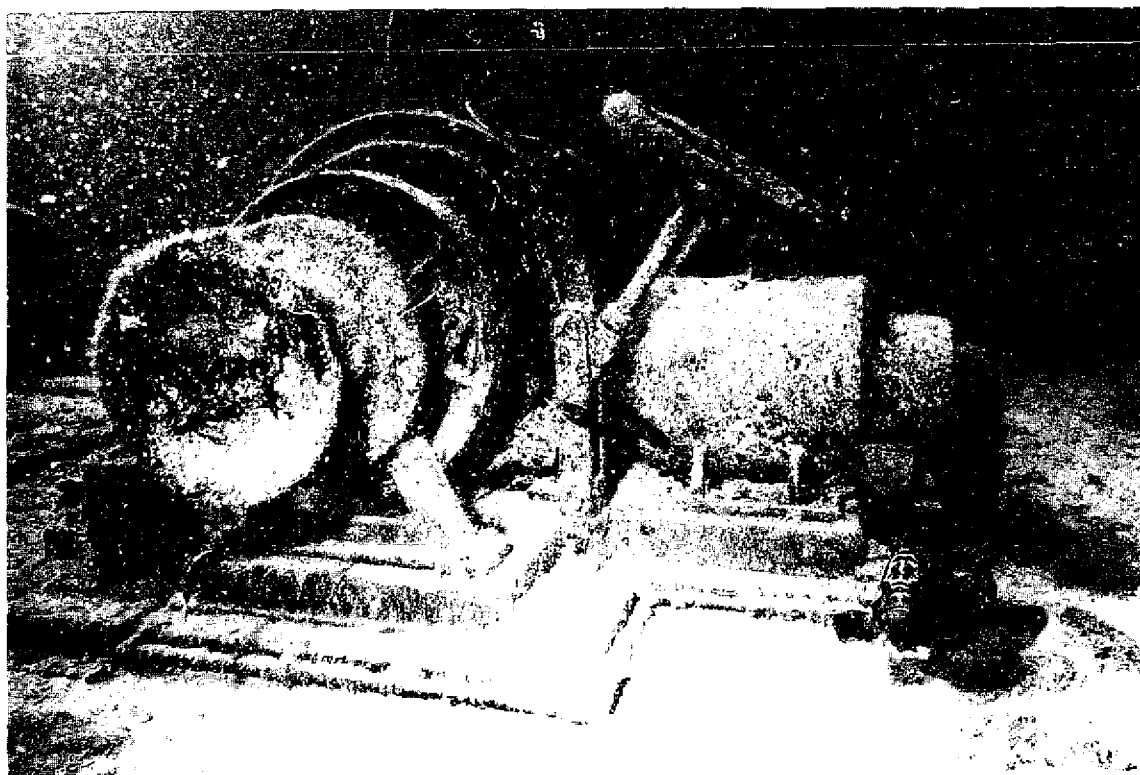
Help may be on the way to alleviate some of those supply and marketing problems and get Guam's small fishermen a bigger slice of the fish pie.

Gerald Davis, Fisheries Supervisor of the Aquatic and Wildlife Resources Division, says a number of projects are currently being implemented to enhance the fisheries resources of Guam. Aquatic and Wildlife biologists travel throughout the island to interview both offshore and reef fishermen. Data collected on the harvest are used to determine participation and catch rates and to identify prime fishing areas, Davis says.

Fishing is even going 'high-tech'. Dr Steve Amesbury of the University of Guam Marine Laboratory is currently researching satellite tracking and oceanographic data to determine changes in ocean temperature, which assists fishermen in finding prime fishing grounds.

'Our long-range goal is to be able to predict when we'll have a good year for fishing', Amesbury says.

Whatever the method, Guam's fishermen, and anyone who has ever held a pole, appreciate any help they can get to capture their sometimes elusive prey. The conflict for fish between large industry and the guy in the dinghy is not likely to end. As long as there are fish in the sea, there will be fishermen to catch them.



FISHERIES SCIENCE AND TECHNOLOGY**THE 1989 TRANSPLANTATION OF TROCHUS TO TOKELAU AND TUVALU**

(Source: R. Gillett — FAO/UNDP)

The natural distribution of the commercially important gastropod *Trochus niloticus* ranges from the islands in the Indian Ocean eastward to Wallis Island in the South Pacific. Outside this zone trochus has been successfully introduced to areas such as the Cook Islands, French Polynesia and parts of Micronesia.

There have been several attempts to introduce trochus to Tokelau and Tuvalu. In 1985 and 1987 respectively, 181 and 200 shells were transported from Fiji to Funafuti by commercial aircraft. In 1988, 1,336, 2,672 and 844 shells were transported by military aircraft and to Nukulaelae, Funafuti and Nukufetau. Fakaofu in Tokelau received 1,029 shells in 1986 and 578 in 1988.

The objective of the 1989 trochus project was to introduce trochus to the northern atolls of Tokelau and Tuvalu: Niu, Nanumea, Atafu and Nukunonu.

Experience has shown that transporting live trochus by ship to remote islands can be quite difficult. Previously, trochus had been satisfactorily parachuted into Tokelau and Tuvalu and this method was therefore chosen for the 1989 operation. Arrangements for the air transport were made between the governments of New Zealand, Tokelau and Tuvalu.

As in the previous trochus transplant to Tokelau and Tuvalu, Aitutaki in the Cook Islands was selected as the base of operations. In many aspects Aitutaki is an ideal location from which to obtain trochus. Trochus are quite plentiful, the divers are willing and the airstrip is conveniently located.

Prior to the arrival of project staff, arrangements were made with the Aitutaki Island Council by the Cook Islands Ministry of Marine Resources for permission to harvest and for compensation. Diving took place on the south-west reef on 19 October 1989 (11 divers, 4 hours, 2,040 trochus) and on October 20 (12 divers, 4 hours, 2,996 trochus). These 5,036 trochus were stockpiled on a coral head about a mile south of the wharf (magnetic bearings: 115 to south point Aitutaki, 25 to shed, 275 to large rock on reef).

As the departure of the transporting aircraft was scheduled for Monday morning, there was difficulty with the local custom of abstaining from activity on Sunday. An additional consideration was the desire to harvest the trochus as late as possible to minimise the amount of time they would be out of their habitat and assure survival during transport. At the same time, it was necessary to collect the shells early enough to be absolutely certain that, in the event of unforeseen difficulties, the required number of trochus would be on board the aircraft at departure time. To accommodate these conditions and to diversify the risks involved, it was decided to collect half of the stockpiled trochus late on Saturday afternoon and the remaining shells starting at midnight on Sunday.

Accordingly, 2,550 trochus were obtained from the coral head by a 9-man crew in 2 hours starting at 1600 hrs Saturday. Another 2,130 shells were collected in one hour starting at 0030 hrs Monday for a total of 4,680 trochus, or a 93 per cent recovery rate.

The collected trochus were counted, bagged, crated and transported to the airstrip, arriving at 0415 hrs. By prior arrangement, the New Zealand troops temporarily stationed on Aitutaki assisted with loading the aircraft. The aircraft departed considerably ahead of schedule at 0615 hrs.

At 1355 hrs (Cook Islands time), 1,000 trochus were parachuted in two loads to Nui at a speed of 130 knots and altitude of 400 feet. At Nanumea, one parachute-load of trochus containing 600 shells was placed successfully on target, but another load of 600 trochus fell from the harness after the parachute opened. The number of trochus to survive the fall is unknown. 1,200 trochus were dropped to Atafu as planned. Nukunonu successfully received 1,080 trochus, 100 kg of bananas and mail.



Dropping trochus onto reef by air

TEMPERATURE AND SEAFOOD SPOILAGE

(Source: *Professional Fisherman*)

Seafood is becoming increasingly recognised as a valuable and essential part of the Australian diet. To supply the increasing demand, much produce is imported and sold in competition with the local catch.

Most imported species are frozen and thawed before repackaging and retail display, a practice which leads to an increased bacterial load and which the consumer perceives to lead to a product of lesser quality.

Local fisherman and processors have the opportunity to capitalise on this perception if they can present top-quality products for retail sale. Loss of quality begins from the point at which the species is harvested.

Initially it results from natural biochemical changes in flesh after death, and is followed by changes that occur as a result of bacterial growth. The former reduce premium quality while the latter lead to overt spoilage odours and flavours which cause rejection by the consumer.

Most fresh seafood products in chill storage deteriorate rapidly as a result of the growth of cold-tolerant bacteria. These produce putrid spoilage compounds such as sulphides, ammonia and some amines.

Manipulation of the storage conditions (for example, the atmosphere in the package or the product formulation) will lead to replacement of bacteria producing the putrid odours with other cold-tolerant organisms which grow less rapidly at chill temperatures and produce less obvious spoilage changes.

Effect of temperature on shelf life

Both biochemical and bacterial spoilage processes are influenced by many factors, but with all products storage temperature is a major factor influencing the rate of product deterioration.

For this reason the Fishing Industry Research and Development Council has funded research to determine the effect of temperature and other factors on the shelf-life and safety of seafood products.

The work at the Department of Agricultural Science, University of Tasmania, continues more than ten years basic research in that Department, and at the CSIRO Seafood Technology Section, Hobart. This resulted in a very simple mathematical model to describe the effect of temperature on the rate of bacterial growth and other spoilage processes.

The best way in which to apply the model is as a relative rate, i.e. if the rate of spoilage at 0°C (on ice) is taken to be 1.00, rates at other temperatures relative to that at 0°C can be calculated (see Table 1).

The rates in Table 1 refer to the deterioration of fresh fish and fisheries products stored in air. Other relative rates are required for products that are smoked, brined or stored in modified atmospheres.

Table 1. Effect of temperature on relative rates of fish spoilage

Temperature	Relative rate of spoilage
0	1.00
2	1.44
4	1.96
5	2.25
7	2.89
10	4.00
15	6.25
20	9.00

Implications

The implications of storage temperature for shelf-life are shown in Table 2 for crayfish paté made in Tasmania by a small producer.

The obvious conclusions are that the product deteriorates rapidly at temperatures greater than 4°C and that even small temperature reductions below 4°C give large increases in shelf-life; e.g. at 0°C the shelf-life is doubled compared with that at 4°C, and the shelf-life at 10°C is halved compared with that at 4°C.

Table 2. Shelf-life characteristics of crayfish paté

Product formulation	Blended crayfish waste		
Process	Thorough cooking		
Product characteristics	Water activity 0.99 (i.e. no added salt); ph value 7.0 (near neutral acidity)		
Expected storage conditions	Plastic containers; aerobic; refrigerated cabinet at 4°C		
Initial number of spoilage bacteria	10 per gram		
Number of spoilage bacteria at end of shelf-life	50,000,000 per gram		
Shelf-life at 4°C (by taste panel)	7 days		
Predicted shelf-life at other temperatures	Temperature	Shelf-life	Change in shelf-life
	10° C	3.5 days	LOSS -3.5 days
	7° C	4.5 days	LOSS -2.5 days
	2° C	9.0 days	GAIN +2.0 days
	0° C	14.0 days	GAIN +7.0 days

Being able to guarantee a shelf-life approaching two weeks allows for much more flexibility in distribution and may allow processors to target more distant markets with fresh product. Strict temperature control has the added advantage of minimising the risk of growth of food-poisoning bacteria, most of which grow very slowly, if at all, below about 7°C.

The relative rates of product deterioration apply to any fisheries product with high water content and a neutral acidity level. The actual time to spoilage will vary from product to product, and will depend to a large extent on the initial numbers of spoilage bacteria present.

Fresh fish fillets, for example, may have 10,000—100,000 spoilage bacteria per square centimetre of flesh immediately after processing. Obviously it will take less time to reach the level at which spoilage is noticeable (50,000,000/sq.cm) than a product in which the initial number of spoilage organisms has been reduced by processing.

On ice (0°C), good quality fillets will last 10 or 11 days, so that the shelf-life at 4°C will be only about five days, and if temperatures get up to 7°C (as they often do on retail display), this will be reduced to about four and a half days. With frozen fish which has been thawed and packaged, the situation will probably be even worse because the spoilage bacteria will have multiplied during thawing and subsequent processing operations.

The same principles apply to the storage of shellfish. Oysters stored on the half shell at 4°C had a shelf-life of about four days, which was doubled to 8—10 days at 0°C. The extension of shelf-life obtained by temperature reduction was better than that in vacuum-packed oysters when the shelf-life at 4°C was 6—8 days.

The message for fishermen, processors, wholesalers and retailers is simple. If you are interested in selling top quality fresh fish, shellfish and fisheries products, temperature control throughout the entire processing and distribution chain is crucial to obtain adequate shelf-life.

AIMS BILLFISH TAGGING PROGRAMME

The Australian Institute of Marine Science (AIMS) at Townsville has begun tetracycline tagging of black marlin and sailfish.

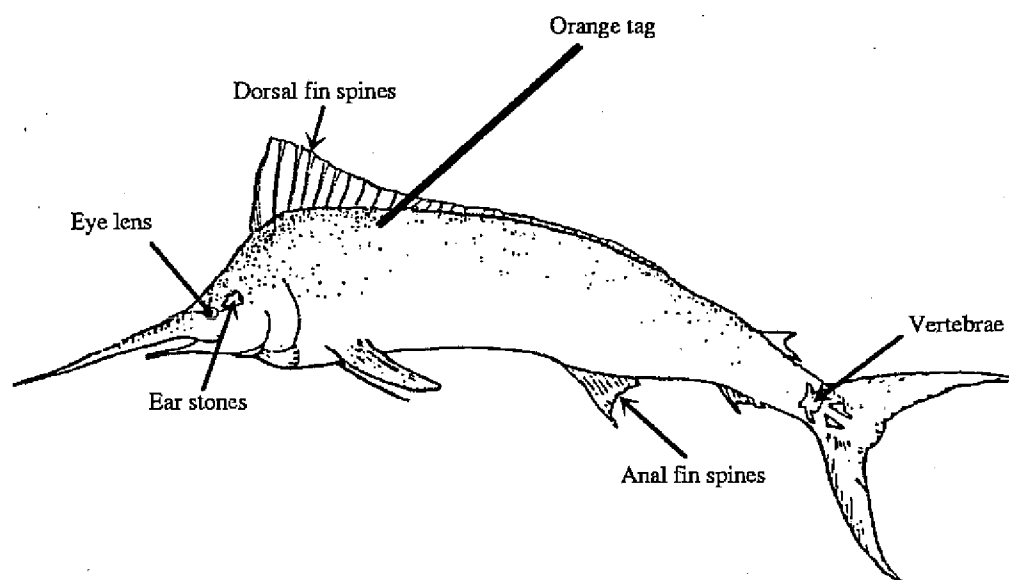
The work is part of studies on the age and growth of these billfishes in eastern Australian waters and will aid in management of exploitation of their populations. Over 200 juvenile black marlins have been tagged in Townsville waters so far. The fish were tagged with the aid of gamefishing boats and crews participating in the NSW co-operative gamefish tagging programme.

A measured dose of the antibiotic tetracycline is positioned under the skin of the fish with a plastic dart tag. This orange 20 cm dart tag bears the AIMS logo and instructions and may be accompanied by a yellow 10 cm NSW gamefish tag of similar design if the fish has been double-tagged upon capture.

The tetracycline dose acts to internally dye otoliths, bones and fin spines with a fluorescent ring which can subsequently be used as a benchmark to study the age and patterns of growth of recaptured fish.

It is anticipated that these tagged billfish will be recaptured by coastal and offshore operations of commercial and recreational vessels within the Australian fishing zone.

Access to the entire fish and the tags is required for research purposes and a A\$ 400 reward is offered for recaptured fish or verified authenticity.



A NEW HANDBOOK FOR ARTISANAL FISHERMEN

A new publication from the National Academy Press, entitled *Fisheries technologies for developing countries (FTDC)*, may best be understood as a form of *Whole earth catalogue* for artisanal fishermen. There is a familiar 'Whole Earth' ring to the common-sense solutions devised by resourceful fishermen in meeting everyday challenges.

FTDC contains chapters on boat design, fishing methods, artificial reefs and fish aggregation devices, coastal mariculture, and fish processing and preservation. An objective of the

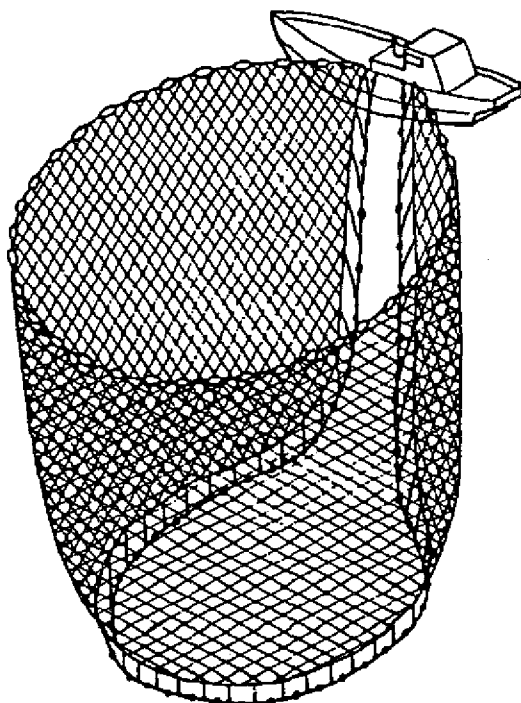
publication is to give individual fishermen with limited budgets access to the economical technologies used in other parts of the world. *FTDC* could also be a useful teaching and reference tool for classrooms and libraries, particularly as it is available at no charge to developing countries.

The goal of *FTDC* is to point out, explain, and teach. The frequent illustrations add to the clarity of the presentation. The book is a primer for those who want a quick introduction to basic fishing vocabulary; it also introduces a number of surprising items to those already familiar with fishing techniques. The construction of artificial reefs and lobster shelters are two examples. In many cases, traditional methods, such as those used in boat building and design, have been improved by modern fabrication methods. All the chapters are supported by well-organised reference material for further study.

FTDC was compiled as a result of a meeting of international fisheries experts at the University of Miami's Rosenstiel School of Marine and Atmospheric Sciences in 1985. The proceedings were brought to publication under the direction of BOSTID (the Board on Science and Technology for International Development, Office of International Affairs, National Research Council).

BOSTID manages programmes with developing countries on behalf of the U.S. National Research Council.

FTDC is just one of an impressive range of BOSTID publications, all of which address themes of interest to developing countries. A complete catalogue of titles, prices, and ordering information is available through the National Academy Press, 2101 Constitution Avenue, N.W., Washington, D.C. 20418, USA.



NEW TOOL FOR DELIMITING MARITIME BOUNDARIES

(Source: International Centre for Ocean Development)

The International Centre for Ocean Development (ICOD) recently announced the availability of DELMART™ 1.0, a computer program library for the delimitation of maritime boundaries.

What is DELMAR?

DELMAR is a portable information tool for use in defining maritime boundaries. Its structure allows the user to select from a number of options that provide valuable technical information relevant to the preparation, actual negotiation and verification of international boundary agreements. DELMAR may also be useful for investigating the technical nature of existing agreements.

Who can use it?

DELMAR is designed for use by those familiar with IBM personal computers or close compatibles and with Microsoft's Disk Operating System (DOS). The product will likely be best put to use by those familiar with the documents and concepts of the 1958 Geneva Convention and the 1982 United Nations Convention on the Law of the Sea. A clear understanding of geodetic concepts and terms such as a geodesic reference ellipsoid and its co-ordinates, datum transformation parameters and geodesic lines is required. Previous exposure to the legal and technical nature of existing boundary agreements is required to make full use of the capabilities of DELMAR.

What can it do?

Key features of the program library include an on-line tutorial and a collection of modules to compute maritime areas, determine offshore limits, delimit equidistant boundaries and delimit boundaries that include points to which 'partial effects' have been assigned. Also included are a suite of utility programs for the solution of peripheral tasks relevant to a boundary delimitation, a full screen text editor for editing and viewing data files and a suite of graphics programs for the display of geographic data.

What do you need to use?

The hardware and software requirements for DELMAR are:

- an IBM or IBM-compatible XT or AT personal computer;
- the Disk Operating System (DOS) version 3.1 or higher;
- a minimum of 510K of RAM;
- a standard (360K) or high-capacity (1.2Mo) 5.25-inch diskette drive, or a standard (720K) or high-capacity (1.44Mo) 3.5-inch diskette drive;
- a hard disk drive;
- a Numeric Data Processor (NDP) Intel 80X87; and
- a Monochrome Display Adapter and a monochrome monitor.

A graphics display adapter, such as Hercules, CGA, EGA, or VGA, is not necessary, but one is required if the graphics capability of this library are to be exploited fully.

To obtain further information about DELMAR, contact: Centre for Ocean Development, 5670 Spring Garden Road, 9th Floor, Halifax, Nova Scotia, Canada B3J 1H6.

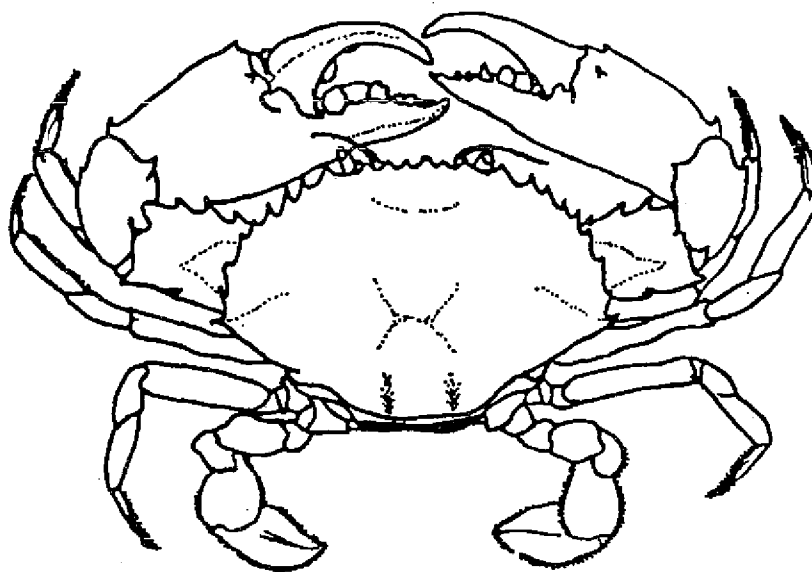
MUD CRAB BORN AT NOUMEA AQUARIUM

(Source: *Les Nouvelles Calédoniennes* and *Queensland Department of Primary Industries Leaflet*)

A ripple of excitement surged through informed scientific circles in Noumea in April 1989. For the first time in a French Territory, a mud crab had just been born in a laboratory. For Stephen Delathière, this event was the culmination of years of study and research. This young scientist is completing a doctoral thesis on mud crabs under a research agreement between the Institut français de recherche scientifique pour le développement en coopération (ORSTOM) and the Territory of New Caledonia.

The mud crab (*Scylla serrata*), now holds very few secrets for Stephen Delathière, who has spent the last few years unravelling the mysteries of this crustacean. Stock appraisal, biological research and economic prospects were all subjects which he investigated with a single purpose in mind: this crab's aquacultural potential.

The mud crab is the largest of the portunid crabs. It has a wide distribution, occurring around the northern half of Australia, eastwards into the Pacific as far as Samoa and Fiji, northwards to the Philippines, westwards into the Indian Ocean and across to the east coast of Africa. Throughout this distribution *Scylla* is found in sheltered waters, especially favouring estuaries and mangrove areas.



The mud crab (*Scylla serrata*)

Mud crabs are extremely tolerant of salinity and temperature variation and can survive in a salinity range of 2—50 per thousand and temperatures of 12°—35° C. It is not known to what extent they are affected by salinity variations, but in the case of temperature it is known that activity and feeding falls off dramatically below 20°C. *Scylla serrata* is mainly active at night. Although many occupy burrows in the intertidal zone, the majority of adults live subtidally and bury themselves in the mud during the day. They emerge at night and forage for food covering about 500 m each night. They feed on slow-moving or stationary bottom-dwelling animals such as bivalves, snails, other crabs, hermit crabs and worms. They rarely eat fish under natural

conditions since they lack the ability to catch them. They are attracted to a wide variety of baits, including fish, but this does not mean that fish form part of their normal diet.

Mud crabs take 1.5—2.5 years to reach sexual maturity. The crabs mate in the warmer months. The mature females extrude a chemical attractant or pheromone into the water. This attracts the males. The successful male picks up the female and carries her around for several days until she moults. Copulation can occur only while the female is in the short shell condition. The male deposits a spermatophore or packet of sperm inside the female reproductive opening, where it is stored until the developing ova are ready to be fertilized. Following mating, the females migrate offshore to spawn.

Their exact progress is not known, but in some parts of the world they remain around the mouths of the river and in others they migrate up to 50 km offshore and into water down to 300 m deep. Eggs are extruded in batches of 2—5 million at a time. The eggs are carried beneath the abdomen, which has to be folded outward to accommodate the large egg-mass. Eggs hatch in 2—4 weeks and a zoea larval stage emerges. These zoea larvae are sensitive to high temperature and low salinities and therefore cannot exist in estuaries; they require marine conditions. There are four zoeal stages; they give rise to a megalopa stage. This resembles a small (3 mm long) elongate crab with a well-developed abdomen which projects backwards like a tail. Appendages on the abdomen enable the megalopa to swim and this is the stage which returns to the estuaries. Larval life is about a month. Once back in the estuary, the megalopas change into juvenile crabs which settle down in sheltered areas between mangrove roots or in seagrass beds.

One of the most important phases of this research project related to reproduction and how the crab developed under controlled conditions, in other words in the laboratory. The experiments took place at the Noumea Aquarium.

For this purpose, at the beginning of February 1989, Mr Delathière induced the egg-laying process by amputation of one or both eye-stalks. This is just like a surgical operation and includes cauterisation: it must be done with great care. The eggs were laid a few days later, in the night of 11 March. This stage is evident even to laymen, because the eggs are outside the female's body, held in place solely by her abdomen. 'You have to be very careful about the quality of the surrounding environment', said Stephen, 'because the eggs are dragged along the ground'. Subsequently, for the embryo to be able to develop, it was necessary to re-create natural temperature, salinity and light conditions because, at this time of year, the water is of course too cold for the female to be able to lay. This stage of development lasted 12 days. From a bright orange colour when laying began, the mass of eggs gradually takes on a darker shade to become completely black; patches appear where the eyes, mouth, abdomen and other organs begin to form.

Hatching

Hatching, in other words the change from the embryonic to the larval stage, occurred on 24 March. 600,000 larvae (Zoea 1 stage) were counted. These are pelagic larvae which remain at the surface and feed on plankton. Here again, the conditions encountered in the natural environment have to be simulated for these larvae to develop. Having divided them among six experimental tanks, Mr. Delathière recorded a high mortality rate in the first 24 hours. 'If the temperature is too low', he explained, 'the larvae's hunting instinct in the plankton is inhibited and they die of hunger. On the other hand, if the temperature is too hot, the larvae use up their internal food reserves and die of exhaustion'.

The survivors continued to develop. After going through four Zoea stages, of three to four days each in length, the larvae metamorphosed into megalopa, resembling small prawns possessing pincers which are already fully functional, so much so, in fact, that a high rate of mortality by cannibalism was observed at this stage.

After another ten days or so, the first young crab proper made its appearance. This period may vary depending on water salinity. 'The less saline the water', said the young scientist, 'the quicker the crab stage is reached'.

Refining the data

Larval development in controlled conditions is a technique that was mastered in India several dozen years ago, and in Australia, where farms already exist. In Japan, however, it is still at the experimental stage.

'These initial data need refining', explained Stephen Delathière, 'to be reproduced on a much bigger scale with a view to aquaculture. However', he concluded, 'this experiment removes all doubt about the aquacultural potential of this species in the Territory.'



Photo : Martial DOSDANE

THE 'POTI-MARARA' — A MULTI-PURPOSE INSHORE CRAFT

by

Gildas Borel

The 'poti-marara' is a small all-purpose fishing boat used by coastal fishermen in French Polynesia. Designed by local boatbuilders, this boat is an interesting case of spontaneous development.

Birth of the 'poti-marara'

The name 'poti-marara' states the basic purpose of this type of boat (boat is 'poti' in Tahitian). It is designed for catching flying-fish or 'marara' (Exocoetidae).

These launches appeared in Tahiti in the fifties. Until then flying-fish had been caught using traditional techniques. At night, two men would paddle out onto the lagoon in a canoe, occasionally venturing beyond the reef. Torches were lit on the boat to attract the fish, which one fisherman caught with a dip net while the other paddled.

The introduction of North American pleasure craft was a stimulus for fishermen to switch to a more versatile boat. A small plywood vessel (13 ft long) propelled by a small outboard motor (7.5 hp in 1956) was then developed. During contests organised by the fishermen, it was observed that boats with a more pronounced V-shaped hull cut through the waves more easily and went faster with a motor of equal size. The shape was gradually streamlined. This evolution was due to the fishermen-boatbuilders, each of whom contributed to the improvement. The 'poti-marara' then developed into a small, highly manoeuvrable speedboat, able to cope with the rapid changes of direction of its intended catch. This required some virtuosity of the person at the controls, at the rear, and perfect synchronisation between the two men. Fishermen would go to great lengths to secure the most skilful drivers.

Around 1960, a forward driving system was developed, enabling one man to fish alone. Seated at the front of the boat, in a small raised cockpit that gave him a good view of his surroundings, the fisherman operated a steering-stick and a gear-shift. He could drive with one hand and hold his bag-net in the other. The flaming brand gave way to an electric light system. The boat would weave its way through the fish, which were not only startled by the noise of the engine but also attracted by the light that the fisherman wore on his head.

This technique is still in use today. The characteristics of the special boat used for this type of fishing did not change significantly until recently. In the late seventies, they measured between 14 and 15 ft in length and were powered by motors of between 20 and 25 hp.

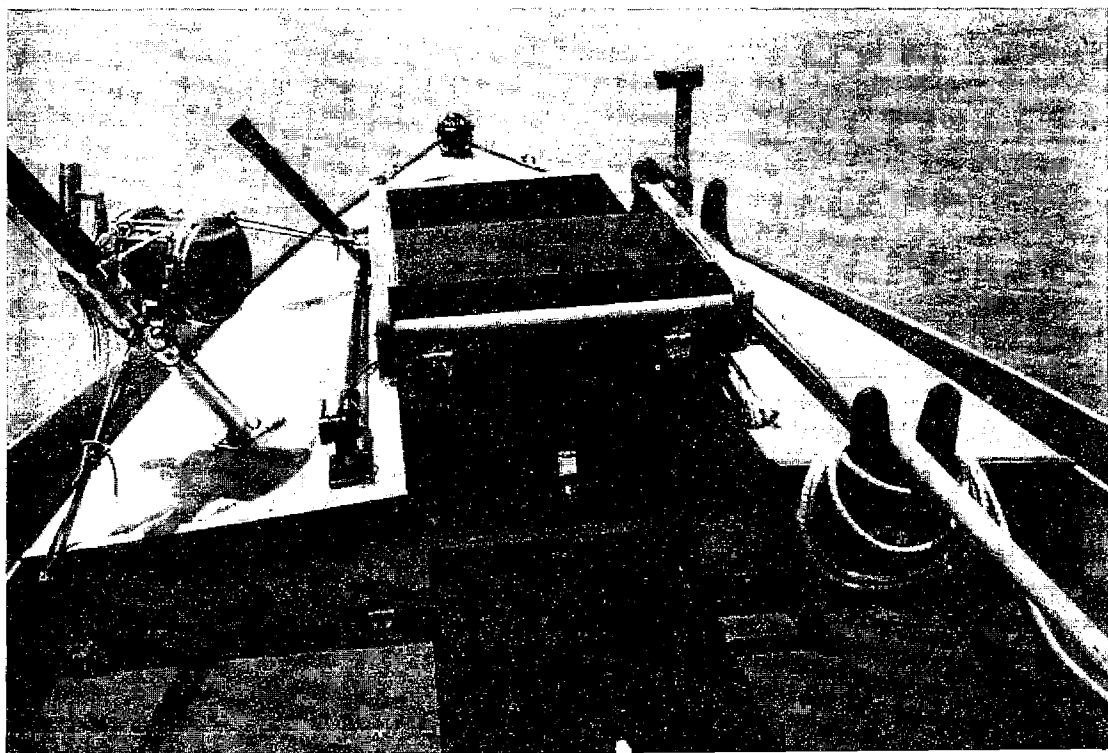
From a single activity to versatility

In the early eighties, the 'poti-marara' turned to a new fishery. It proved singularly suitable for catching dolphin fish, known locally as 'mahi-mahi' (*Coryphaena hippurus*).

The fish is speared after a chase which also requires a rapid, easily manoeuvrable boat. Birds circling overhead lead the fisherman to his prey. He goes in pursuit and begins to harass the fish, which tries to escape, but the boat's manoeuvrability enables the fisherman to keep up and the fish finally reaches a state of exhaustion. The fisherman then uses a harpoon, which is secured to the boat by a long line, to spear his victim and hauls it on board.



'Poti-marara' coming back into Tahiti



Forward section of a 'poti-marara' showing the cockpit in which the fisherman is perched. (Note the rail which another man can hold). To the right is the gear-shift, to the left the steering-stick. The harpoon lies on the right of the cockpit, while a rod and reel stand in a holder to the left.

Demand from the hotel sector has led to the development of this activity, which is becoming the main source of income for many fishermen. This fishery draws the boats further and further away from shore and a longer version has had to be designed. In 1983, typical boat length was 16 ft and average outboard motor size was 50 hp. In 1984/85, the boat that fishermen would be tempted to call a 'poti mahi-mahi' was a 17—18 ft launch powered by a motor of between 55 and 75 hp.

The fishermen continue however to call this boat 'poti-marara'. The name 'poti mahi-mahi' would not be adequate, in any case, because this boat quickly became an all-purpose vessel. As it often ventures further offshore and may meet a school of skipjack, it has been fitted with one and sometimes two rods and reels, mounted on the gunwhale. With this rig, a line can quickly be deployed; the boat then slows down and can start trolling. The hook is hidden by a plastic lure, similar to those used by the 'bonitiers', 12 m boats specialising in trolling and pole-and-lining for skipjack tuna.

The 'poti-marara' is also used to fish for deep-swimming tuna. This is a traditional activity which was previously carried out from single or double-hulled canoes. The technique used remained unchanged until recently: the fisherman would tie a strong hook to the end of his line and wrap several loops of the line around a large stone to act as a sinker, inserting pieces of shad, a baitfish (*Selar crumenophthalmus*) generally caught at the lagoon entrance, between the loops. He then cast the line and, by jerking it, released the stone at the required depth. As the stone dropped to the bottom, the pieces of bait dispersed in the current and attracted any tuna in the vicinity which devoured them greedily including the piece hiding the hook. The fisherman only knew he had a bite when the line, which he had to hold in his hand, went taut. He would then pull in his catch at the cost of much heaving and groaning.

Major progress was made with this fishing technique in 1986 when floats were bought into use; these dip when a fish has been hooked and make the fisherman's work easier, allowing him to move around and chat with his mates while keeping an eye on his floats. Previously, no boat could put out more than two lines with two men aboard. At the end of 1988, two fishermen could easily hang five lines.

This type of fishing is conducted not far from the shore, over the outer reef slope. As in the past, the lines are dropped into 'tuna holes' on the outer slope where, for reasons which are still not fully known, the large predators gather. Tahitian fishermen have always known where these fishing holes are located and have passed this information on over the years.

Such fishing now, however, increasingly takes place near the fish aggregation devices (FADs) moored by a fishery development agency, EVAAM (Etablissement pour la valorisation des activités aquacoles et maritimes), around Tahiti and a number of other islands. The type of FAD tested in French Polynesia is a floating circular raft, balanced by a counter-weight and fitted with a radar reflector and a flashing light powered by solar panels. This device is moored by means of an 800 kg block of concrete lying on the bottom and a line consisting of polyamide and polypropylene rope and chains at either end of the rope. A local bush, 'miki-miki', is hung from the raft to attract small fish. This type of set-up has been designed specifically to attract young fish and their predators, i.e. tuna species.

The devices were deployed by EVAAM to help the 'bonitiers'; who used to waste much time searching for skipjack schools, but the 'poti-marara' were quick to take advantage of them too, which, predictably, has led to some conflict. The skipjack boats circle the rafts, trying to catch surface fish, while the 'poti-marara' moor close to them to fish for the deep-swimming species. The skipjack fishermen claim that the releasing of the bait at great depth encourages the fish to stay deep. Some 'poti-marara' tie up to the raft, although an EVAAM regulation stipulates that boats should not approach within 100 m of FADs. The risk is that fishing lines could get intertwined with the mooring; with a big fish hooked the mooring rope could be cut. It is hard to be sure whether or not these fears are justified, but it is a fact that many rafts have broken loose.

The 'poti-marara' are also used to catch swordfish and marlin by trolling or bottom lining and for other types of fishing activity. Special weighted longlines are used to catch deep snapper (*Etelis* or *Pristipomoides*).

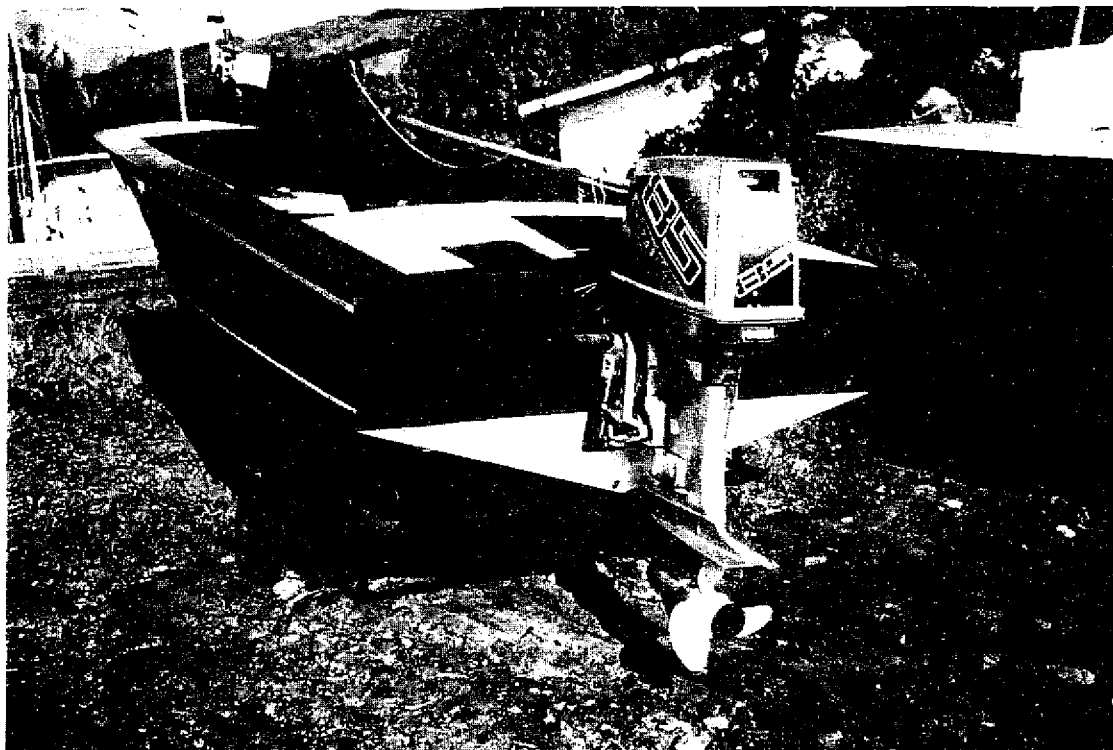
A locally built boat

The 'poti-marara' used by professional fishermen is a plywood speedboat built by craftsmen who are fishermen as well. One of them has built up a sound reputation in boat construction and has today become the main builder of this type of boat for professional fishermen. Two or three others are also making a success of a similar ventures, without being as good as the leading builder. Many small craftsmen build such boats just for their family, friends and neighbours.

The various models vary in shape, but are all built according to the same principles. In some islands, the hull is shorter and flatter. There are also small, 14-ft boats which are usually fitted with a 50 hp motor; these continue to be specially used for catching flying-fish.

The various types of wooden 'poti-marara' are all built from sheets of plywood between 6 and 12 mm in thickness, on a framework of pinewood trusses and ribs made from local timber. The local timber used is 'purau' (*Hibiscus tiliaceus*) which grows along the shore and on river banks on high islands. The ribs are made of lengths of timber glued and screwed together.

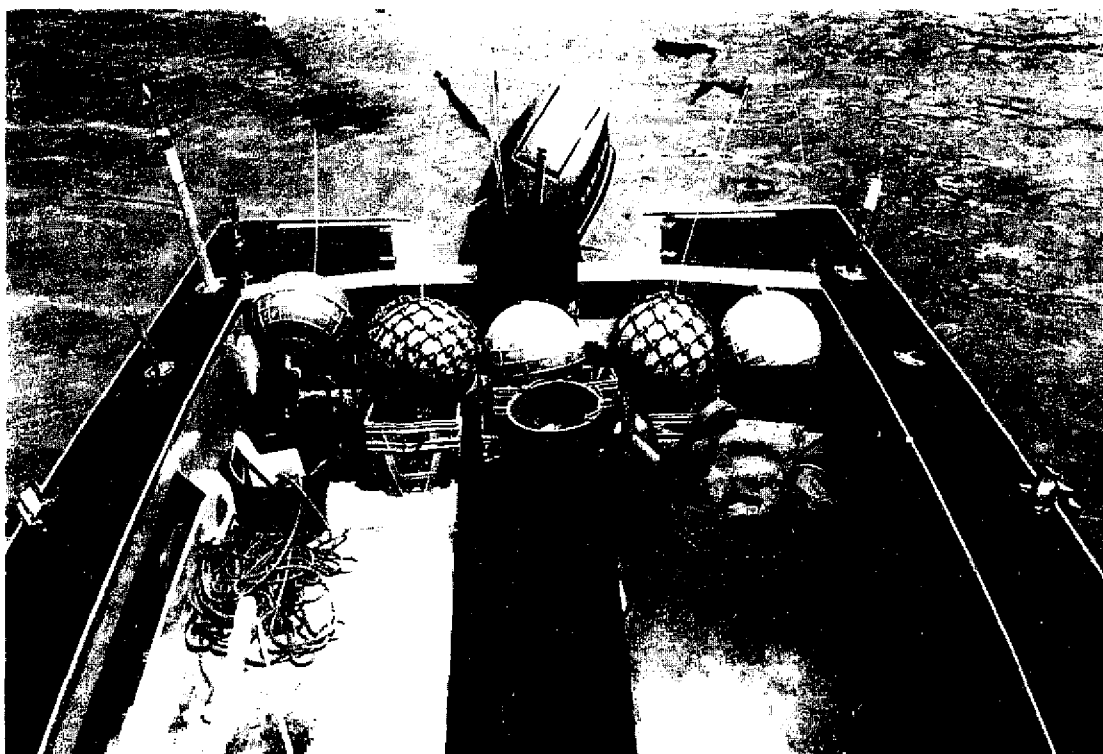
In the most widely-used model the overall length of the hull is between 17.5 and 18 ft (5.4 to 5.5 m), whereas the length at the waterline is more variable (3.1 to 3.5 m). The beam is constant (approximately 2 m) and the midships depth is between 1 and 1.2 m. The stern V varies in sharpness from boat to boat. In 1987 and 1988, the size of the outboard motors varied from 55 to 85 hp. The most common size in Tahiti is 75 hp but the 85 hp engines are becoming more and more popular.



Stern of 'poti-marara' (85 hp outboard motor)

Since 1983, polyester craft have also been manufactured, but these have not proved very popular with the professional fishermen. The first boats built using this material were often damaged by the pounding they took in the waves. These unfortunate experiences do date back a few years, but misgivings about polyester have remained. Today, almost all the 'poti-marara' of this kind are used by pleasure fishermen, town-dwellers who go fishing for recreation. The greater strength of these new models and advantages they offer where maintenance is concerned have somewhat toned down the fishermen's distrust of polyester. Most professionals, however, continue to spurn this material because of its high cost or their deep-rooted preference for plywood. The polyester 'poti-marara' will probably have some difficulty finding buyers among commercial fishermen, particularly as the builders who specialise in manufacturing with this material are now turning out models that appear to be more suited to recreational fishing.

The 'poti-marara' is therefore a genuine all-purpose craft; to a background of expanding fisheries, the function it performs in inshore waters is that traditionally performed by the outrigger canoe in the lagoon. This boat, which is authorised by local legislation to travel up to 15 miles off-shore, is competing with the 'bonitier' skipjack boat.



Stern of 'poti-marara' with the floats used for bottom-lining

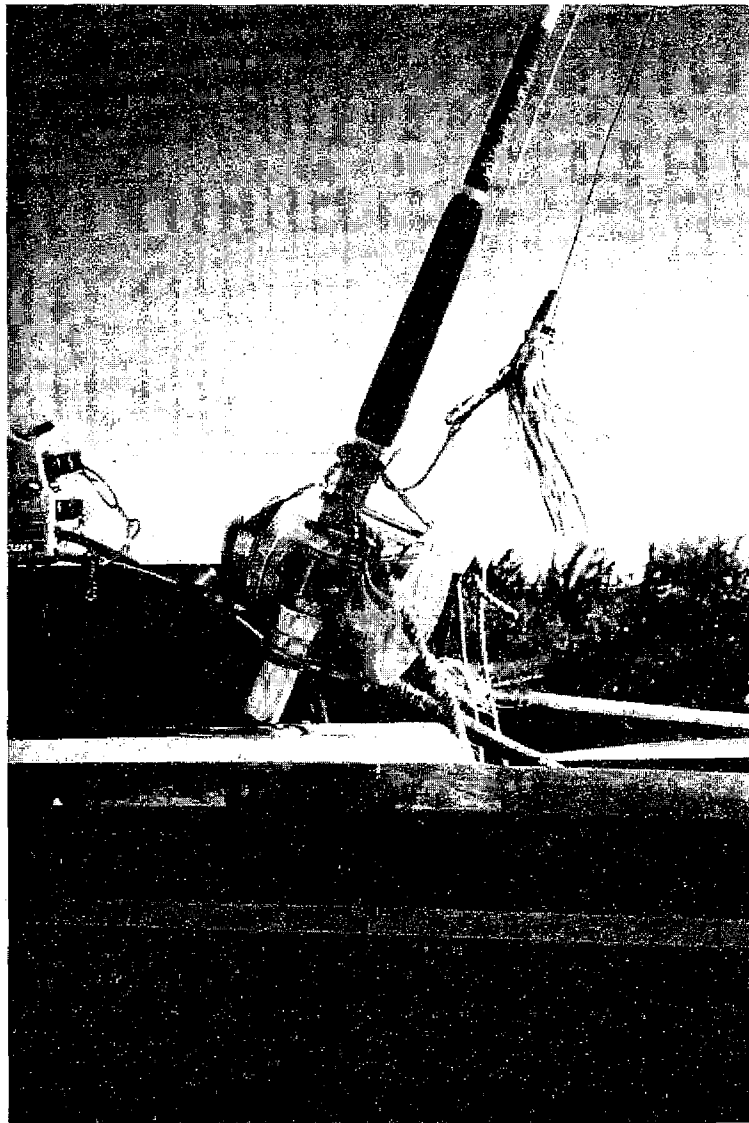
It is becoming more and more popular; after being in demand chiefly in 'tourist' islands (Tahiti, Moorea, Bora Bora), it is gradually spreading to other islands. The 'poti-marara' now enjoys support from the Territory. Up to 50 per cent of the cost of the hulls, motors and equipment of registered boats is refundable, up to a pre-determined limit.

This assistance is proof that the boat's potential has been recognised, although fishing with it is of assured profitability only for fishermen who make regular trips in a specific economic context. Nevertheless, in comparison with the failure of many of the prototypes promoted by the Administration, the success, even if it remains relative, of an idea stemming from the fishermen should be stressed.

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Close-up of rod and reel with a hook, hidden in the water by a plastic lure for skipjack fishing



Help stop the plastic tide

Discarded fishing line kills sealife — carry home what you carry out

Fisheries Department of Western Australia



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