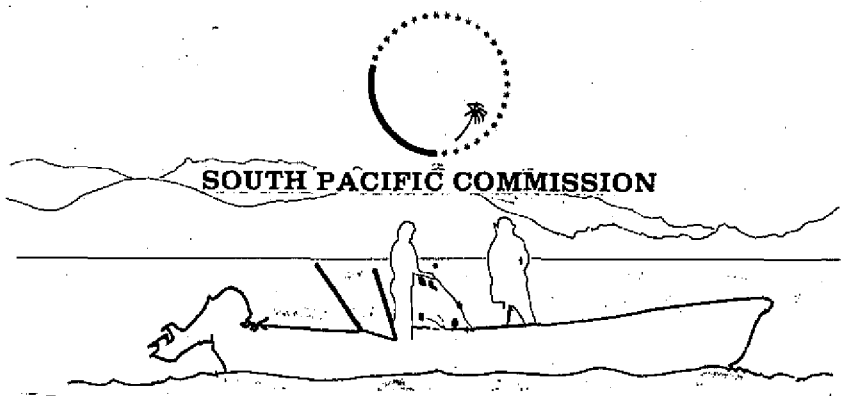

FISHERIES NEWSLETTER

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SPC ACTIVITIES

DEEP SEA FISHERIES DEVELOPMENT PROJECT NOTES

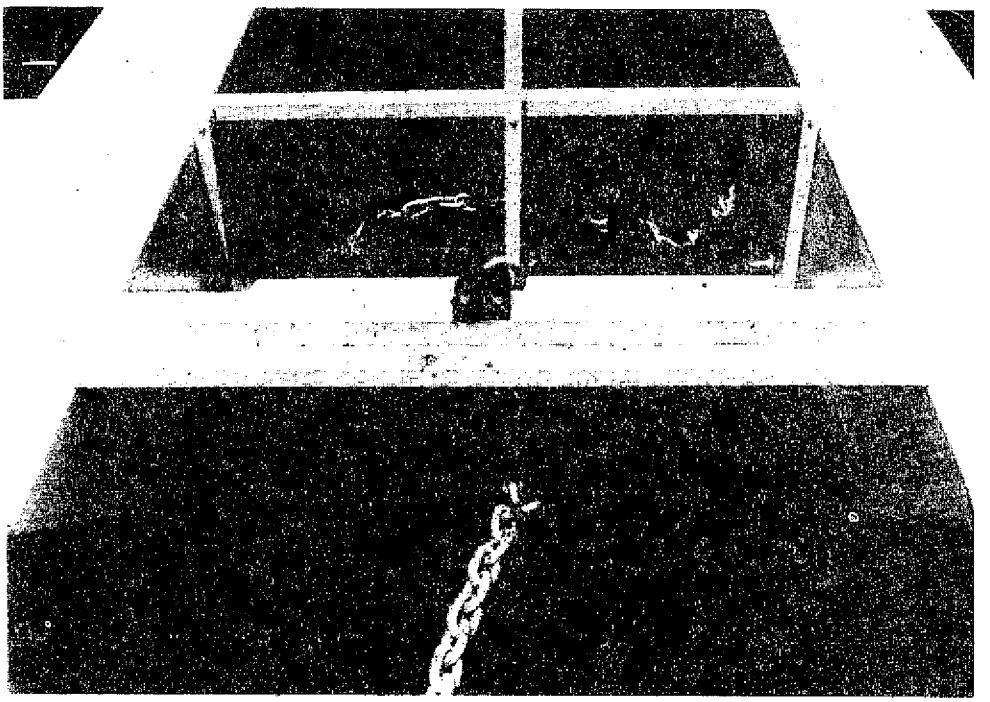
SPC assistance to Palau FAD deployments

Under the Commission's 'Short-term experts and specialist services' grants programme, the Republic of Palau (Belau) was recently able to make use of the services of Gerry Davis of Guam's Division of Aquatic and Wildlife Resources (DAWR) to assist in implementing a revitalised Fishing Aggregation Device (FAD) programme. With the co-operation of the Government of Guam and DAWR, the South Pacific Commission was able to arrange for Davis to provide technical advice and assistance through each stage of Palau's FAD project and subsequently travel to Palau to supervise deployments.

Although a biologist, Gerry Davis is well known to those concerned with FADs in the Pacific as co-ordinator of Guam's successful FAD programme. He participated in the SPC-sponsored practical FAD workshop held in Kiribati in 1987 and the FAD workshop session held as part of the 1990 SPC Regional Technical Meeting on Fisheries.

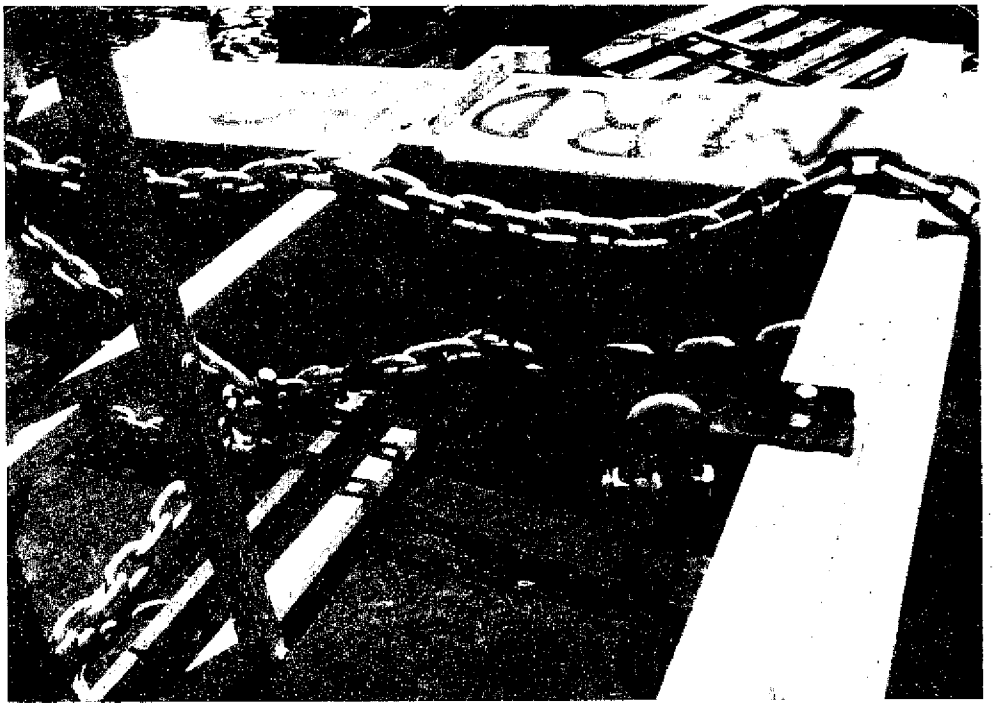
At SPC's request, Davis was involved in the Palau FAD project from the outset; he was consulted in regard to the site selection, assisted with determination of the mooring design and calculations, identified sources of supply, co-ordinated the ordering and shipping of FAD materials and, when all was to hand in Palau, travelled there to train local staff in mooring calculation, rigging and deployment procedures.

The FAD mooring system adopted in Palau is essentially the same as that used in Guam, that is, the SPC-recommended catenary curve mooring system comprising both 12-strand nylon and polypropylene ropes.



Original catamaran design

Palau, however, had decided to make use of plywood catamarans as FAD rafts because surplus steel buoys, of the type typically used in Guam, were locally unavailable. The catamaran (see photo on previous page) proved to be less than adequate, with the lower cross-member supports failing on the first deployment. Under Davis' supervision, the first raft deployed was retrieved with some difficulty and replaced with a strengthened version (see photograph below).



FAD (catamaran) improved for the second deployment. The ropes were tied in to direct the tension to the large cross supports.

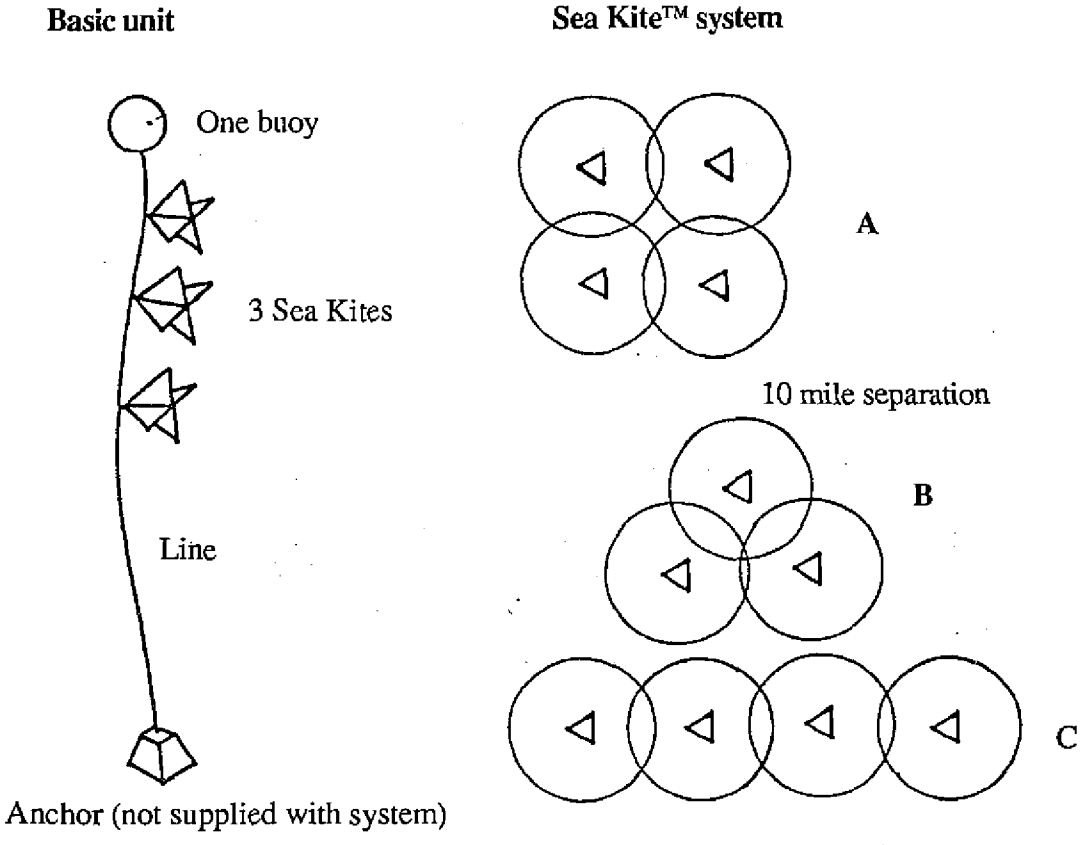
This modification was also used for the second FAD, which was deployed without incident. Palau decided, however, to replace the wooden catamarans with steel buoys as soon as they could be obtained from surplus dealers in Hawaii. The Palau programme calls for the eventual deployment of eight FADs.

Tuvalu — Tuna longlining project

SPC Masterfisherman Tuainetai Rata, who recently completed a long field assignment in Papua New Guinea, returned to SPC headquarters in Noumea briefly in October 1990 before leaving to join a commercial tuna longliner operating out of Suva in Fiji. He joined the vessel for a week's cruise in order to become familiar with the latest developments in tropical tuna longlining with monofilament gear, now used successfully by a number of vessels in the Fiji-based longline fishery.

The cruise was in preparation for a DSFD Project assignment which began in early November 1990 in Tuvalu. The Tuvalu project is concerned with developing a gear system for the capture of offshore tunas suited to the local fishing fleet. The eventual aim is to establish an ongoing tuna fishery capable of landing sufficient quantities of quality fish to sustain production of a secondary tuna product with export market potential.

An important part of the project is an attempt to develop practical and productive methods for the capture of local baitfish *Selar crumenophthalmus* and *Decapterus* spp. in support of the tuna fishing effort. As part of the baitfishing trials, Rata has deployed two shallow-water fish aggregation devices (FADs) in Funafuti lagoon. These units, manufactured by the McIntosh Corporation of the United States are known as 'Sea Kites'.



The McIntosh Sea Kite™ fishing system

The lightweight 'Sea Kites' were deployed in the lagoon in areas where **atule** and **kopelu** were reported to swarm, with the actual kite assembly moored 10—15 m below the surface. Early reports from Rata say that the kites are working extremely well, attracting large shoals of mixed species. Rata is about to begin baitfishing trials using gill nets and jigs.

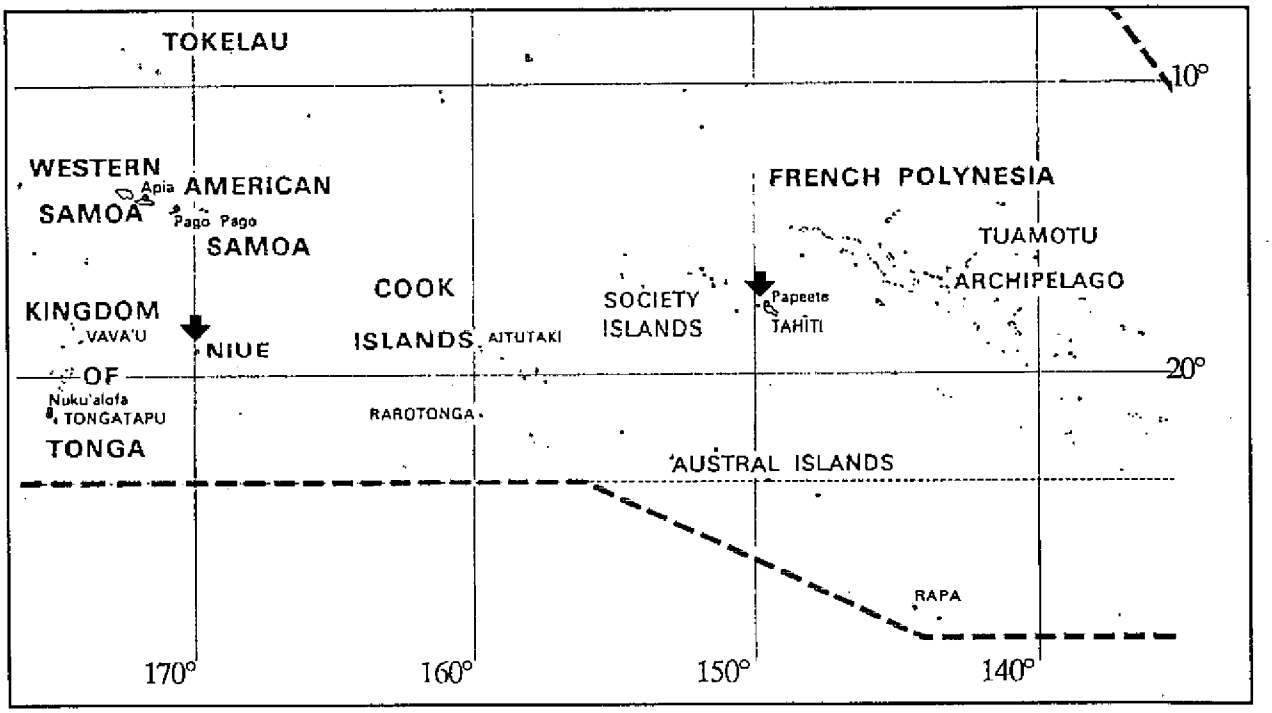
Once bait supply is regularised, tuna fishing trials will begin, using multiple vertical longlines rigged from monofilament nylon and carrying ten hooks each. Initial trials will be centred at FADs offshore of Funafuti.

Rata is expected to remain in Tuvalu for four months and for part of this time will supervise attachment training for Fisheries Extension Officer Rakwa Leka, of Papua New Guinea's Department of Fisheries and Marine Resources. The attachment training has been arranged in response to Papua New Guinea's plans to establish a domestic masterfisherman programme; working alongside an SPC Masterfisherman will equip the trainee with many of the skills required to manage fisheries development field assignments at home.

French Polynesian FAD found at Niue

In November 1990, Sione Leolahi of Niue's Department of Agriculture, Forestry and Fisheries notified SPC's Fisheries Programme that a steel FAD complete with a section of trailing mooring rope had been found drifting off the island and recovered by a Fisheries vessel. From what he had seen at the FAD workshop session held during SPC's 1990 Regional Technical Meeting on Fisheries, Sione thought the raft design resembled that used in French Polynesia.

Subsequent contact with Frederic Leproux, Co-ordinator of Tahiti's FAD programme, confirmed that the raft, clearly marked with a code number, was indeed one deployed in French Polynesia, off the island of Moorea, and reported lost in late December 1989. The raft had thus drifted for some 11 months and at least 2,000 km before the vigilant Niueans spotted it.



Reports of sightings and recoveries like this one can play a useful role in determining causes of loss. In this case, it is expected that the surviving mooring rope end will be returned to Tahiti for examination and, perhaps, a clue to how it parted will be discovered. This recovery also demonstrates the value of marking rafts with clear identification codes and keeping thorough records of deployments.

INSHORE FISHERIES RESEARCH PROJECT

Workshop on trochus resources planned

Fisheries for the trochus shell, *Trochus niloticus*, at present generate an estimated US$26 million per annum region-wide from shell sales. A large proportion of this money enters directly into village economies. Shells are gathered for sale to processors and exporters, and ultimately end up as expensive buttons on fashion clothing, or are put to other uses. The fishery provides important cash-earning opportunities in coastal and outer island areas where the alternatives may be very limited.

The 22nd SPC Regional Technical Meeting on Fisheries, held in August 1990, recommended that the South Pacific Commission work with the South Pacific Regional Aquaculture Development Programme in raising awareness of the potential and limitations of the techniques and technologies involved in artificial enhancement of marine resources; and that the Commission also consult with the Forum Fisheries Agency with a view to developing co-operative action to address a range of issues relating to management, culture and marketing aspects of trochus and pearl shell.

One of the Commission's responses to these recommendations has been to organise a regional workshop on trochus resource assessment, development and management. This will address many of the issues presently of concern and interest to countries of the region trying to maximise returns from trochus resources. These include appropriate management systems for trochus fisheries, artificial enhancement of wild trochus stocks through aquaculture, regional variations in shell quality and therefore value, and the development of facilities within the region for adding value to the product.

The workshop, which will be held in Vanuatu in May 1991, is divided into three week-long parts, and is designed for a range of different participants. The programme is as follows:

Week 1

This week is aimed at a range of individuals involved in work on trochus, from those dealing with broad aspects of trochus resource assessment and the provision of management advice, to those involved in decision-making at a senior level, or in product quality assessment, control or marketing. Parts of Week 1 will also be relevant to individuals from the private sector.

Sessions during Week 1 will consist mainly of lectures and discussion groups covering aspects of trochus biology and life history, population dynamics, basic resource assessment methods, hatchery technology and juvenile propagation, resource management, shell processing and quality assessment, and marketing. Some attention will also be given to the species *Tectus pyramis* and *Turbo marmoratus*, which occupy similar habitats and are traded in similar ways to *Trochus niloticus*. It is also planned to organise site visits to commercial shell processing factories and to the government trochus hatchery where, if conditions permit, participants will be able to observe trochus spawning and subsequent larval development and rearing.

Week 2

This week is aimed at a smaller number of individuals who are involved in survey and assessment work on trochus (and/or other sessile marine invertebrate resources) and who have completed Week 1. Week 2 will consist of two main elements:

— The comparison of field survey methods and the development of a standardised survey methodology for future use in Pacific Island trochus surveys;

— An experiment to intensively monitor the short-term effects of a mass release of trochus juveniles in a selected location. Juveniles will be provided for the purpose by the Vanuatu Government trochus hatchery. (Such experiments are essential if we are to correctly assess the usefulness of juvenile release programmes for fishery enhancement in the region.)

Week 3

This week will provide an opportunity for participants who have completed Weeks 1 and 2 to assist with an intensive field survey using the standardised methodology developed during Week 2. The survey will form part of Vanuatu's national trochus assessment programme and will therefore provide important support for trochus resource development and management in Vanuatu.

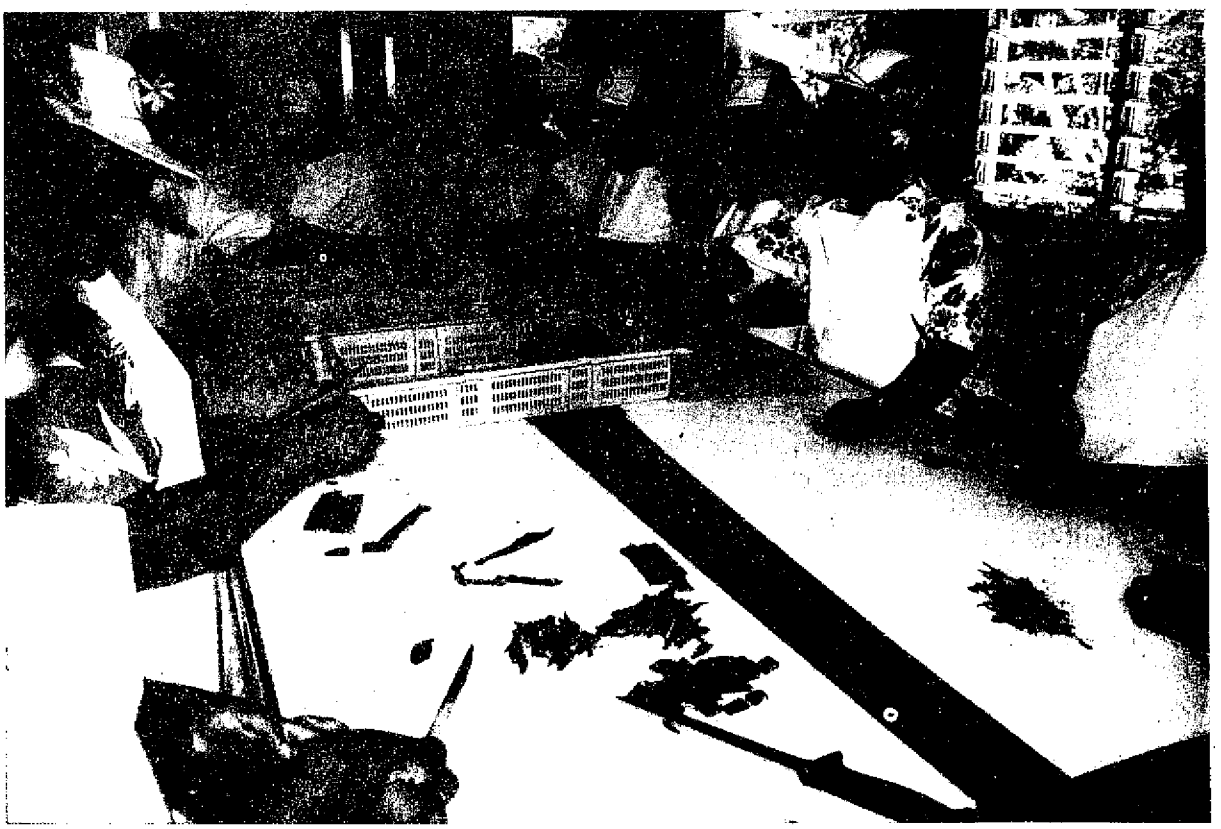
The overall aims of the workshop are to provide participants with a better understanding of all facets of the trochus industry, which, like other forms of trade with South-East Asia, can be complex and difficult for outsiders to understand fully: and to equip selected participants with the skills they need to carry out standardised and effective field work to assess and monitor changes in trochus resources, and the effects of management and development activities on them. Through these means we hope, over the long term, to assist Pacific Island governments improve the returns to their countries from trochus exploitation.

FISH HANDLING AND PROCESSING PROJECT

Kileva Fisheries

Tokelau is very hopeful that a new tuna product manufactured since October 1990 at Kileva Fisheries on the atoll of Atafu will excite the palates of many New Zealanders. This snack-like product is presently undergoing marketing trials in Auckland with the assistance of the South Pacific Trade Office. The initial response has been encouraging.

The tuna, supplied daily by local fishermen, is chilled for a day or so, then processed under hygienic conditions in specially built facilities. The basic steps in processing are to loin the tuna and cut the flesh into long thin strips. The strips are then marinaded for about twelve hours in a specially formulated **teriyaki** style sauce. The tuna strips are removed, placed on mesh drying racks and put out in the sun to dry for one to one and a half days. The dried product is cut up into sticks, chunks, and bits'n'pieces, sealed in 200 g plastic packs, then packaged in cartons ready for shipping.



Dried tuna being cut up ready for packing

The product has many advantages over chilled or frozen products: it is easy to make; does not require expensive or complicated equipment; the product is preserved and therefore once properly packed can be stored at ambient temperatures; has a shelf-life of up to six months; and is light because most of the water has been removed thus reducing distribution costs. It is particularly suitable for isolated communities to make.

Technical advice on tuna processing and design of buildings, plus training for all the facility's staff, was provided by Steve Roberts, SPC's Fish Handling and Processing Officer, through a one-month assignment to Tokelau in October 1990. Tokelau utilised its Economic Development Fund allocation from the U.S. Tuna Treaty to finance buildings, equipment and materials.

The next few months will be important for Kileva Fisheries and the community on Atafu as they eagerly await the reaction of buyers in New Zealand to their unique and tasty tuna snack.

REGIONAL FISHERIES TRAINING PROJECT (RFTP)

UNDP/FAO/SPC Organisational Management Workshop for Senior Fisheries Officers

This workshop was run in Suva, Fiji from 26 November to 7 December 1990. It has raised considerable interest (most Regional Chief Fisheries Officers attended) and was a very useful exercise. An experienced team of three management consultants from the Queensland Department of Primary Industries ran the workshop.

Funding was supplied by the Commonwealth Secretariat, the United Nations Development Programme, the United Kingdom through the British Development Division in the Pacific and the Australian International Development Assistance Bureau.

Future Training Activities

Extension and Communication Skills Workshop

A three-week workshop for persons who will teach communication and extension skills to Pacific Island Fisheries Officers will be run in Port Vila (Vanuatu) from 18 February to 8 March 1991.

This workshop will be similar to the one that SPC ran in 1987. The 18 individuals trained on that occasion were not considered sufficient for many countries to continue effective training programmes in extension and communication for the fisheries sector. The course will be taught by three tutors: one of the original facilitators from the Queensland Department of Primary Industries, one Pacific Island participant in the first course and a specialist from Canada. Funding will be supplied by the International Centre for Ocean Development (ICOD).

The *Extension and Training Manual* which was drafted by the participants in the first 'train the trainers' course will be printed and circulated before the workshop. This manual is expected to be the main teaching material for participants to use in running their own in-country courses.

SPC human resource consultancy

Early in 1991, SPC will conduct a survey to assess, within the existing economic constraints of each country and fisheries department, the future personnel needs of fisheries administrations in the region in terms of qualifications, skills, level of competence and number of people. This information will be used to make recommendations which will assist countries, funding agencies and educational institutions to develop appropriate approaches and training which will endorse these needs.

This survey, funded by ICOD, will be undertaken by a team of four people: a Canadian consultant, the SPC Fisheries Education and Training Adviser, a Pacific Island consultant and the Director of the Institute of Marine Resources (IMR), University of the South Pacific.

1991 SPC/Nelson Polytechnic Pacific Island Fisheries Officers Course

The 12th SPC/Nelson Polytechnic Course will be held from 11 February to 19 July 1991. Two new subjects have been introduced into the course syllabus. They are *Echo sounding and fish finding* and *Bookkeeping and keeping accounts.*

As in 1990, the practical fishing module will be run in Fiji in conjunction with IMR. The 1991 SPC/Nelson Course will be funded by the New Zealand Government, the Commonwealth Secretariat, the Commonwealth Foundation, the French Government, UNDP and SPC.

Post-Harvest Training Project

Funding is still actively being sought for this project which is expected to commence no later than the middle of 1991, if funds are available.

Phase 1 of the project will be a six-week training course for selected participants. It will consist of technical training as well as extension/communication and adult teaching skills. Trainees on their return home will be expected to run their own in-country training course (Phase 2) and in this they will be assisted by the tutors and facilitators to the Phase 1 course.

Training Course for French Polynesia on Tuna Handling for Sashimi Export Market

SPC has been requested by the Etablissement pour la valorisation des activités aquacoles et maritimes to organise a tuna handling training course for local fishermen and staff of the company which starts exporting tuna to Japan. RFTP is actively seeking a tutor and teaching materials for this course, which is planned for mid-1991.

Revised directory of training opportunities

A draft *Directory of training opportunities* was circulated in 1986 during the Regional Technical Meeting on Fisheries. Funding has been obtained from ICOD to thoroughly revise the *Directory*, which will be printed and circulated early in 1991.

TUNA AND BILLFISH ASSESSMENT PROGRAMME

Regional Tuna Tagging Project (RTTP)

In its final month of charter, the *Te Tautai* moved to Kiribati waters during the first week of October and fished primarily near Tarawa and Maiana Bank. Yellowfin and skipjack schools were plentiful in these areas but baitfish were difficult to obtain and the schools did not respond well to chumming efforts. The project purchased several loads of cultured milkfish for use as bait from the Fisheries Division in Tarawa. Most of the tuna schools observed were feeding on ocean anchovy *Stolephorus punctifer* and were not interested in the cultured bait. Ten days were spent fishing in Kiribati; they resulted in a total of 800 tag releases, of which 156 were yellowfin and 644 were skipjack.

Four days were spent in Tuvalu at the end of the cruise, during which 36 yellowfin and 167 skipjack were released. Tuna schools sighted near Nukufetau and Funafuti were also feeding on *S. punctifer* and were difficult to catch.

RTTP Scientist, Kevin Bailey, releasing a tagged tuna

The first ten months of charter officially ended on 18 October with the *Te Tautai* arriving in Funafuti. SPC and NAFICOT planned to give the crew a well-deserved break of two months while the vessel underwent drydocking, maintenance and repairs in preparation for next year.

Third South Pacific Albacore Research Workshop

The Third South Pacific Albacore Research (SPAR) Workshop was held at SPC headquarters in Noumea, New Caledonia, from 9 to 12 October 1990. The workshop was attended by scientists and fisheries officers from American Samoa, Australia, the Republic of China, the Cook Islands, Fiji, France, French Polynesia, Japan, New Caledonia, New Zealand, Papua New Guinea, Solomon Islands, Tonga and the United States of America. Representatives from the South Pacific Forum Fisheries Agency, the Food and Agricultural Organization of the United Nations and the South Pacific Commission were also in attendance.

Participants at the workshop reviewed developments within the 1988–89 and 1989–90 albacore fisheries exploiting the South Pacific stock. Plans for the upcoming 1990–91 fisheries were also described. The agenda focused on developments and updates of information available since the Second Consultation on Arrangements for South Pacific Albacore Fisheries Management, held in Honiara, Solomon Islands, from 2 to 7 March 1990.

Third Consultation on Arrangements for South Pacific Albacore Fisheries Management

The Third Consultation on Arrangements for South Pacific Albacore Fisheries Management was held at SPC headquarters, Noumea, New Caledonia, from 17 to 20 October 1990. Representatives from American Samoa, Australia, Canada, China-Taiwan, the Cook Islands, the Federated States of Micronesia, Fiji, France (represented by French Polynesia, New Caledonia and Wallis and Futuna), Japan, Kiribati, the Republic of Korea, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Solomon Islands, Tonga, Tuvalu, the United States of America, Vanuatu, Western Samoa, the South Pacific Forum Fisheries Agency and the South Pacific Commission met to discuss recent developments in South Pacific albacore fisheries and management arrangements for the species.

National statements were presented on behalf of China-Taiwan, France, the Republic of Korea, Japan, New Zealand, the United States, and the Pacific States and Territories. Accompanying the national statement from Japan was a draft entitled *An international convention for the conservation, management and optimal utilisation of the South Pacific albacore stock.* The statement on behalf of Pacific states and territories included a document entitled *Possible draft arrangements relating to the management of South Pacific albacore.* The Chairman of the Third South Pacific Albacore Research Workshop, which took place at SPC headquarters just prior to the consultation, presented a report of the Workshop.

In the closing statement on behalf of Pacific delegations, the areas on which positions expressed during the consultation were widely divergent were listed, as follows:

— the driftnet fishing issue;

— a fair balance between the rights of coastal states and distant-water fishing nations;

— decision-making procedures;

— the scope and membership of the management arrangement;

— the functions of the management body;

— the use of existing regional institutions;

— a high seas observation and inspection scheme;

— the dispute settlement mechanism; and

— the legal form of the arrangement.

The points on which there may have been some general agreement were noted in the closing statement by Pacific delegations as follows:

— All South Pacific coastal states and territories have a legitimate interest in participating in the management arrangement;

— Existing regional organisations have a role to play in the management arrangement;

— All participants in the management should provide relevant scientific data in a timely fashion; and

— The principle of flag state responsibility is an important consideration in the management arrangement.

NEWS FROM IN AND AROUND THE REGION

MARSHALL ISLANDS: FISHERIES DEVELOPMENT PROJECT
(Source: Asian Development Bank)

The development of the fisheries sector in the Marshall Islands will be supported by a US$ 100,000 technical assistance grant approved recently by the Asian Development Bank.

The objectives of the technical assistance are to undertake an assessment of the country's fisheries resources, to examine past, ongoing and further development of the sector and to prepare the first phase of a Fisheries Development Project.

The Project is designed to meet the Government's development goals to increase employment and incomes, reduce imports and increase foreign exchange earnings. It is expected to provide improved fishing gear and vessels, infrastructure and marketing services and institutional strengthening to support the expansion of private sector fishing for artisanal and commercial fishermen.

Under the technical assistance grant, consultant services of a fisheries/project economist and a fisheries specialist are being provided.

FIJI SHRIMP FARM GETS NEW LEASE OF LIFE
(Source: *Infofish International*)

An Australian firm has invested over F$ 1 million in its Fijian subsidiary to upgrade and reorganise a shrimp farm which went into receivership in 1988 and shut down in 1989. The farm, located on the main island of Viti Levu, will go into full production after the completion of major reconstruction work on the 25 ha of ponds to facilitate improved management.

The farm has already started supplying the local market, mainly for the tourism industry, which will absorb 30 tonnes per year, while the balance of production will be exported to New Zealand, Australia and perhaps the United States.

NEW SEAFOOD AIRFREIGHT GUIDELINES
(Source: *Professional Fishermen*)

Australian Cargo has recently issued a revised edition of the publication *Specifications for the carriage of seafoods by air* which will make it easier and safer for seafood shippers to transport their product by air.

The reasoning behind the revision of the guidelines goes back some time. Before August 1988, Australian Cargo was a major transporter of seafood. However constant and on-going spillage within the cargo holds of aircraft reached a point where the cost of repairing corrosion damage plus the loss of revenue due to aircraft downtime became prohibitive.

As a consequence, the airline was forced to place an embargo on the carriage of seafood. This was both disruptive and inconvenient to the seafood industry, as well as curtailing a major source of revenue to Australian Cargo. In an effort to solve these problems, Australian Cargo has formulated a procedure which it believes will eradicate future spillages.

The revised guidelines now contain a section listing in detail the minimum performance standards for various packaging methods and materials and a list of recognised testing authorities through which these standards can be verified.

Once a packaging manufacturer or shipper has had a preferred pack tested to the required standards, it can submit a written report to the Airlines Engineering Department which will then issue a registered number to the pack and add the number to a register of approved packages.

In this way, when a shipper submits an approved and suitably marked pack for shipment by air, there will now be no constraints on its uplift, no delay in its movements, and the product will arrive at its destination in optimum condition.

TWO FOR TONGA

(Source: *Fishing News International*)

Tonga is to build up its tuna fishing industry with loans totalling US$ 3.17 million from the Asian Development Bank (ADB) based in the Philippines.

The money will be used to buy two tuna longliners for the recently-established Sea Star Fishing Co. Ltd. (SSFCL), which is a public limited company funded by private and government equity. The interest-free loan to the Kingdom of Tonga will be repaid over 40 years, with a ten-year grace period, and a one per cent annual service charge.

The Asian Development Bank outlined the following points:

— Tonga's rich fishing grounds lie in the centre of a major north-south migratory path of tuna in the South Pacific. In 1981, the Government of Tonga acquired its first steel-hulled longline fishing vessel to begin developing the tuna fishing industry.

— Along with its fish-catching operations, which have been making profits in recent years, the vessel has, over the year, trained about 100 crew members in tuna fishing operations, established the viability of tuna longlining in Tonga and generated useful information on catch rates and composition.

— The government now seeks to expand existing longline operations by establishing a commercial tuna fleet. To handle these operations, it recently established the SSFCL.

— The objective of the ADB loan is to assist the government in developing the fisheries sub-sector, which has potential for substantial growth. The benefits of the project will be additional income and employment, foreign exchange earnings and new investment opportunities in related activities.

— The loan will finance construction of two additional steel-hulled longliners and various shore facilities, including a small office building, warehouse and workshop. Also provided will be equipment, furniture, vessel spare parts and vehicles. A consulting naval architect will be hired to review engineering design, oversee procurement and supervise vessel construction.

This four-year project will be carried out at Faua Harbor.

FIJI TUNA BOAT OPERATES IN SOLOMONS WATERS

(Source: *The South Sea Digest*)

Ika 9, the first Fiji pole-and-line tuna boat to fish outside Fiji waters, left Fiji at the end of October to fish for skipjack tuna in Solomon Islands waters under an agreement between the Ika Corporation Ltd., of Fiji, and National Fisheries Development Ltd., of Solomon Islands. Ika Corporation's general manager Penisoni Usumaki said that, by fishing in the Solomons during Fiji's off-season, Ika was able to extend its tuna-catching season by up to six months.

BUSINESS BRIEFS FROM FEDERATED STATES OF MICRONESIA

(Source: *Pacific Magazine*)

Chuuk (Truk) has the largest population (about 50,000) among the states in the Federated States of Micronesia (FSM), in a tiny land area of some 50 square miles. Consequently, the 1,000-people-per-square mile of land have significant economic problems. To earn revenue and create employment opportunities, the government is trying to use its most valued natural resource—the sea.

A fisheries joint venture between Chuuk and the National Fisheries Corporation of FSM was established in July 1990. The Chuuk Fresh Tuna Inc. will build and operate a multi-million dollar long-line fishing facility on Weno in Chuuk Lagoon to supply and service local and foreign vessels.

Construction has started on a US$ 5 million fish processing operation on Takatik Island off Pohnpei. When completed in early 1992, the plant will be supplied by Taiwanese and Japanese fishing craft that are now exporting to Guam, Honolulu and Tokyo, as well as four 32-foot state-run reef fishing vessels.

The plant will have the capacity to process more than 7,000 tonnes of fish a year. It is adjacent to the Mobil Oil tank farm on the site of the dismantled State Marine Resources building.

JICA INVESTS IN COASTAL FISHERIES DEVELOPMENT

(Source: *Fiji Times*)

In 1984, an agreement was signed between the Government of Japan and Papua New Guinea (PNG) to run a regional training course in coastal fisheries development.

Recognising the importance of the fisheries resources development in PNG and the South Pacific as a whole, the programme was set up and is now being carried out jointly by the University of Papua New Guinea (UPNG) and the Japan International Cooperation Agency (JICA).

Since 1984, six courses have been conducted, with 80 participants taking part. South Pacific countries like Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Palau, Solomon Islands, Tonga, Vanuatu and Western Samoa have participated in the past. Between 18 November and 13 December 1990, 16 fisheries extension officers were in Port Moresby and Kavieng to participate in the seventh regional training course.

JICA spent K 68,000 for the 1990 course and, according to its director, Mr Okazaki, there were more participants than in the previous year. Under the agreement signed in 1984, UPNG is to provide and arrange training curriculum, teaching staff, training facilities and accommodation for participants, secretarial staff and others.

Between 1984 and 1989, a total of K 517,000 was spent by JICA to run the annual courses. Topics for discussion during the 1990 seminar include fishing gear for coastal fisheries, small-scale line fishing, deep handline fishing, fish identification, troll line fishing, tuna fishing and other topics. The participants will travel to Kavieng where they will study the work being done by the Kavieng Fisheries College, as part of the fishing course. Mr Okazaki said the courses were part of a five-year programme in educating and training fisheries officers on methods and issues involved in coastal fisheries.

JICA has been in PNG for some time now, assisting in technical co-operation and training of PNG citizens and other Pacific Islanders in different fields of activity.

FIRST TUNA SHIPMENT TO JAPAN
(Source: *Marshall Islands Journal*)

The long-awaited commencement of tuna airfreight shipments from the Marshall Islands to Japan began in December 1990 with the successful delivery of 1,200 kg of yellowfin tuna.

The fish, which were caught over a seven-day period by the crew of the Majuro-registered *Crescent*, received a high quality rating, according to Ricky Gonzales, secretary of Trans Pacific Enterprises Ltd. He added that marlin, sailfish, wahoo and mahi mahi were also caught by the boat in its first trial operation. These species were used for local market consumption.

Gonzales explained that the trans-shipment of quality grade tuna through Honolulu required a high degree of co-ordination of the fishing enterprise and the airline. 'We pack the fish in special fish boxes and band the boxes', he said.

'The cartons are wax-lined to prevent leakage. The fish are never frozen. We keep them in an ice-cold brine solution on board, and after the fish are cleaned, we stuff ice gel in the stomach cavity and in the mouth to preserve the freshness during air shipment', he said.

Since the amount of ice gel necessary depends on the length of time anticipated for delivery to market, good airline connections permit the shipper to use less gel and save on the airfreight bill. The cost of the first shipment was just over US$ 2,000, and included the cost through Japan.

Gonzales explained he was quite happy with the results of this first shipment, but he is now concerned by the rate they paid. He paid a general commodity rate and he felt they should receive a specific commodity rate that applies to seafood (generally the specific commodity rate is lower than the general cargo rate).

He added that his company was looking into the possibility of shipping from the Marshalls directly through Guam, depending on the availability of an immediate connection in Guam for Japan.

The *Crescent* can hold up to 19 tonnes of fish, and until the boat produces at a maximum, Trans Pacific will be considering expanding their fleet to include other boats. Aside from concern about the current air-freight rate, Gonzales also said he was aware of a problem with his company's use of the new fishing base at the main dock area. 'Right now we are storing our baitfish in the fishing base but the government has a notice on the front of the office there that says control of the base is reserved for the new fishing venture organised out of Hawaii.'(The new fishing company, a combination of government and private ownership, had five boats scheduled to arrive in Majuro the first week of December 1990. Due to storm activity, several of the boats returned to Honolulu.)

'We have been informed that we will have to remove our bait from storage in the fishing base and we won't know where to store it', said Gonzales. He added that perhaps the Government

was not aware that other fishing companies would be operating here and should consider making some of the facilities available to all fishermen, not just one company.

Mike Mehau, who represents the Hawaii-based venture, said he knew that the company was storing bait there, but had been informed that it would be removed. According to Mehau, the space will be needed for the anticipated arrival of bait from their own boats.

The beginning of large-scale air-freight tuna shipments from Majuro was given as the reason for the increase of four flights weekly in the Honolulu service by Air Marshall Islands in the first week of December 1990. The fact that the two industries will require a high degree of co-ordination in working together is obvious. But it is also apparent that the fishermen themselves, as companies, will also have to work things out together if the Marshalls want to maximise yield and guarantee fair use of the existing infrastructure.

JAPAN MOVES FARMS TO SEA
(Source: *Fishing News International*)

Japan plans to boost its fish supplies by 200,000 tonnes a year by farming fish in floating cages in more exposed locations at sea.

The trend is to withdraw from the sheltered, but overcrowded, bays and to farm fish in floating cages based at exposed open-sea locations where conditions are better for healthy fish growth.

A pilot project is being carried out with sophisticated Marino-Forum 21 cage-farm service platforms. These platforms, which have been financed by the central and regional governments, could be the first of many such structures to be located around the Japanese coast over the next few years. They are designed to withstand seven to ten metre high waves and the first platforms are equipped with computerised feeding systems. The feed is delivered to the nearby floating cages through hoses.

Advanced Furuno sonars and underwater camera systems monitor the behaviour of the fish and the cage nets. A third service platform will be placed in position off the island of Hokkaido in 1991 and, if the results from the first facilities are positive, it is estimated that as many as 100 such platforms—each serving 20 cages—could be deployed over the next few years.

With each location capable of rearing to harvest up to 2,000 tonnes of fish yearly, this could boost Japan's output of yellowtail, red sea bream, coho salmon and other species by 200,000 tonnes a year. This would create a significant demand for meal as feed, which could be supplied by commercial vessels.

According to Joergin Gunnarsson, of Hi-Seas P/F, the main distributor in Europe of Bridgestone fish cages, this project is the most advanced and exciting fish farming project in the world.

POHNPEI FINDS FISHING HAS A FUTURE
(Source: *Islands Business*)

Pohnpei was the first state in the Federated States of Micronesia (FSM) to enter a joint venture with an Australian fishing company, Kailis and France. Then the Pohnpei legislature agreed to fund three purse seiners at a cost of more than US$ 11 million. In addition, almost 20 Japanese and Taiwanese longline fishing boats are based in Pohnpei. The numbers are expected to jump dramatically, according to Micronesian Maritime Authority Director Peter Sitan. Pohnpeians are now trans-shipping these fish catches of yellowfin to Japan, Hawaii and Guam.

The other states in FSM smell the business potential in fisheries and are moving to establish their own trans-shipment facilities. According to Peter Sitan, the FSM government tries to open the door for development and let the development agencies in each state look after the details. As the number of locally-owned boats increases, as with the Pohnpei-Australian joint venture, and more foreign boats base themselves in the islands, Sitan says the government will phase down the number of licences granted to operators who do not have a local connection. Already, the Federated States of Micronesia has told Taiwan and South Korea to cut their fleets in the Federated States by 20 per cent as a precaution against over-fishing, he says.

Meanwhile, Pohnpei's trans-shipment operation is working with expansion in the offing. At the rear of the dock side freezer/storage plant in Pohnpei, a tuna processing plant is in the early building stages. Being built by a Danish firm, it will open in February 1992.

The director of Pohnpei State's Economic Development Authority, Pedro Harris, said it may take time to find the 'critical mass' needed to make a trans-shipment operation work smoothly. The Pohnpei operation is shipping out 17 tons of yellowfin a week, but Harris believes they could triple it if they had the air-freight service.

Tuna landed in Pohnpei before being flown on to the markets of Japan

Currently, the freezer/trans-shipment operation employs about 30 people, and the number is likely to be more than double this when the tuna processing plant opens in 1992. Harris says that he intends to develop it slowly, taking each step in turn. When the plant opens for loining and filleting tuna, it will work at about 50 per cent of its capacity.

'The business side says we should go full blast when we open, to maximise profits', he says. 'But in an environment like this, to process 15 to 20 tonnes of tuna a day, we would probably stumble over.' Harris says it will take about four years to get up a full operation. The logistics are problematic, and there is no guarantee they will improve overnight. In mid-September 1990, Continental/Air Micronesia—the only air carrier that services Pohnpei—had a combination of plane breakdowns and heavy passenger loads. This prevented the airlift of tuna for more than 10 days, Harris says. He was trying to get 55 tonnes out of the holds of foreign fishing vessels anchored off Pohnpei harbour and onto the planes to Japan.

Can the four states establish their own trans-shipment facilities in such close proximity to each other? Says Harris,'There is room to develop them in the four states because when you consider the scale achievable, it's such a minuscule part of the world's production. Anyway, in this region, fish is going to be the major thing; if the economies are going to develop, it will be in fisheries.'

JAPAN WELCOMES AUSTRALIAN IMPORTS

(Source: *Australian Fisheries*)

Japan's resolute commitment to expand imports under new measures announced recently offered Australian exporters their best opportunity yet to target the lucrative Japanese market, the managing director of the Japan External Trade Organization's (JETRO) Sydney office, Mr Yasuhiro Tashiro, said recently.

The Japanese Government has introduced a comprehensive package of import expansion programmes, which seek to be a mirror image of previous export-oriented policies. The programmes are designed to make Japan an 'import superpower', by stimulating imports into Japan. They include elimination of tariffs, tax incentives for manufactured imports, an expanded budget for import promotion, and the expansion of import loans programmes.

Elimination of tariffs

Japan has expanded the list of duty-free manufactured products, eliminating tariffs on 1,004 manufactured items and reducing tariffs on four more. A drawback system, which returns to importers duties paid on items imported into Japan and then re-exported, has also been set up.

Tax incentives

Manufacturers based in Japan who increase their value of qualified imports by ten per cent or more, compared with their most recent highest year, will receive a tax credit equal to five per cent of the increase, or ten to twenty per cent additional depreciation on eligible machinery and equipment. Wholesalers and retailers are allowed to build reserves to fund the marketing of imported products.

Expanded budget for import promotion

Aggressive steps to stimulate grassroots interest in imports are being taken throughout Japan. Funding for these measures jumped to a total of 14.5 billion yen (about A$ 130 million). Major items in the new budget include the following programmes undertaken in co-operation with government authorities in exporting countries:

— a computerised information network linking Local Internationalisation Centres (see next page) in every Japanese prefecture;

— support for import-buying missions from Japan and export sales missions from abroad;

— sending experts to exporting countries to search for products with potential in the Japanese market; and

— pilot projects aimed at establishing comprehensive import promotion centres in Japan.

Expansion of import loans programmes

Four major public financial institutions, including the Export-Import Bank of Japan and the Japan Development Bank, now offer low-interest loans to encourage imports. Formerly restricted to companies based in Japan, some of these loans are now being offered to companies based outside Japan. These loans feature very attractive rates and will make available 220 billion yen (about A$ 1.9 billion) to fund expanded imports.

How JETRO can help?

JETRO was set up in 1958 to encourage the development of Japan's overseas trade. Now, JETRO's mission is to encourage imports, facilitating industrial co-operation with other countries and promoting technical and capital exchanges across national borders.

Research reports, case studies and other publications that provide the facts and hints that a company exporting to Japan needs to succeed are all available from JETRO. Consulting, language and logistical services are also provided to simplify entry into the Japanese market.

Computer network link

JETRO is currently creating a computer network that links Local Internationalisation Centres throughout Japan with the central database at JETRO headquarters in Tokyo. It will also be directly linked to 35 JETRO offices overseas, including Sydney, Melbourne and Perth.

This network will offer information on overseas companies and the products they produce to consumers and companies inside Japan. Australian companies with potential export products can use the system to alert potential business partners to what they have to sell. The system also offers a contact list of 20,000 importers, as well as comprehensive data on agents and trading companies, trade fairs and exhibitions.

Trade experts

JETRO also oversees Japanese Government programmes which send experts abroad to find products with strong import expansion potential. A specialist was sent to Australia in August 1990 for a one-year stay, and was actively looking for opportunities to work closely with public and private trade organisations. Another expert has been sent to Australia for a two- or three-month stay to identify products with good sales potential for small and medium-sized Japanese distributors.

Study programmes

In March 1990, three business and trade experts from Australia were invited to Japan under the First Export to Japan Study Programme. Their aim was to study the Japanese market, meet with specialists, visit facilities and gain a first-hand knowledge of what was needed to export

successfully to Japan. During 1990, a further 200 individuals from countries including Australia were invited to participate in similar programmes.

Sales and buying missions

JETRO is currently working with the Australian Federal and State Governments and trade promotion agencies to providing support for Australian selling missions in Japan. During 1990, it helped Japanese trade associations send trade buying missions to Australia to purchase products at trade fairs and to visit nearby factories.

Import promotion

During 1990, JETRO staged import promotion exhibitions in three Japanese cities. These exhibitions introduced imported products to consumers and distributors, and provided opportunities to distribute samples and engage in business negotiations.

BLUEFIN TUNA HANDLING COURSE

(Source: *Fishing Industry Board Newsletter*)

The New Zealand Fishing Industry Training Council is planning to run a further series of the successful Southern Bluefin Tuna Handling Courses. This detailed training course has been designed to teach New Zealand fishermen the ways and means of producing high quality fresh chilled and frozen southern bluefin for sale on the Japanese sashimi market. Because the fish is sold by auction to discerning Japanese buyers, the price is very much dependent on quality. Conclusive evidence shows that tuna caught by fishermen who have completed this course fetches premium prices. At the other end of the scale, fish caught and handled by untrained operators results in a price which may not even cover the cost of freighting the product to Japan.

Obviously, fish of the highest quality is essential. This can only be achieved through proper care and handling during the cycle from catching to processing to exporting. The course will cover the correct techniques for landing the fish, bleeding and cleaning, stowing, unloading, and packaging for exporting.

An increase in the number of fishermen interested in catching these tuna has resulted in the need to offer this course. Courses will be run in Tauranga and Nelson.

PRELIMINARY TALKS ON SOUTH PACIFIC FISHERIES ACCESS FOR EUROPEAN COMMUNITY VESSELS

(Source: Forum Fisheries Agency)

A delegation from the South Pacific, comprising Forum Fisheries Agency (FFA) Director Mr Phillip Muller and Mr Joseph Gabut of Papua New Guinea visited the Commission of the European Communities (EC) in Brussels on 24 and 25 September, for preliminary talks on possible access to the region for EC flag vessels. EC tuna fleets are dominated by Spanish and French flag vessels, fishing longline and purse seine.

EC officials outlined the general terms and conditions applicable under the 18 existing bilateral arrangements the Community has with ACP states, and emphasised the keen interest of Mr Manuel Marin, Vice-President of the Commission of the European Communities and Commissioner for Development and Fisheries, in the possibility of European vessels gaining access to the tuna resources in the South Pacific. The South Pacific delegation discussed terms

and conditions that would probably apply for access to the Forum region. The South Pacific delegation promoted possibilities of investment in the fisheries sectors of South Pacific countries, joint ventures, technology transfer, fish processing and fisheries trade matters.

EC officials expressed interest on behalf of EC member states in entering into formal access talks, but stated that information was lacking on South Pacific fisheries, in particular with regard to the extent of the resource, available shore facilities, and existing fishing activities and patterns. The South Pacific delegation suggested that such information could be readily made available for interested EC member states and fishing industry interests to determine the viability of entering into formal access talks. The South Pacific delegation suggested a fact-finding mission be undertaken by EC government and industry officials to the region to evaluate first-hand the region's tuna fishing potential.

While the EC realises the potential of tuna fishing in the Forum region, there is scope for bilateral arrangements for investment in the fishing sector that could enhance the attractiveness of basing an EC tuna fleet here. Although no agreement was reached on scheduling of negotiations, an EC regional programming mission was due to visit the South Pacific later in 1990.

TUNA CANNERIES CLOSED IN PUERTO RICO
(Source: Forum Fisheries Agency)

Two canneries in Puerto Rico have closed down and the U.S. tuna canning industry appears to be facing a critical situation. In July 1990, the Van Camp plant was closed down, to be followed by Neptune a month later. Van Camp was bought by a large Indonesian corporation, P.T. Mantrust, in 1988 and it is possible that the Puerto Rico plant capacity has been transferred to the Mantrust cannery in Bali.

With the closure of the two canneries, three companies are left in operation in the United States—Starkist, Bumble Bee, and Mitsubishi Foods.

The sharp increase in imports of canned tuna from South-east Asia (where labour costs are low); the possible removal of preferential treatment, e.g the exemption of Federal tax on investment profits applied to tuna canneries in Puerto Rico; the tuna fishing operations in the eastern Pacific, the principal fishing ground; and the tuna—dolphin problem contributed to the closure of the canning plants. Imported canned tuna comprised 29 per cent of the total U.S. canned tuna supply in 1988. This share increased to 33.6 per cent in 1989.

FISHERIES SCIENCE AND TECHNOLOGY

LOW-COST COMPUTERISED FISHERIES LIBRARY AVAILABLE SOON
(Source: ICLARM News Release)

Scientific information on tropical aquatic animals will be soon at the fingertips of researchers in developing countries through a low-cost computerised data library, called FISHBASE, now being developed in the Philippines.

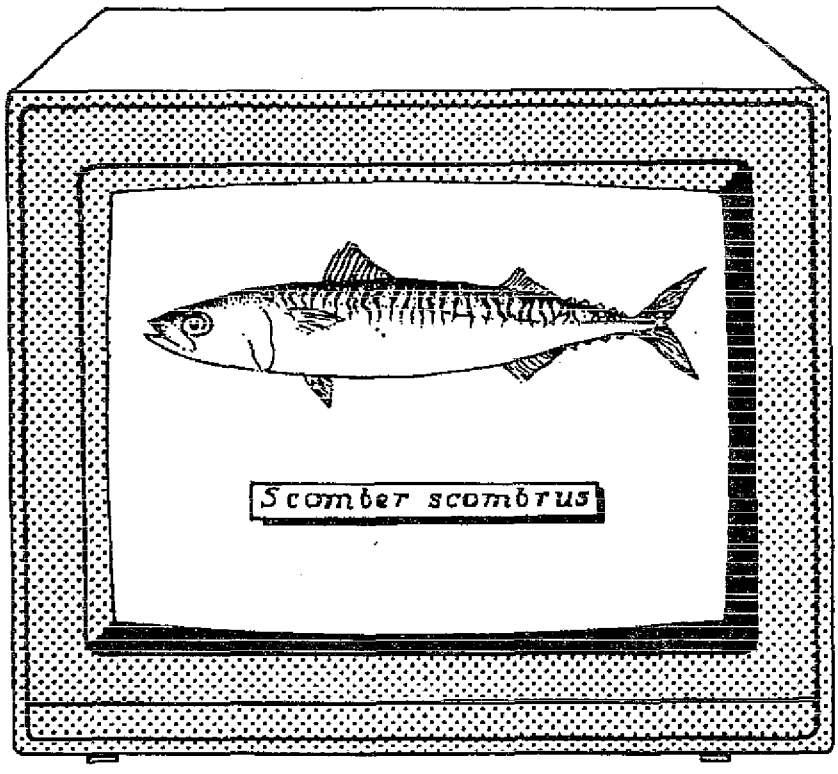
FISHBASE can replace costly reference books in fisheries libraries of developing countries. The large databank describes all major groups of aquatic animals important to the tropics, namely finfish, crustaceans and molluscs.

This user-friendly computer library features full-colour pictures of these animals (for easy identification), distribution maps and quick access to information on the habitats, population

structure and reproduction, aquaculture and diseases of over 2,000 different species. It also lets users compare species groups or geographical areas.

FISHBASE runs on low-cost IBM-compatible micro-computers. It is being developed by the Philippine-based International Center for Living Aquatic Resources Management (ICLARM) in collaboration with the Food and Agriculture Organization of the United Nations and the Commission for the European Communities. The first version of FISHBASE will be ready in 1991.

For more information, contact ICLARM, MC P.O. Box 1501, Makati, Metro Manila 1299, Philippines.



The full-colour images in FISHBASE, a new low-cost computer program, help researchers identify and compare over 2,000 different species of tropical aquatic animals.

EMERGENCY RADIO PROCEDURES

(Source: *Fishing News International*)

The last in a series of six video tapes has been released in the United States as part of the internationally-recognised Marine Survival Equipment Training Program.

Named *Emergency radio procedures*, the video demonstrates the proper use of radio communications equipment during an emergency at sea. The programme simulates both ends of the distress communication — the skipper's Mayday and the Coast Guard response.

It covers various parts of the process, including the search and rescue system, VHF and single-sideband radios, designated distress frequencies, picking the best channel, what to do when a Mayday is received, making a Mayday call, and what happens when it is received by the Coast Guard.

The programme is added to five other 12- to 17-minute videos named *Inflatable life rafts, Immersion suits, EPIRBs, Visual distress signals* and *Personal flotation.*

A SIMPLE EMERGENCY SAIL RIG FOR SMALL FISHING BOATS

(Source: Robert Gillett — FAO/UNDP Regional Fishery Support Programme)

In traditional times all Pacific Islands sailing craft were propelled by sail, paddle, or pole. In the past few decades many of the fishing fleets have become engine-powered. This mechanisation has sometimes enabled fishermen to land more fish, catch previously under-exploited species, reduce the time necessary for a fishing trip, or improve the quality of the catch. The use of engines, however, has resulted in an increased number of boating accidents. It is a fairly common occurrence for fishermen in small boats to develop engine problems offshore. Without a secondary means of propulsion, disabled boats will often drift away. Their crews far too frequently never return.

It is generally recognised that small motor boats should never venture out of the lagoon into the open ocean relying on only one outboard engine. Carrying a second outboard engine certainly helps prevent accidents, but it is not the perfect solution; if the second outboard is seldom used, it may not be mechanically reliable. Also, if the cause of the primary outboard not functioning is lack of fuel, a second outboard will not help. Furthermore, many fishermen may have difficulty in paying for an additional engine.

For these reasons, in many cases a simple emergency sail may be the best means of secondary propulsion for outboard-powered fishing craft.

In June and July 1990, the United Nations Regional Fishery Support Programme sponsored some work in Kiribati on the development of an emergency sail appropriate for small fishing boats. A consultant boatbuilder, Mike Savins, designed, tested and demonstrated a simple sail rig which could be adapted for use on fibreglass, wood or aluminium boats 4.5 to 8 metres in length.

The arrangement consists of a sail, supporting spars, and a rudder. This gear can be stored in a small amount of space until actually needed. The trials in Kiribati have indicated that a boat using the emergency rig can sail about 75 degrees off the wind — not enough to win a yacht race but enough to crawl back to land after an outboard engine has failed. The estimated cost of the materials used to make the sail, spars, and rudder is between US$ 200 and US$ 300 depending on the choice of sailcloth.

The United Nations Regional Fishery Support Programme will be issuing a booklet of easy-to-follow instructions and plans for making the emergency sail rig.

AQUACULTURED TUNA ?

(Source: *Infofish International*)

Japanese scientists are exploring the possibility of fattening Southern bluefin tuna in sea cages at Port Lincoln, South Australia. According to a spokesman of the Australian Fisheries Service, the plan only involves the grow-out of immature tuna to commercial size and does not include breeding or spawning in captivity.

The fish will be caught while small and transferred to pools or cages where they will be kept and fed until marketable size is reached. The crucial part of the operation is expected to be catching the tuna and transferring them to the farm site without undue trauma, but this has already been accomplished in an experimental exercise.

MARINE LEATHER: A CHANCE TO EARN TWO SOURCES OF INCOME FROM ONE FISH

(Source: *Australian Fisheries*)

Being fairly new, fish leather has attracted an enormous amount of interest on the world market, especially at fashion shows. It provides an exotic alternative leather to that made from the skins of endangered species such as crocodiles, lizards and snakes.

Perth-based company Neptune Leather started manufacturing marine leather in 1986. According to director Peter Lewis, they have developed a tanning methodology that produces some of the best fish leather in the world. This assertion has been supported by the company's performance at fashion fairs in Hong Kong and Paris, where their leather was widely acclaimed.

'There is a keen demand for this type of exotic leather', Mr Lewis said. 'But everyone is aware of the need not to see animals killed purely for their skins. That's why fish leather is such a great alternative. It is a by-product. We are using something that would otherwise be thrown away, and we are turning it into a valuable product and an export earner for the country.'

Marine leather has two unique qualities which make it suitable for a large variety of applications: it is very strong and it has an interesting pattern. Crocodile and snake skin were also popular for these reasons, but have now become less attractive as people turn away from the idea of killing an animal solely for its hide.

Marine leather is currently being used in a wide variety of applications, including fashion garments such as jackets and dresses, leather accessories, office furniture and footwear. Other products are also sure to appear, as marine leather becomes more widely accepted. Neptune Leather is currently developing a range of accessory items aimed at the Australian market which are proving popular with tourists as an alternative to plastic kangaroos and koalas.

Which fish?

Not all fish can be used successfully to make marine leather. Barramundi is currently the most popular fish because of the strength and texture of its skin, as well as its distinctly Australian background, which appeals to buyers on the international market.

But there is a market for other species. Peter Lewis is looking at a range of fish, and has already tried snapper, with some success. The Townsville-based Serpentine Leathers company has also had success with salmon and sweetlip. One of the main requirements is that the fish themselves be fairly large with large scales.

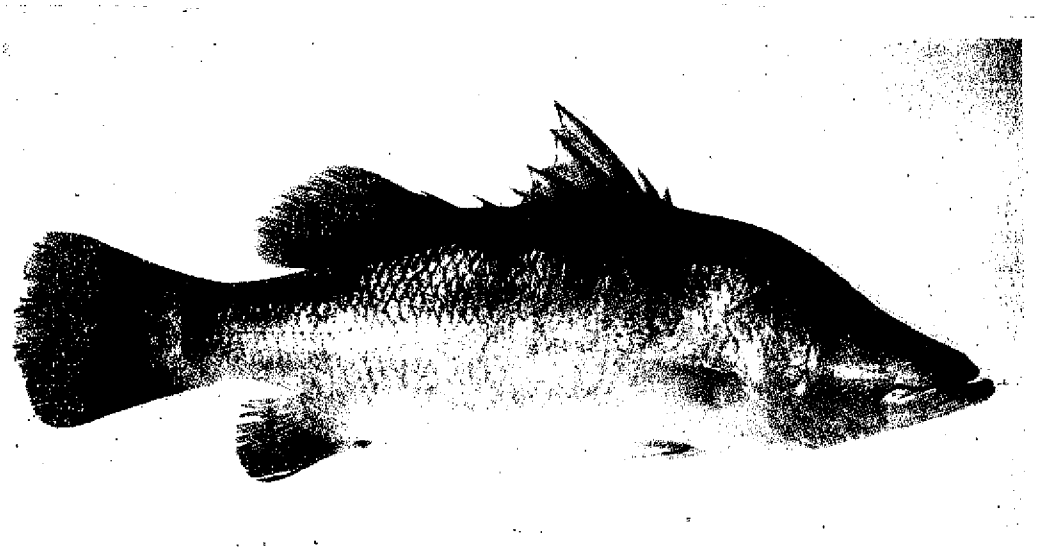
'Fish with small scale pockets don't make an attractive finished product', said Serpentine Leathers director Laurie Morris. 'We look for fish which have large scale pockets because these create an interesting patterned leather'.

Mr Morris was a fisherman for 23 years before he decided to go into the business of marine leather in 1987. He originally started out tanning sea snake, but the environmental implications associated with using this species made him turn to fish. He now concentrates on barramundi, salmon and sweetlip, trying to generate interest on both the international and domestic markets.

A great opportunity

The interesting thing about the marine leather industry is that it has one foot in the fishing world and the other firmly planted in the money-spinning world of fashion. This has significant implications for fishermen, offering them the potential to earn two sources of income from one fish — one from the flesh and the other from the skin.

Both Peter Lewis and Laurie Morris believe that fish leather is no longer a gimmick, that it is now a solid industry, and one that is gaining popularity. 'I've been promoting fish leather for almost three years, at great personal expense', said Laurie Morris. 'I put all my life savings into this business. But now, it is generating interest in Australia and around the world. The environmental concern over using the hides of kangaroos, crocodiles, emus and snakes means that a lot of the world is looking for a leather that is environmentally acceptable. Fish leather is one answer.'



The barramundi (*Lates calcarifer*), one of the species used to make marine leather

Ready buyers

Both Peter Lewis and Laurie Morris are ready buyers for good quality fish skins. What they look for are skins that:

— have been properly fleshed;
— have no holes; and
— have a reasonably sized scale pocket.

Laurie's advice to fishermen wanting to sell skins is to look after them, treating them as you would the flesh. 'Don't leave them lying around the deck where they can get bacteria on them, that's the main thing. Fishermen should have two trays — one for fillets and one for skins — and the skins should be frozen as quickly as possible', he said.

There are no special packaging requirements, as, once frozen, the fish skin is fairly durable. However, it is important to get as much of the flesh off as possible, leaving the scales on.

Serpentine Leathers pay A$ 2 per kilo for most skins. The skins are then chemically treated to remove the scales, which represent about 50 per cent of the weight.

TUNA IN THE 1990s
(Source: *Infofish International*)

Economic affluence during the past decade set the trend in many urban communities for an appreciation of **sushi**. Simultaneously, overwhelming health consciousness created a definite trend towards the consumption of fish in one form or another. Throughout the world, both trends focused on tuna as a staple. Following an inevitable boom, how should the industry anticipate the forthcoming decade?

Many developments have occurred within the industry since the first Tuna Trade Conference organised by INFOFISH in February 1986. Of total world fishery production, tuna accounts for only three per cent. However, it has always been a product immersed in controversies—legal, conservationist, environmental, humanitarian as well as commercial.

At present, the Japanese industry is facing difficulties in coping with the dwindling stocks of some particularly prized species. In an effort to prevent the destruction of marine mammals, U.S. authorities have imposed strict measures affecting tuna fishing.

During the 1980s, developing countries established a secure foothold in the industry. Thailand became the leading producer of canned tuna, with Indonesia and the Philippines not far behind. In an unprecedented move, an Indonesian canning company acquired the second largest U.S. tuna company, thus securing a marketing channel for its production. Such initiative prompted a Thai canning company to acquire another major U.S. counterpart, once again linking production with marketing. Yet another recent development has been the increased trading of semi-processed tuna instead of frozen whole tuna.

Altogether, the tuna industry experienced phenomenal growth in the 1980s:

— World-wide landings rose from 1.7 million tonnes in 1979 to more than 2.5 million tonnes in 1989;

— Exports of fresh and frozen tuna increased from 500,000 tonnes in 1980 to 980,000 tonnes in 1988;

— Exports of canned tuna increased from 116,000 tonnes to 393,000 tonnes during 1980—88;

— Production of **katsuobushi** in Japan reached 37,000 tonnes in 1988, an increase of 68 per cent compared to 1980;

— U.S. imports of canned tuna increased from about 30,000 tonnes during the end-1970s to some 347,000 tonnes by 1989, thus maintaining the United States' status as the largest consumer of canned tuna in the world.

So how will the developments to date affect the tuna industry of tomorrow? World-wide tuna landings are rising steeply; are catches in the Western Indian Ocean already reaching a peak? If so, is another recession imminent? Also, will expansion of fleets operating in the Indian Ocean cause depletion of stocks? Will expansion of canning capacity lead to a glut of canned tuna world-wide?

It is expected that these questions, plus a multitude of other issues, will be presented and discussed at the second Tuna Trade Conference being organised by INFOFISH and EUROFISH for May 1991.

NEW TUNA FREEZERS HAVE FEWER TANKS
(Source: *Fishing News International*)

Teknotherm of Halden, Norway, has announced a radical re-think for tuna ships, introducing both plate/tunnel freezing to maintain quality and low-temperature freezing systems for the Japanese sushi market.

Most tuna ships are still using brine freezing systems based on 1950s technology, according to Teknotherm. The company has installed freezing systems in three tuna ships during the past ten years, including the low-temperature freezing plant aboard the Norwegian tuna purse seiner *Tuna West.*

'Tuna deserve better handling', Teknotherm said, and it sees tuna operators fitting limited processing capacity aboard their ships. It is proposing the use of separate freezing systems for normal freezing and low-temperature operations, using Japanese Mycom low-temperature compressors, and a brine system using a heat exchanger.

Present day 1,500-tonners would have 12 instead of 19 tuna tanks, as the new Teknotherm system does away with traditional internal tank coils which can damage the tuna. 'We want to get rid of the coils to get clean-sided tanks which do not damage the fish. Also, you get better heat transfer with a heat exchanger acting as the chiller', said the company.

Another bonus is that the system needs just three pumps to circulate the system, instead of 19 — a major saving in itself — and that the brine pumping is simplified. Teknotherm is discussing projects in the United States which, typically, would allow between four and eight tons of a daily 80-ton catch to be frozen down to minus 55°C.

Some 20 per cent of the catch would be plate (steaks) or tunnel (whole) frozen, still leaving the majority of the catch to be frozen in the tanks. Hand-picked tuna would be low-temperature frozen for storage in double-insulated floating tanks, holding up to some 80 tonnes. Teknotherm has ample experience in fitting freezing tunnels and plate freezers in trawlers, so it sees no problems with this type of installation in tuna ships. The liquid chiller system for the tanks would be very versatile, being capable of directing freezing capacity to a single tank, if need be.

Then, when the tuna were frozen and the brine pumped to other tanks, an air duct chilling system forcing air under a grating at the bottom of the tanks would take over. Teknotherm expects the system to maintain tuna at minus 28°C to minus 30°C, instead of the normal minus 23°C to minus 25°C in present units. R22 refrigerant is concentrated in the engine room only,

which is another benefit of Teknotherm's system. 'We think that this combination — with tanks, processing and low-temperature freezing — is the only way to go, as you can reduce your catch by one-third and still pay for the boat', says the company.

Discussions are under way with designers and owners in the United States which could lead to an order for a Teknotherm-equipped tuna freezer at the end of 1990. But it's not all plain sailing with low-temperature freezing. There is a lack of low-temperature cold stores in Africa, Europe and the United States and so, at present, fish has to be transported in special containers, which the buyers organise.

However, Teknotherm can — and is — quoting for shore-based cold stores capable of maintaining tuna at low temperatures, also for traditional coil tank freezing systems for tuna ships.

GENETICALLY ENGINEERED FISH
(Source: *Fishing Industry Board Newsletter*)

Aquaculture is one of the world's fastest growing industries. Although it supports million dollar businesses in warm-weather climates, it has been slow to develop in colder areas. Fish adaptable to the cold climate of the American Midwest are slow growers, making feed and labour costs comparatively expensive.

Making fish grow faster is one way to make cold climate aquaculture more competitive. By adding growth hormone genes to northern pike, a team of Sea Grant researchers has been able to increase their size by 40 per cent. Such genetically engineered fish are called transgenic.

The researchers are now studying the structure of other growth-promoting genes from northern pike, walleye, salmon, and rainbow trout, said Professor Anthony Faras. By comparing these growth genes to one another, as well as to growth genes in other fish species, Faras hopes to determine how growth genes differ among fish species.

Professor Kevin Guise is attempting to improve disease resistance in fish through the use of genetic engineering. Disease can be a major problem in fish production; some viruses can kill most or all of a grower's fish within a week. Simply adding new genes to fish, however, will not make them grow faster or resist disease. 'The genes must be "switched on" in order for them to work', said Professor Perry Hackett.

'Genes are like a music cassette', Hackett said. 'To hear the music, you have to put it in a cassette player. We are making the player — an expression vector — that allows the gene to be expressed.'

Hackett will then fine-tune control the expression. 'We want the gene to be expressed at selected levels, in selected tissues, and at certain periods of development', Hackett said. 'For example, in an ordinary fish, growth hormones are expressed in the fish's pituitary glands and are at their highest levels when the fish is young and growing. In transgenic fish, we may want to reduce production of the growth hormone as the fish grows large enough to sell for food', he said.

Use of transgenic fish for food production is being studied by Professor Anne Kapuscinski. 'So far, nothing is known about the effect of the new gene on the fish's ability to convert food into meat, to store fat, or to reproduce', Kapuscinski said.

'We need to consider how growth rate and other traits relate to each other and how faster growth may affect some traits needed in aquaculture, such as the fish's ability to grow well in crowded conditions', Kapuscinski said.

Researchers agree that results of this work have incredible potential for the aquaculture industry and for gaining a better understanding of genetic engineering. Perfecting gene transfer in fish is 'opening up the frontier', Guise said. 'As more information is gathered about certain fish genes, we can essentially tailor a fish to what we want it to be. We can introduce new genes to make fish disease-resistant or increase fish reproduction rates. The improvements could mean millions of dollars in the worldwide aquaculture market.'

GENETIC TAGGING OF MAHIMAHI TO AID AQUAFARMERS IN STOCK SELECTION

(Source: *Makai*)

Aquafarmers may be able some day to 'hand-pick' animals best suited for breeding stocks through genetic tagging, a means of identifying fish species by using their genes. 'Genetic tagging is a harmless way of acquiring the genes that make fish individually unique', said University of Hawaii assistant Rebecca Cann.

With genetic tagging, genes are obtained by gently scraping a fish's scales. Genes from a fish found within one breeding population in the wild are compared to genes taken from another fish of the same species from a different population. The data gathered in comparing the two fish can be used to determine which of the two is better in terms of growth, health and adaptability.

Previous to genetic tagging, scientists physically tagged fish. The physical tags failed because fish would be killed by stress in handling and because a low number of marked fish were recovered.

Cann is the principal investigator in a mahimahi genetic tagging project funded by the University of Hawaii Sea Grant College Program. 'The principal goal of the project is to discover non-destructive means of tagging and identifying mahimahi in the wild', said Cann. He added that they picked mahimahi first of all because it was an economically important sportfish, and people were trying to put it into aquaculture in a variety of places.

Mahimahi is an excellent model for many other pelagic species, because its biological structure is simple and similar to many other finfish species. This similarity means that knowledge gained about mahimahi, such as information on viruses affecting the species, will aid in control of diseases found in other species.

Most fish species, including mahimahi, often stay within the geographic region that they are born in and establish a breeding population perfectly suited to the specific area. Because fish within the same breeding population will be genetically similar, genetic tagging can identify the genetic structure of an entire breeding population by sampling the genes of one fish in that population. 'Fish from different populations in the wild placed in aquaculture rearing tanks may not adapt well to one another and may not produce good off-spring. Certain individuals will adapt better to crowded conditions in rearing tanks than others', said Cann.

In addition to adaptability problems, breeding stocks run the risk of becoming genetically homozygous, which is dangerous because it may result in inbreeding and complete destruction of the stock. An ideal breeding stock consists of individuals with different yet compatible genetic structures. 'A virus can wipe out every individual in the (homozygous) population because there are no slight alternatives in the gene that could create some kind of disease resistance', said Cann.

Genetic tagging also allows for early detection of sublethal or subvital mutations within a breeding population through a concept called genetic linkage. 'Genetic linkage is when scientists know the existence of mutations within a fish's genes through some kind of genetic marker, like a particular chromosome, that serves as an indicator to that mutation', said Cann.

Four bases of DNA, read three at a time, combine to determine amino acids, which combine to make proteins vital for fish growth, according to Cann. Sublethal or subvital mutations directly affect the DNA bases by either substituting one DNA base for another, thereby creating a protein that geneticists know nothing about, or totally deleting an entire DNA base, thereby causing a protein to stop developing prematurely. Sublethal or subvital mutations can be quickly removed once found within the breeding stock. 'The mutations won't kill the fish but the fish are not as good as if they were healthy', said Cann.

Genetic tagging of mahimahi is done by cloning mitochondria DNA (mt DNA). Mitochondria are power-houses located outside the nucleus and control all the energy production for the cell. 'Genes in mt DNA are smaller, easier to study, simpler in organisation than any other genes, and we know a lot about them', said Cann. 'We know exactly what they do and how they do it.' She added that how fast a fish can swim is determined by the mitochondria.

Because DNA is transmitted only through maternal ancestry, genetic scientists are able to follow distinct lineages within the mahimahi, as well as other pelagic species, using a technique called Polymerase Chain Reaction (PCR). PCR is a new technique designed for the cloning of mt DNA for genetic-tagging research, but it does not use a bacterial cell, like conventional cloning. In PCR, synthetic DNA pieces, called primers, and the DNA sequence to be copied are placed in a heating machine called a thermo cycler. The DNA is separated into two strands by heat. A reduction in temperature attaches the primers to the ends of DNA strands and a polymerase (copying enzyme) is added to produce clones.

By providing enough clones, PCR helps genetic scientists to study the genetic diversity of mahimahi in different breeding populations in the wild. Based on the data genetic tagging will produce, aquafarmers will avoid many of the problems of homozygosity and adaptability, and as a result increase the efficiency of their operations.

ABSTRACTS

A NEW SPECIES OF GIANT CLAM (TRIDACNIDAE) FROM FIJI AND TONGA, by J.S. Lucas, E. Ledua and R.D. Braley

The ACIAR/JCU Giant Clam Project commenced in 1984 as 'The culture of the giant clam (*Tridacna* sp) for food and restocking of tropical reefs (Project N°8332)'. James Cook University (JCU) was the commissioned organisation, collaborating with Fiji Fisheries, the University of Papua New Guinea, the University of the Philippines Marine Science Institute and Silliman University's Marine Laboratory.

This first phase culminated in an International Workshop on Giant Clams, held at JCU in 1988. A second phase of the Project commenced in 1989 (Project N°8733) and this involves ten collaborating institutions in Australia and five overseas countries: JCU, the Australian Institute of Marine Science, the Oonoonba Veterinary Laboratory, the two Philippine Universities of the previous Project and Fisheries Departments of the Cook Islands, Fiji, Kiribati, Tonga and Tuvalu.

This thirty-third ACIAR working paper presents briefly a new species of giant clam (*Tridacna tevoroa*) which has been found in the Lau Islands, Fiji, and the northern islands of Tonga. While being most closely related to *T. derasa* , which also occurs in this geographic region, it is readily distinguished from *T. derasa* by various features of its valves and soft anatomy. A paper presenting a fuller description, consideration of morphometrics and the position of *T. tevoroa* n. sp. within the family Tridacnidae will be published later.

TUNA BAITFISH IN THE INDO PACIFIC REGION, by S.J.M. Blaber and J.W. Copland

This publication arose from a workshop held in Honiara, Solomon Islands, in December 1989. Baitfish are important for tuna fishermen in Solomon Islands and the Maldives who use the traditional pole-and-line method. It is thus vital that baitfish stocks are not over-exploited, and this workshop examined research results from an Australian Centre for International Agricultural Research (ACIAR) project designed to assist in managing the resource.

Additional papers from leading baitfish researchers were presented at the workshop. Although many of the workshop papers were directed at the biology of tuna baitfish, the work had wider implications because species used as baitfish are often important food fishes in the countries of South-East Asia, the Indian subcontinent and the African coast.

For further information contact: Inkata Press, 13/170 Forster Road, Mt Waverley, Victoria 3149, Australia.

FISHERMAN'S WORKBOOK, by J. Prado and P.Y. Dremiere

This handy little book of nearly 200 pages has been published by the Food and Agricultural Organization of the United Nations in conjunction with *Fishing News International*.

It is a very basic 'ready reckoner' and research document for fishermen of all kinds in all places. It provides some very useful information on the strength and properties of various materials such as ropes, hooks, floats and other hardware, as well as details of almost every imaginable kind of net and its various properties, including strength and weight.

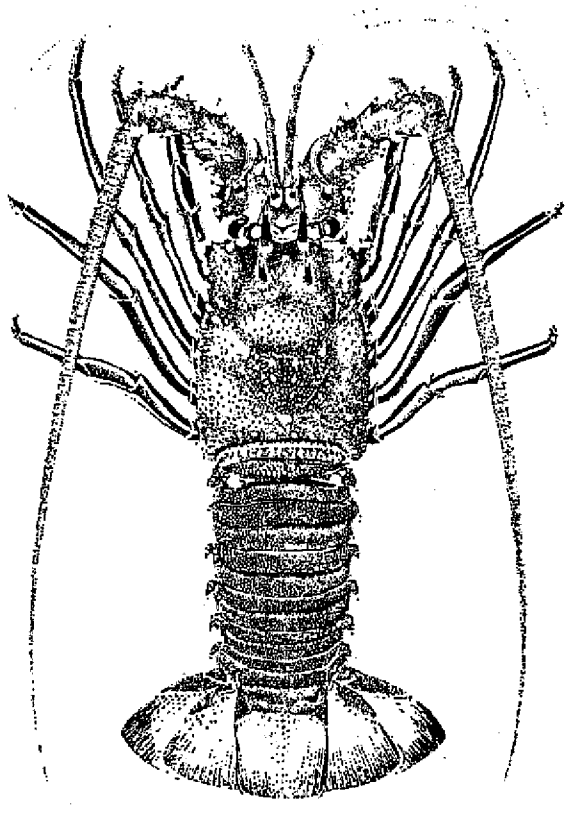
It gives basic details of electronics, engines, fish holds, fish keeping equipment and others, as well as a very useful set of formulae and tables covering all manner of fishing possibilities.

For further information contact: Fishing News Books, Blackwell Scientific Publications Ltd., Osney Mead, Oxford OX2 0EL, United Kingdom. Also available in Australia from Boat Books, 268 St Kilda Rd, St Kilda, Victoria 3182.

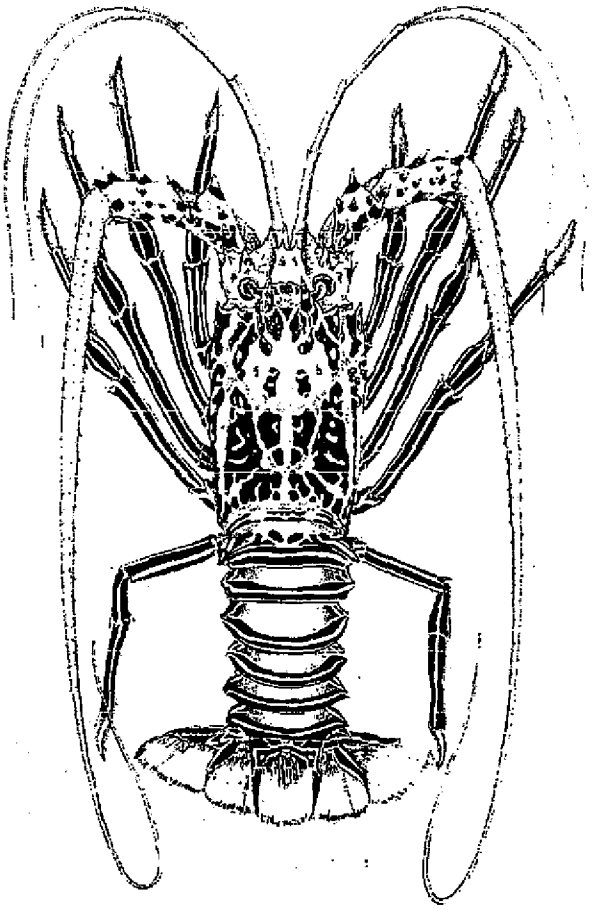
FECUNDITY AND REPRODUCTIVE RATES IN INDO-WEST PACIFIC SPINY LOBSTER, by C.D. MacDonald

The relationship between fecundity and carapace length is analysed and reproductive rates are calculated for the spiny lobsters *Panulirus versicolor* and *P. penicillatus* at Palau, Western Caroline Islands. The information provided has a number of fishery management implications and enables consideration of reproductive tactics in these species.

For more details or to obtain copies, write to the University of Hawaii Sea Grant College Program, Communications Office, 1000 Pope Road, MSB 200, Honolulu, HI 96822.



Panulirus penicillatus



Panulirus versicolor

POHNPEI COMMERCIAL SPONGE SURVEY

by

Richard A. Croft

Introduction

Aquaculture has been identified as having much potential for the Pacific region, and virtually every area within Micronesia has included some form of aquaculture development within its Development Plans.

During April, 1986, an Aquaculture Planning Workshop was held on Kosrae Island and was attended by 24 experienced aquaculture managers, researchers and economists from across the Pacific.

The conclusions of the workshop were that the aquaculture of certain species, including commercial sponges, did indeed have good potential for Micronesia. The office of the South Pacific Regional Aquaculture Development Project was created the following year by the Food and Agriculture Organization of the United Nations, after consultation with various Governments throughout the tropical Pacific, to assist in the development of aquaculture within the Pacific region.

Aquaculture development has been given a high priority by many Island Governments, including the Federated States of Micronesia (FSM) National Government and the Pohnpei State Government, and is included in their Development Plans. At the request of the Division of Marine Resources, FSM National Government, the office of the South Pacific Regional Aquaculture Development Project agreed to support a limited commercial sponge survey of the Pohnpei lagoon to assess brood stocks and suitable culture sites.

Constraints

There are several disadvantages to growing commercial sponges. The first is the long growing time. This is easily solved by simply planting a certain number of cuttings each year and establishing a planting/harvesting cycle. Once the cycle is established, a farmer will harvest and export on a regular basis. It will just take time to establish this cycle. The only real potential problem which may be encountered during this long growing period is the possibility that some disease may appear. If this were to happen, the potential impact would be reduced by quickly harvesting the affected sponges as well as all those in the immediate area. This should reduce or prevent the spread of any disease to unaffected sponges.

The possibility of disease is probably small, but real. The wild sponges located off the Florida coast have suffered from a 'blight' only twice in the past 90 to 100 years. Recent information received indicates that, for the first time, a blight may be affecting some of the commercial sponge stocks located in the Mediterranean. While this problem has only occurred two or three times over the past 100 years, there is always the possibility that some organism may attack a growing sponge and a close watch would have to be maintained on any sponges being cultured.

The biggest problem facing the establishment of a commercial sponge industry in Pohnpei or FSM is that the known wild stocks of commercial sponges are not large enough to support commercial exploitation nor to provide sponge cuttings for more than one or two commercial farms. To develop a viable commercial sponge industry within Pohnpei or FSM, it will be

necessary to establish a nursery farm which then can be used to train potential farmers and to provide trainees with the cuttings needed to start setting up their own private operations.

Before this nursery farm can be established, a survey of wild commercial sponge stocks, as well as potential sponge farming sites, must be conducted to determine their present status. The following survey addresses this need for Pohnpei State.

Commercial sponge survey

As noted above, the office of the South Pacific Regional Aquaculture Development Project agreed to support this survey. The author was contracted, on the basis of his private work with culturing commercial sponges for the past several years, to conduct a 21-day survey, covering as many sites as possible within this time period. The survey began on 4 September 1988 and was completed on 16 October 1988. The survey was to be done using scuba diving techniques, two dives per survey day. The sites to be surveyed were recommended by the author and approved by the FSM Office of Marine Resources. They were selected on the basis of how closely they matched the conditions, observable from the surface, of the one known commercial sponge bed — i.e. close to a reef passage, mixed coral and sand, good clean water away from any rivers or streams, gentle sloping bottom.

Sites were selected all around Pohnpei. While each scuba dive only lasted about 45 to 60 minutes, only two were possible for most sites. Travel to the sites on the other side of the island took at least two and a half to three hours each way, while travel to the closer sites took about half an hour each way. At least two to three hours were required for the surface interval between dives. Preparation time was necessary both before and after each trip. All in all, from six to ten hours were spent each survey day.

Each site was surveyed by two divers, using scuba equipment and a 19-ft (1 ft = 0.30 cm) FRP boat with a 30 hp outboard motor, and where possible, was surveyed down to a depth of 65 ft. On the outward leg of the dive, one diver swam at a depth of 55 ft, and the other at a depth of 40 ft. On the return leg of the dive, one diver swam at a depth of 30 ft, and the second at a depth of 20 ft. Using this method, reefs with a relatively steep slope could be sampled at all depths from 15 ft down to 65 ft. As noted in the site reports, some sites did not reach a depth of 65 ft, and these were surveyed to their deepest point.

All commercial sponges sighted during a dive were noted as to size and depth. However, as no calipers were available on the island and as shapes, in most cases, were very irregular, the sizes had to be estimated by the investigator. Depths were measured using a standard, oil-filled, depth gauge. Notes were made on the potential suitability of each site for a sponge farm.

We were able to cover most of the area of the sites which did not bottom out at 65 ft.This does not mean, however, that we found every commercial sponge within that site. The sponges are hard to see, being black, and are sometimes found within corals, or growing under ledges. This is even more true for the areas which did bottom out at 65 ft or less. At these sites we were only able to make a large circle, noting what sponges we could observe. So in all probability we did not find all the commercial sponges within any area.

However, we did get a good sampling of the density of commercial sponges within each area, and this can be compared to the density of commercial sponges found within the known sponge bed. During any dive within the commercial sponge bed, at least 35—40 sponges of commercial size, i.e. in excess of 14 ins, will be observed.

Conclusions and recommendations

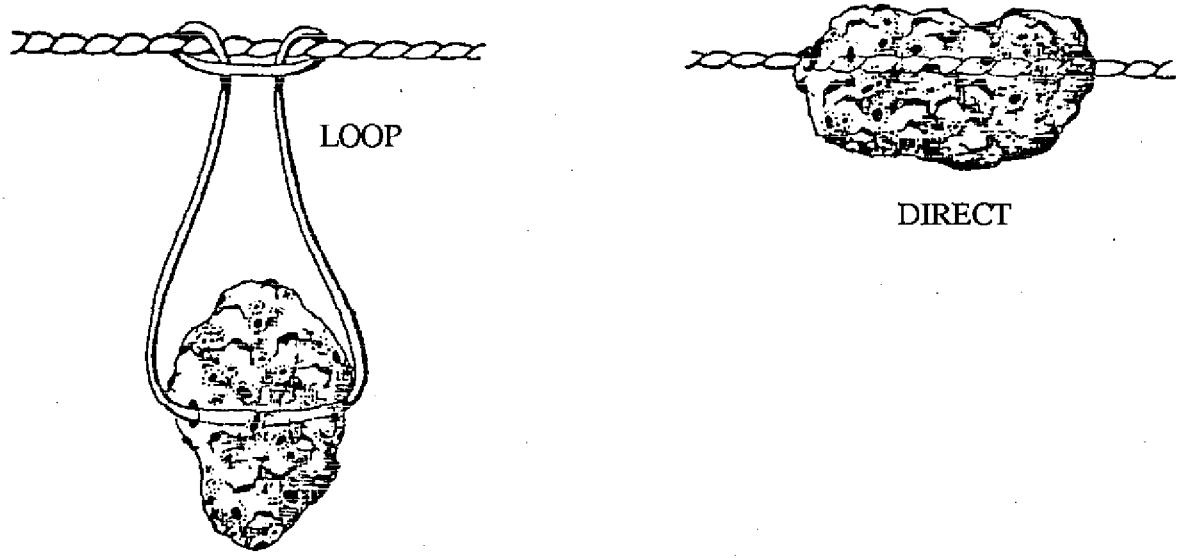
On the basis of the information obtained, it appears that commercial sponge farming has potential for Pohnpei and possibly the rest of Micronesia. Future work in this area should include:

— Establishing test sites around Pohnpei Island to measure growth rates and to test the best method of growing sponges commercially;

— Establishing a demonstration farm which can be used to train potential farmers and to provide these farmers with seed stock to assist them in establishing their own private farms;

— Employing an aquaculture extension agent to assist potential farmers with the establishment of private farms;

— Surveying other islands in an effort to determine the suitability of establishing other commercial sponge aquaculture operations.



Methods of planting sponge cuttings used in Pohnpei

BRACKISH-WATER AQUACULTURE IN TAHITI

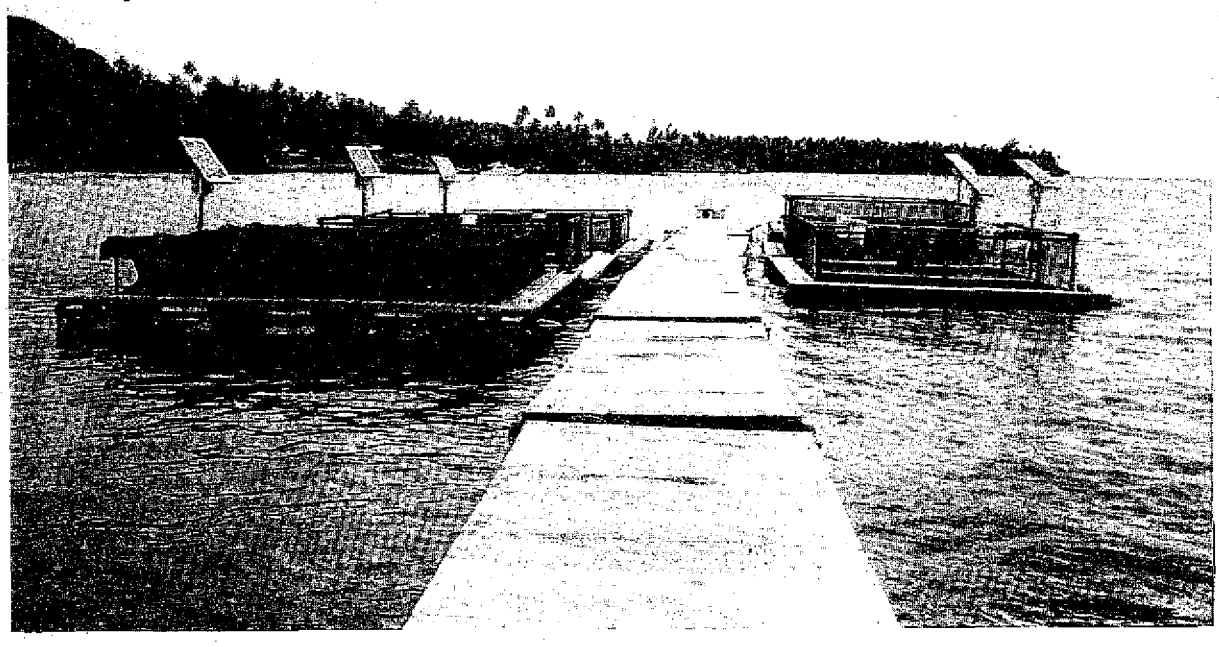
by

G. L. Preston
South Pacific Commission
Noumea, New Caledonia

A number of agencies and private individuals are involved in developing a variety of pond aquaculture activities, using saline water, in French Polynesia. These activities include green mussel grow-out, turtle head-starting, a territorial hatchery to provide seed for private farmers, and private prawn farms. The French Institute for Ocean Research (IFREMER) provides support for many of these projects.

Jean-Michel Griessinger, Director of the IFREMER station, says that IFREMER has in the past tried culturing locally available species in Tahiti, but trials mostly did not work out. As a result, IFREMER has targeted on the several 'classic' species that it now works on, all of which have been introduced to French Polynesia from elsewhere. With the advances in aquaculture techniques made in recent years, it might be time to look at some of the local species again, but IFREMER will not be giving this a very high priority as it does not want to disperse its effort too thinly. It is nevertheless keen to support Pacific Island enterprises where it can, and will consider any requests for technical expertise from Pacific Island countries or from SPC.

The central IFREMER facility holds broodstock of imported seabass (barramundi, *Lates calcarifer*). It has had several induced spawnings in the past, but in November 1990 had their first 'natural' spawning, brought on by temperature change and a switch to a high-protein feed. The juveniles are reared on rotifers that are also cultured at the station.



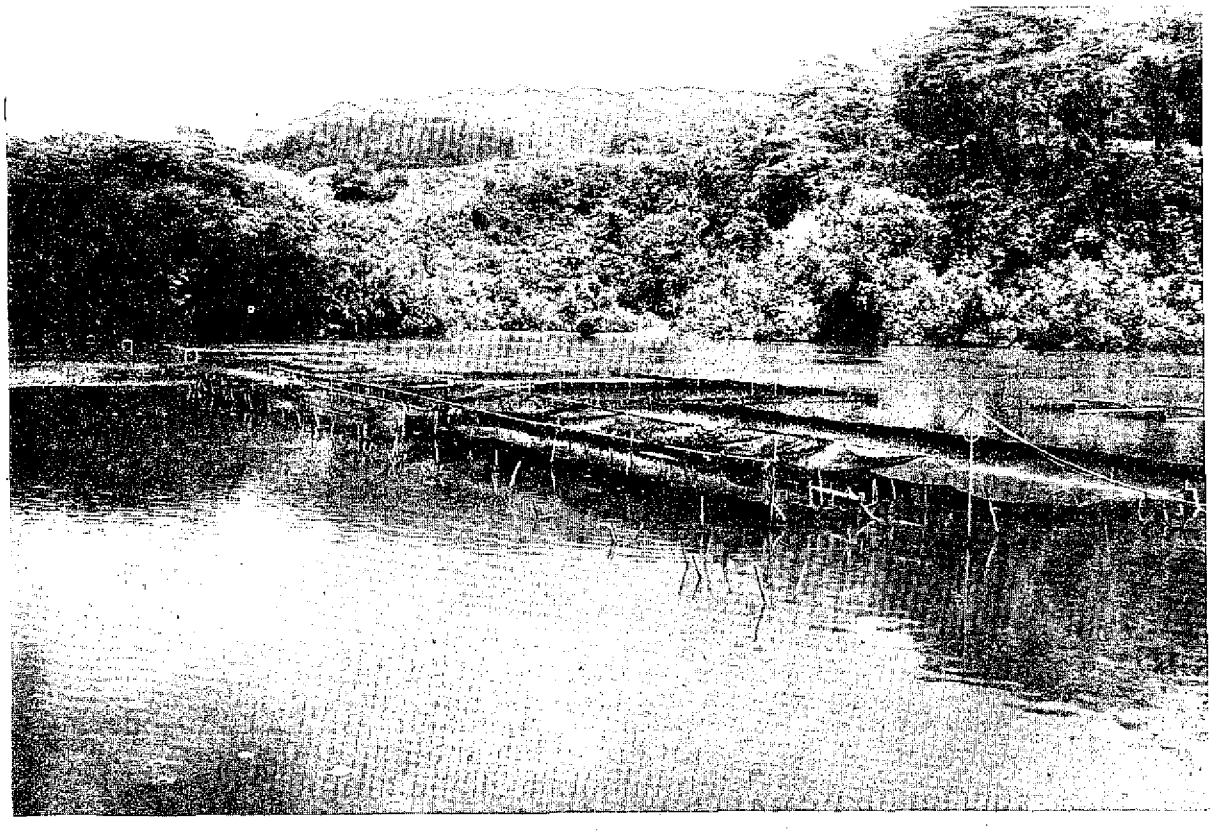
Barramundi (*Lates calcarifer*) are grown in floating sea cages in a sheltered part of the Tahitian lagoon. Solar panels power automatic feeders that provide regular, measured amounts of food to the fish.

IFREMER also continues to produce green mussel seed (*Perna viridis*) which are held until they are 1 cm long and then sold on, at 1,100 CFP per 1,000 spat, to the on-growing site, where they are reared in a natural semi-enclosed lagoon. The spat are placed in baskets with pieces of iron bar, to which they attach in a few days. The bars are then hung along racks in the lagoon. Feeding is natural, and experiments are being carried out at the moment with a system of fertilization of the water to enhance phytoplankton growth. There are problems with temperature, which can reach as high as 40° C at the bottom on a hot day, and with freshwater run-off which causes a zero-salinity layer to form at the surface. There are air bubblers at the inner part of the lagoon, partly to aerate the water but mainly to break down the thermal and saline stratification. During June—September, the water typically clarifies as plankton production stops, for unknown reasons. The fertilization experiment is partly intended to deal with this problem, but up till now attempts have usually been made to sell off the mussels at this time. They are sold when they reach a wet weight of about 20—30 g, i.e. 8—10 months old, at a price of 550 CFP francs/kg.

Green mussels (*Perna viridis*) are grown on from hatchery-produced spat on iron bars suspended in a shallow semi-enclosed part of the lagoon. These mussels are approaching marketable size.

The 3 ha lagoon should be able to produce about 8 tonnes of mussel per year, although this target has not been achieved so far.

The turtle head-starting scheme, run by the Fisheries and Aquaculture Extension Organisation (EVAAM), is at the same site. There are two batches of animals, one brought in as juveniles by a private individual, the other collected as eggs by the staff. Another collecting trip was made to Montpellier atoll in December, with the aim of bringing back ten nests of one hundred eggs each. The turtles are hatched and grown on with the aim of releasing half, and selling the other half on the commercial market in Papeete. The purpose is to restock wild stocks, and to start competing on the market with wild-caught turtle meat. Until recently, turtles were subject to size limits and seasons, but these were widely ignored. New legislation instituted recently makes it illegal for anyone to capture turtles without a licence from the Ocean and Aquaculture Service (SMA), which has the responsibility of managing fishery resources in French Polynesia.



A view of the semi-enclosed bay used for on-growing mussels and turtles. The covered pens in the centre hold mussels that are being grown in phytoplankton-rich water from the fertilized enclosures behind. At the far right are the turtle pens.

The turtles already under culture are of two different age groups, the older from juveniles collected in 1989, the younger from eggs hatched in January/ February 1990. The smallest animals weigh about 1—4 kg, the biggest up to 14 kg, with a wide range of growth in each age class. They are kept in cages, with several animals of similar size to a cage, at a density of about one animal per cubic metre. The turtles are fed four times a day on prawn food pellets at the rate of six per cent of body weight per day for the small animals, falling to one or two per cent for the large. The animals that are to be put on the market will be reared to a weight of 40 kg, and are expected to fetch about 2,000 CFP francs/kg (meat only).

The main problem experienced so far is the animals biting each other. The bitten area necroses and goes white, attracting further bites. The staff normally treat the bites by protecting them from further attacks (using inner tubes), which works well and leads to recovery in a few days.

The biting is thought to be due not to overcrowding *per se*, but to the size of the cages, which do not allow the animals to swim very far. Some bigger cages, which will be stocked at the same density, will soon be built, in order to assess whether this is correct.

This captive turtle has had one flipper bitten by other turtles and is now protected by a 'shoe' made from an old inner tube.

Although IFREMER still produces small amounts of green mussel larvae, most larval production has now been passed over to the Territorial hatchery, which is run entirely by a local staff of 15, and which is presently producing seed of the prawns *Penaeus vanamei* and *Macrobrachium rosenbergi*. It also cultures feed organisms, including a local variety of the phytoplankton *Chaetoceros*. It will start with the green mussel *Perna viridis* next year, and ultimately *Lates calcarifer*, at which time IFREMER will cease production of these larvae.

Seed are produced for sale to local farmers, at the following prices:

Species	Price (CFP francs/1,000)	Planned annual production
P. vanamei	2,000	15 million
M. rosenbergi	1,250	6 million
P. viridis	1,100	3 million

(Figures for *P. viridis* are estimated only, as production has not started yet.)

There are three or four private farmers rearing prawns, all but one using the fresh-water *M. rosenbergi*, but all planning to transfer to the brackish-water *P. vanamei* in the near future. The transfer is because the product from seawater prawns is considered superior to fresh-water prawns, and because the strain of *P. vanamei* in Tahiti is highly disease-resistant. Once the transfer is complete, the hatchery will cease production of *Macrobrachium* spat.

Gerard Cuzon of IFREMER is working on nutrition issues, trying to develop aquaculture feeds that can be locally fabricated. This is being done for prawns at a factory that used to process coconut oil, although fabrication is entirely from imported raw materials. Different-sized feed pellets are manufactured to suit different sizes of animal, and the composition is adjusted to suit different species. (A modified version of the prawn pellets is being used to feed the head-started turtles, although attempts are still being made to improve these, in particular to make them float).

Finally, IFREMER is associated with a newly-established private company, Pacifique Aquaculture Services, run by J. F. Virmaux. The company is owned 65 per cent by Mr Virmaux and 35 per cent by France Aquaculture. France Aquaculture itself has changed hands, being now owned 70 per cent by SANOFI, a French-based international aquaculture conglomerate, and 30 per cent by IFREMER. IFREMER can thus be viewed as having a 10 per cent share in Pacifique Aquaculture Services (although the relationship is of course not quite so simple). Participation in a commercial venture of this type permits IFREMER to become involved in, or provide consulting services to, aquaculture projects elsewhere in the region on a commercial basis.