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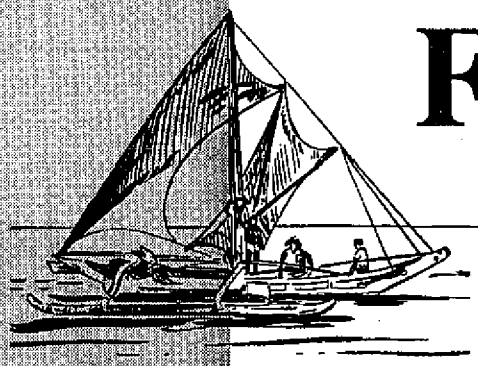

FISHERIES

Newsletter

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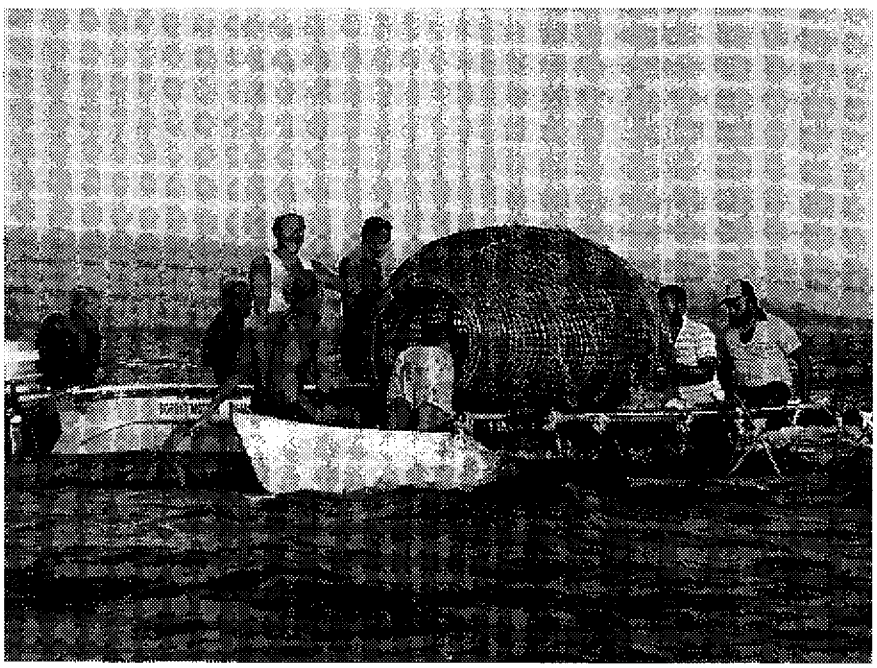


Photo: Chris Martinello

Traditional *Tolai* baskets are deployed around Rabaul to catch bigeye scad and larger pelagic fishes

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

RESOURCE ASSESSMENT SECTION

Assignments in Papua New Guinea

During February and March, Inshore Fisheries Scientist Paul Dalzell carried out three assignments in Papua New Guinea.

The main purpose of the visit was to continue providing editorial support for the Department of Fisheries and Marine Resources fisheries scientists in the production of technical reports. On this visit a backlog of five reports was finalised on reef and estuarine species, generated by the work of fishery biologist Augustine Mobiha at the Kavieng and Daru field laboratories. The final documents will be published as Research Branch technical reports.

On the same visit, Mr Dalzell carried out two assignments on behalf of the Offshore Fisheries Development Project (OFDP). These assignments concerned monitoring of a fish aggregation device (FAD) near Port Moresby and observations on catches of small pelagic fishes around the Gazelle Peninsula of East New Britain. These activities are described in greater detail in the article on page 37.

(Contributor: Paul Dalzell)

Micronesian Regional Sea-cucumber Meeting

Between 3 and 5 March the University of Guam convened a meeting on beche-de-mer biology and fisheries for fisheries officers and scientists from the Micronesian islands and territories.

Senior Inshore Fisheries Scientist (SIFS) Dr Tim Adams attended on behalf of the South Pacific Commission's Fisheries Programme. Subjects discussed at the meetings, included biology, stock assessment, economic and trade issues.

Discussion focused on the use of minimum size limits as a management tool and how to educate fishermen to selectively harvest larger animals and thus improve their profit margins.

Other topics included for discussion were tagging of sea-cucumbers, larval biology, reproduction and sea-cucumber ecology. A workbook summarising some of the issues was produced before the meeting and will be re-issued based on the discussions at UOG.

The meeting was a very useful exercise with a mutually beneficial exchange of information between the fisheries officers and the University staff. (P.D.)

Micronesian Heads of Fisheries Meeting

This meeting was held immediately following the sea-cucumber meeting and made it possible for the various Micronesian state and national senior fisheries staff to learn about developments in different parts of Micronesia and to discuss areas of common interest.

This was particularly important for the Federated States of Micronesia since state fisheries staff do not participate in regional meetings such as FFC and RTMF.

The U.S. Fish and Wildlife Service addressed the meeting on the Lacey Act, which empowers the U.S. Government to take legal action against anyone importing something to the USA in contravention of the laws of the exporting country.

This is particularly important for the Micronesian islands since the vast majority of their marine exports pass through Guam, a U.S. Territory.

Other topics discussed at the same meeting were the impacts of tourism, legislation, education, extension, dredging, statistics and conservation.

The meeting considered various aspects of these topics and tried to agree on setting priorities for the various issues under discussion.

The three topics thought to be highest priority were education (of public and resource users), legislation and collection of statistics. (P.D.)

Palau Division of Marine Resources research review

Following the meetings in Guam, Senior Inshore Fisheries Scientist Tim Adams spent two weeks in Palau at the request of the Chief of Marine Resources. He was asked to assist with finalising the 1992 Marine Resources Division (MRD) Annual Report, reviewing ongoing changes in the staff and goals of the MRD Fisheries Resources Management Section and initiating an inshore fisheries statistical program for the MRD computers.

Much of the time in residence was spent reviewing documented activities and seeking the opinions of MRD staff on previous and proposed activities.

Additional time was spent producing data entry programs for the statistical database to reduce the time taken to enter records.

The draft of the 1992 Annual Report was also reviewed and some suggestions to improve the presentation of the information were incorporated in the text. (P.D.)

Ciguatera Management Workshop

During April, an international workshop on ciguatera management was convened at Bribie Island, Australia, by the Queensland Department of Primary Industry (QDPI). QDPI has been in the forefront of ciguatera research, initially led by Dr Noel Gillespie and more recently by Dr Richard Lewis.

This meeting followed the 4th International Conference on Ciguatera Fish Poisoning which was hosted in Tahiti during May 1992 by the Institut Louis Malardé.

Over 40 papers and poster presentations were given during the meeting, which included sessions on detection, pharmacology, legal aspects, clinical aspects and the origins of ciguatera.

SPC was represented at the meeting by Inshore Fisheries Scientist Paul Dalzell who spoke on ciguatera management and fisheries in the Pacific and presented some analyses of the SPC ciguatera database, which currently contains over 400 case histories.

A significant feature of this meeting was the inclusion of more presentations on the social aspects of ciguatera, which are probably more immediately relevant to the Pacific Islands than the details of its biochemistry and physiology.

A solicitor presented a legal perspective on the rights and obligations that exist with respect to ciguatera under present laws in Queensland.

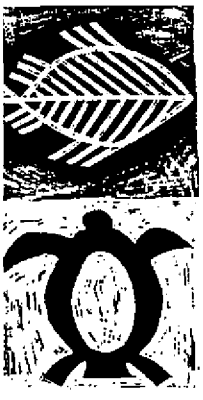
Another participant described an analysis of over 900 case histories from Queensland recorded over a 30-year period.

Some possible areas of co-operation were discussed between the authors of this work and the Resource Assessment Section (RAS) of the SPC Fisheries Coastal Fisheries Programme. The RAS is currently holding significant time series of data on cases that resulted from a ciguatera outbreak in Tuvalu.

Of interest to all participants (and to the region) was the evaluation report on a commercial test for ciguatoxins, designed to screen for toxic fish. The evaluation was conducted by the US Food and Drug Administration and concluded that at present, high false negative and false positive values might be expected if the test were to be used in market situations.

This paper and other contributions will be edited into a workshop proceedings and published as a special edition of the *Memoirs of the Queensland Museum*. Readers of the newsletter will be advised when this and the proceedings of the Tahiti Conference are available.

The next international conference on ciguatera is scheduled for Hawaii during May 1994. (P.D.)



Ciguatera at the 14th Regional Conference of Heads of Health Services

The South Pacific Commission's 14th Regional Conference of Heads of Health Services was held from 14 to 18 June in Port Vila, Vanuatu. This meeting is the Health Progamme's equivalent of the Regional Technical Meeting on Fisheries (RTMF) and brings together the senior medical staff of the region to hear the reports of the SPC Health Programme staff and discuss future work priorities.

Inshore Fisheries Scientist Paul Dalzell attended the meeting to review the work of the Fisheries and Health Programmes in documenting ciguatera case histories and to encourage greater effort from medical staff to report incidence of such poisonings, using the forms provided by the SPC.

The Fisheries and Health Programmes jointly established a database to collect case histories on ciguatera and related marine poisonings. Entries in the database, which are based on questionnaires that have been widely circulated in the region, contain information not only on the symptoms of the poisoning, but also on the type of animal responsible, and the place in which it was caught.

Such information will allow the study of links that might exist between different kinds or intensities of ciguatera poisoning and different types of fish, and of regional differences in types of ciguatera or the fish responsible. However, to be useful, the database needs to accumulate a large number of records from a range of different sources.

There has been a mixed response in the region to reporting case histories to the SPC for entry into the database. In a number of countries where ciguatera is common, few or no case history data have been sent to the SPC, even though the database and the report form have been publicised in the Health and Fisheries newsletters, through the *Ciguatera Information Bulletin* and, more recently, through national press and radio.

The Port Vila conference was an excellent opportunity to discuss the problem of under-reporting of ciguatera case history data with senior medical personnel from the region and to ask them to do all they could to improve reporting rates.

Mr Dalzell emphasised the need to manage the problem of ciguatera and minimise the impact on commercial reef fisheries by identifying the species responsible and ascertaining where it was captured. Long-term trends in ciguatera outbreaks could also be examined if case histories were continually reported after an outbreak. An example of this is Tuvalu, where over 300 case histories have been collected since an outbreak of ciguatera on the island of Niutao in 1989.

Mr Dalzell's presentation was favourably received and one Australian observer to the meeting noted that this type of work had been successful in eliminating many of the problems associated with ciguatera from Spanish mackerel (*Scomberomorus commerson*) in southern Queensland. An offer of potential collaboration on case history data was made by the delegate from New Caledonia.

Following this session, a recommendation on the need to improve ciguatera reporting was drafted for inclusion in the conference report. (P.D.)

Scomberomorus commerson

Meeting provides direction for new SPREP project

Senior Inshore Fisheries Scientist Dr Tim Adams was invited to a meeting in Apia hosted by the South Pacific Regional Environment Programme (SPREP).

The meeting, held from 22 to 27 May, was convened to provide directions and strategies for the Coastal Zone Management Programme recently established by SPREP.

Delegates from Pacific Island countries and other regional organisations concerned with various aspects of marine science participated in the meeting. There is growing concern about the coastal environment in many South Pacific countries as population growth leads to increasing urbanisation.

The 'Earth Summit' held in Rio in 1992 considered that more inter-sectoral communication, co-operation and co-ordination is needed if the productivity of the coastal zone is to be main-

tained. The new SPREP project will act as the regional clearing-house and medium of communication between different organisations and disciplines. SPC was asked to participate in the meeting as one of the organisations in the South Pacific concerned with fisheries research, development and management.

Dr Adams participated in the plenary sessions and discussion groups and provided information and background on the coastal fisheries sector in the region. There is growing interest amongst ecologists in the use of fisheries data to indicate long-term changes in climatic and oceanographic conditions.

The SPC Fisheries Programme has considerable experience in the collection and interpretation of fisheries statistics in the South Pacific and this may be the basis of some useful participation between the IFRP and the SPREP Coastal Zone Management Programme.

Following the meeting, the SPREP Coastal Zone Management Programme will, in future, be included in the regular exchange of information on project activities that is conducted between the FFA Research Coordination Unit and the Resource Assessment Section of SPC's Coastal Fisheries Programme. (P.D.)

INFORMATION SECTION

Publication of the fisheries address book in conjunction with the Forum Fisheries Agency

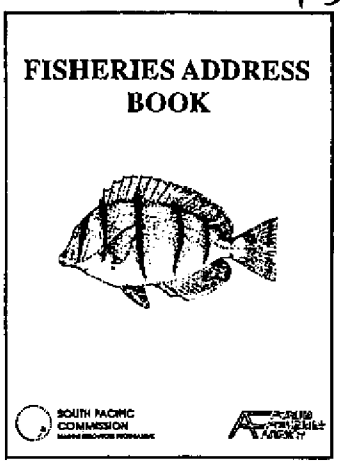
Our readers will no doubt remember that in *Fisheries Newsletter #62* we published an article announcing the closure of the FAO/UNDP Regional Fisheries Support Programme. The annual publication of the well-known *Addresses useful to Pacific Islands Fisheries Personnel* had been one of this project's much-appreciated activities in the region.

Aware that documents of this kind should be issued regularly, the South Pacific Commission Fisheries Programme and the Forum Fisheries Agency decided to collaborate to resume publication of the address book. A preliminary version was presented to the last Forum Fisheries Committee meeting.

A fuller version should be available by the next Regional Technical Meeting on Fisheries. In addition to some 850 addresses covering 47 countries, territories and districts, basic fisheries statistics and a map are included for each Pacific Island country or territory.

We trust that this document will remain very popular and we are always open to suggestions on how to make it even more useful.

(Contributor J.P. Gaudechoux)



Special Interest Group Information Bulletins

In May, the Information Section published the sixth issue of the *Pearl Oyster Information Bulletin* as part of the activities of the Pearl Oyster Special Interest Group. Since the last issue in September 1992, the Group has grown considerably bigger. Its members are contributing actively to this bulletin and have made this SIG one of the most productive of the six that now exist.

Contributions on stock assessments of *Pinctada mazatlanica* and *Pteria sterna* in the Gulf of California, Mexico, pearl culture projects in Venezuela and pearl oyster production in Malaku Province, Indonesia are featured in the current issue.

In the previous *Fisheries Newsletter*, we announced that a Special Interest Group on fisheries education and training would be set up. The first Information Bulletin has now been produced. The Commission's own professional staff were largely responsible for the authorship of issue number one. We hope to receive contributions from professionals in the fisheries training sector in the future.

This first issue includes what we hope will become regular features – reports of fisheries training activities carried out by SPC and FFA, news from training centres and fisheries departments, training course appraisals and information on short-term courses. Our wish is that these articles provide up-to-date information on training activities and possibilities within and outside the region.

August should see the publication of *Beche-de-mer Bulletin* #5, *Ciguatera Bulletin* #3 and *Trochus Bulletin* #2.

Anyone wishing to become a member of any Special Interest Group should contact the Fisheries Information Officer at SPC.

(Contributor: J.P. Gaudechoux)

TRAINING SECTION

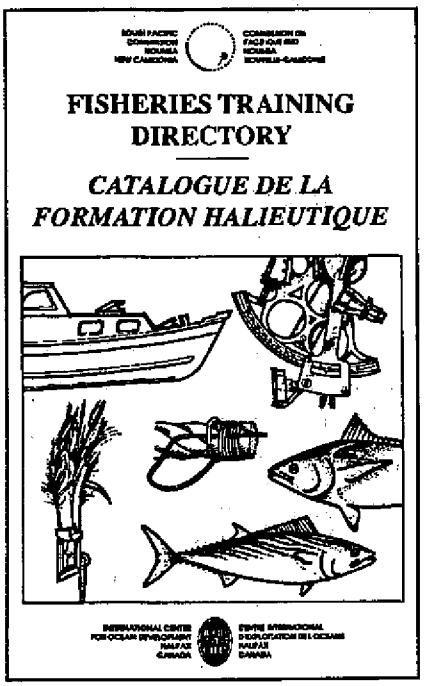
Publication of educational materials

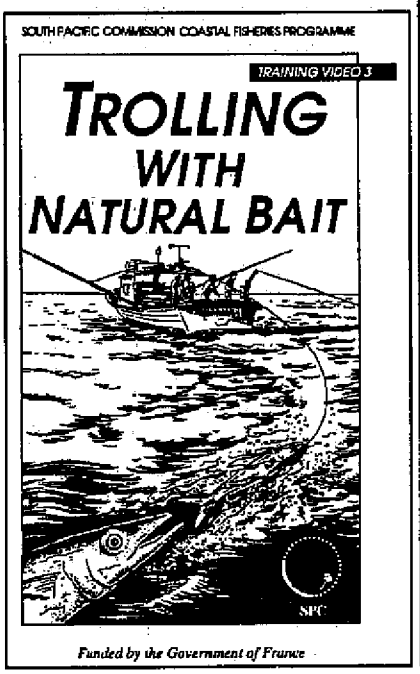
Over the past few months, the Training Section has worked hard to eliminate backlogs in the publication of educational materials. Readers interested in fisheries education and training will be pleased to learn that various training aids, in French and English, have recently become available from SPC.

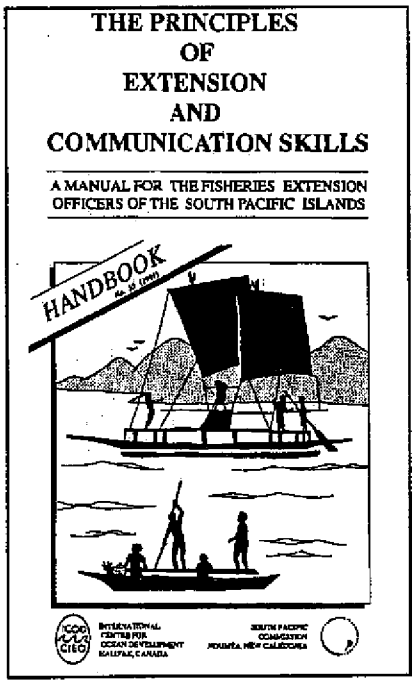
The *Principles of Extension and Communication Skills* handbook, now available in French, can help fisheries workers become better public speakers, acquire skills in resolving disputes between fishermen, put over their ideas better or conduct surveys. Although it uses examples from the fisheries sector, this handbook could also be useful for agricultural department staff or any extension personnel. The original English version was published in 1991.

Guidelines in French to on-board handling of sashimi-quality tuna came off the SPC presses early in 1993. It was used during a training course for crewmen from a New Caledonian company engaged in monofilament tuna long-lining. With many illustrations, it accurately describes the various stages required to obtain sashimi-quality fish, from gaffing to refrigeration.

A video cassette on trolling with natural bait has just been distributed to training centres and fisheries departments in the English-speaking countries of the region (English version available on PAL and NTSC systems). This video, filmed in Fiji during the practical training component of the SPC/Nelson







Samples of the latest Training Section productions

Polytechnic course, describes a trolling technique which is relatively unfamiliar to Pacific fishermen. Its effectiveness in catching large predatory fish and the low cost of bait as compared to artificial lures should make it popular with low-income fishermen in remote areas. The French version will be available in SECAM format by the end of 1993.

Lastly, the Fisheries Training Section staff sent out some 300 copies of the long-awaited Fisheries Training Directory early in June. This publication lists more than 400 courses offered by 113 institutions in 25 countries. We hope that the Directory will quickly become a reference guide for preparing training plans in Pacific Island fisheries departments.

(Contributor: Michel Blanc)

SEAFDEC training opportunities for Pacific Island fisheries sector

SPC Fisheries Training Section has liaised with the Director of the Western Pacific Fisheries Consultative Committee (WPFCC) and the South-east Asian Fisheries Development Centre (SEAFDEC) Secretariat to promote access to SEAFDEC courses for Pacific Island Nations (PINs) participants. Discussions to this end took place during the 1992 ASEAN Study Tour sponsored by the Canadian International Development Agency and the Government of France.

The newly appointed Secretary-General of SEAFDEC, Dr M. Duangsawasdi, recently met with the Director of WPFCC and advised that the SEAFDEC Council had already agreed to a change in policy which will allow access to SEAFDEC courses for students from non-SEAFDEC countries. Following this meeting, WPFCC formally requested the regular provision of information from SEAFDEC on training courses and opportunities. WPFCC will in turn forward such information to regional organisations and interested parties.

SEAFDEC training programmes cover three main areas. The *Aquaculture Section* offers annual short courses in hatchery/nursery of marine fishes (7 weeks), fish health management (5 weeks), aquaculture management (4 weeks), culture of natural food organisms (4 weeks), and shrimp hatchery/nursery operations (7 weeks). Internship training in associated areas is also available on request.

The *Marine Fisheries Research Department* focuses on post-harvest technology, particularly quality control and improvement of fish products. A variety of annual courses, with emphasis placed on the use of small fish with low market value, are offered. Courses include aspects of microbiology, chemistry, laboratory practice, grading, quality and preservation, and product development.

The *Training Section* is housed in extensive waterfront facilities along the river estuary of the Gulf of Thailand. Two six-month courses a year in fisheries technology and marine engineering form the basis of the training programme, with extensive provision for practical fishing aboard three training vessels. A new purse-seine training vessel, recently donated by Japan, takes pride of place in the training fleet and may be of interest to PINs for the training of observers and fishing deckhands.

Specific dates for SEAFDEC courses and nomination details should be advertised to Fisheries Departments and interested persons by letter, and will be featured in the Training Course section of the Special Interest Group Information Bulletin on fisheries education and training. Enquiries can also be directed to WPFCC, FFA, or SPC's Fisheries Training Section.

At present there are no guaranteed sources of funding for trainees to SEAFDEC courses, however, the regional organisations may be able to assist in finding financial support.

(Contributor: Hugh Walton)

Fisheries Training Section in Micronesia

During April and May, Hugh Walton, Fisheries Education and Training Advisor, travelled extensively through Micronesia with country visits to the Federates States of Micronesia (all four states), Guam, Palau, the Commonwealth of the Northern Mariana Islands (CNMI), the Marshall Islands, Kiribati, and Nauru.

The trip was undertaken primarily to meet with fisheries sector interest groups to work on some of the recommendations of the 1991 Human Resource Development Survey

and the 24th RTMF, particularly in relation to human resource development (HRD) planning, personnel training plans, organisational management and deckhand certification.

The 1991 HRD survey highlighted a 'general absence of long-term human resource development plans' throughout the fisheries sector of the SPC region, and the Commission's fisheries training section has subsequently undertaken to provide consultative and organisational assistance to member countries, states and organisations interested in the development or review of HRD plans.

During the visit to Micronesia, a draft plan was prepared for Palau which included proposing individual training plans for key staff and a review of local training opportunities. The provision of similar services was outlined in Pohnpei, Yap, and Kosrae States (FSM) and in CNMI and the Marshall Islands.

The development of a sustained organisational management training programme raised considerable interest during the country visits.

In the course of country visits, it was suggested that a 'travelling management training team' could be organised in 1994 to conduct in-country workshops of between one and two weeks duration (depending on the size and scope of the participating organisation). It was further suggested that the workshops would be based on the principles of TQM (Total Quality Management) with a general orientation to management systems and problem-solving.

The suggested format for workshops included one or two days with senior management, a similar but separate programme for middle and junior management, followed by several combined sessions.

The concept was generally endorsed during the Micronesian country visits with suggestions for the involvement of local tutors and the need for regular consultative review of 'action plans' formulated during the initial workshop.

On the basis of discussions and consultations in this area, SPC hopes to join with management trainers from the University of the South Pacific (USP) to develop this programme. A progress report is planned for RTMF 25.

The dramatic increase in foreign fishing activity in Micronesia in recent years has helped to stimulate interest in the expansion of employment opportunities for its nationals aboard foreign fishing vessels.

Consequently, there was general support throughout the region for the development and implementation of a standardised qualified fishing deckhand certificate programme. SPC was able to report that a draft curriculum had been prepared in consultation with the Vanuatu Fisheries Training Centre and the Solomon Islands School of Maritime and Fisheries Studies.

The curriculum is being circulated to interested training institutions and fisheries sector representatives for consideration.

The issue of the deck-hand programme will be comprehensively reported to RTMF 25.

(Contributor: Hugh Walton)

CAPTURE SECTION

Capture Section staff were mostly occupied in responding to requests for assistance with fish aggregation device (FAD) programmes during the second quarter of the year.

Field staff assigned to Papua New Guinea, Palau, Fiji and Nauru assisted with the deployment of ten FADs between April and June.

Staff also provided technical advisory, planning and material procurement services for upcoming FAD programmes in Western Samoa, Tokelau, Kiribati, and Tonga. Once these countries have landed their FAD materials, Capture Section staff will be assigned to assist with site survey, rigging and deployment. This work is expected to involve the deployment of at least 16 FADs.

New FAD raft further improved

During these projects work has progressed on development of an alternative FAD raft type based on a design developed in the Indian Ocean (described in the *Fisheries Newsletter #62*). This type of raft consists of a string of small floats rather than a single larger float. Experience in the Indian Ocean and with the few units deployed so far in the Pacific indicates that this type of raft has several significant advantages over the single float typically used in the Pacific.

The most important advantage is that the string of floats follows wave action and there is virtually no slamming or jerking to strain the upper mooring sections; this is likely to be of particular advantage in severe weather conditions. The string of small floats also presents lower drag to current and this may mean that smaller diameter, and therefore less costly, mooring ropes can be used successfully.

Users of this type of FAD raft in the Indian Ocean reported that under the effects of severe currents, the raft would be forced under the surface and thus out of the way of most of the turbulent action at the surface – this tendency to submerge was the reason for using hard plastic floats with depth ratings of 300–800 m. The main drawback of the Indian Ocean-style raft however has been the cost of the hard plastic pressure-resistant floats used. As reported in the *Fisheries Newsletter #62* a single raft incorporating 30–50 floats costs around US$1500.

We think we may now have the answer to this problem.

Cutting costs

During a recent FAD programme, undertaken by the Palau Government with assistance from the SPC Capture Section, an Indian Ocean-style FAD raft was rigged, but with the hard plastic pressure-resistant floats replaced by second-hand purse-seine net floats. These floats, obtained from a fishing vessel supplier in Guam, are usually discarded by purse-seiners once they have become damaged by passing repeatedly through the power block that hauls the purse-seine.

Although no longer suitable for seining, many of these discarded floats retain their shape and buoyancy and can often be obtained very cheaply, i.e. for around US$ 1 apiece. Although purse-seine floats are not rated to resist water pressure at substantial depths, the Capture Section staff's experience with Indian Ocean-style FADs rigged with hard plastic floats in New Caledonia, Vanuatu and Kiribati indicates no tendency for the rafts to submerge significantly under the force of current or wind action.

A second problem with this raft type has been in finding suitable material on which to string the floats. In the Indian Ocean galvanised wire rope is used, but this corrodes quickly and also abrades the floats so that cushioning has to be used between wire and floats. FADs rigged in New Caledonia used stainless steel wire rope; this worked well but was expensive and some of the stainless steel connecting hardware components were hard to obtain. A FAD in Kiribati which used rope encased in plastic hose to string the floats was cut off by a fisherman unhappy at the benefit the FAD gave his commercial rivals.

During preparations for the recent Palau FAD programme, Capture Section staff came across a product manufactured in New Zealand which seemed to provide the answer to this problem. The material is 16 mm, 7-strand steel wire rope covered with a 8 mm thick coating of PVC, giving a final diameter of 32 mm. The PVC is bonded to the wire rope and is

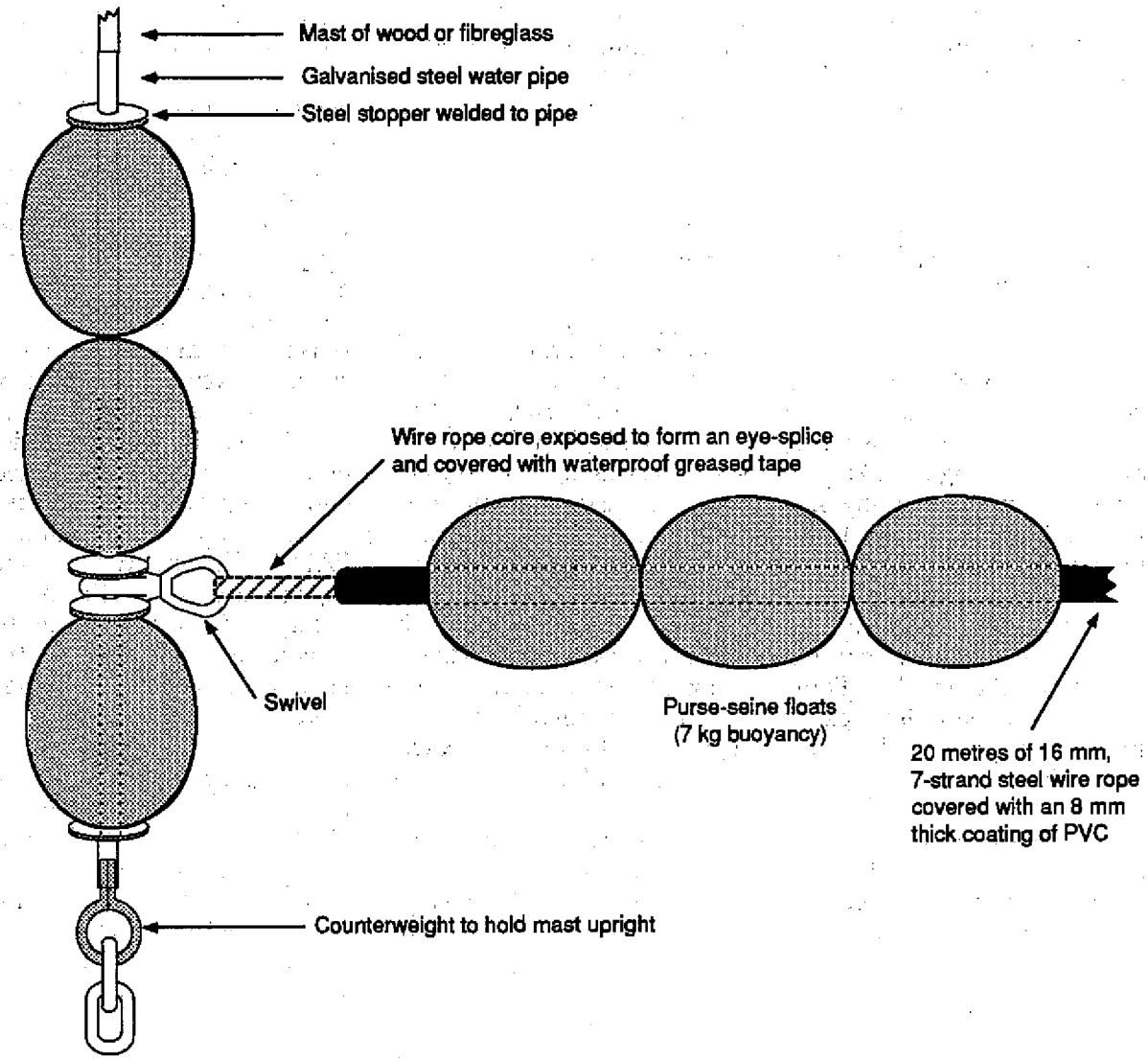
watertight. The eye-splices, which must be formed at either end of the cable to connect to the main mooring and a mast, require exposing the steel wire core and these are wrapped with waterproof greased tape.

The 50 second-hand purse-seine floats used on the Palau FAD were strung on 20 m of this PVC-covered wire rope. Both materials performed well. The purse-seine floats are very strong but resilient rather than brittle like the hard plastic floats and thus do not require cushioning between each float. The PVC-covered wire rope is both strong and flexible and the covering ensures that the floats will not be abraded.

Costs for an Indian Ocean-style FAD raft rigged with these materials are much lower than the typical cost of US$ 1500 for rigging with pressure floats. The Offshore Fisheries Development Project recently found a source of supply for new purse-seine floats at greatly reduced prices. These floats, with a buoyancy of 7 kg, are available for US $3.50 each. With a 20 m length of PVC-covered wire rope and connecting hardware costing approximately US$ 130, total cost for a raft incorporating 50 floats (350 kg buoyancy) is around US$ 305.

FAD users interested in more details about the rigging design and technique for this type of FAD raft and sources of supply for floats and PVC-covered wire rope are invited to contact SPC Fisheries Development Officer Peter Cusack.

(Contributor: Peter Cusack)



Rigging detail for the low-cost FAD raft

POST-HARVEST FISHERIES SECTION

The processing of novel tuna products in the Pacific

There are at present four small enterprises in the region manufacturing marinated dried fish. In addition to Tokelau's tuna processing and marketing trial project which has been reported on in the past and is now in its third year, there are two small businesses in Kiribati and one in the Marshall Islands.

All four process yellowfin tuna, although the processor in Majuro mostly uses marlin and swordfish as well as other by-catch species from the local longline fishery. The new manufacturers mostly sell their product on the local domestic market through hotels, bars and supermarkets.

The Tokelau project, based at Kileva Fisheries on Atafu, is export-oriented. It has had some success in finding buyers for its product 'Teriyaki Tuna' in New Zealand. For a long time the product could be seen on sale at a speciality New Zealand produce shop at Auckland International Airport. Interestingly, most customers for the product were Japanese tourists and Chinese businessmen.

The project is going through a bad patch, with the processing of 'Teriyaki Tuna' temporarily suspended because of the lack of funds to subsidise the operation while the marketing trials continue.

However, since May the prospect of reviving the project has been looking brighter. A company in New Zealand has indicated its interest in entering into a joint-venture agreement with the Office for Tokelau Affairs (OTA), which oversees the activities of Kileva Fisheries, to produce and market marinated dried tuna.

Such an agreement would allow processing to start sooner than would otherwise be possible. The New Zealand company would primarily be responsible for providing the marketing expertise and input. It is presently evaluating the improved products developed through an SPC initiative, in particular the chilli– and curry-flavoured dried tuna. If these results are favourable the New Zealanders will enter into negotiations with OTA to develop the joint venture agreement.

The two fish processing businesses in Kiribati have ambitions to expand into the export area.

SPC's Fish Handling and Processing Project has provided assistance to such enterprises over a number of years, starting with the Tokelau project in October 1990.

With the expansion of the project to include these other countries, a collaborative project has been developed with the Australian Centre for International Agricultural Research (ACIAR). The aim of this sub-project is to help establish small- to medium-scale commercial operations in isolated Pacific Island countries that would be income-generating, provide employment and use the region's most important and abundant natural marine resource, tuna and other oceanic species.

Under this initiative two desk studies ('Processing of novel tuna products in the Pacific Islands: Desk study on the Market' by Richard O'Neill, and 'A desk study on the type and range of novel tuna products that can potentially be developed and manufactured in the Pacific Islands' by Souness/Buckle, University of New South Wales (UNSW)) and two product development investigations have been completed.

The first product development investigation was on improvements to Tokelau's 'Teriyaki Tuna', carried out by the International Food Institute of Queensland (IFIQ).

The second investigation was on making dried flavoured product from minced skipjack tuna. Skipjack tuna is more abundant in the Pacific but is more difficult to process because the flesh is oily, soft and dark.

Since it was set up at the end of 1991, the SPC/ACIAR collaborative project has helped processing operations involved in the manufacture of marinated dried tuna.

The marketing desk study was optimistic about the prospects of marketing marinated dried tuna and similar products in Australia, particularly through the duty-free outlets and with Japanese tourists in mind.

The treat market for cats and dogs was also considered to be worth pursuing.

The product development work on Tokelau's 'Teriyaki Tuna' has created a product with improved appearance, texture and flavours (including curry and chilli flavours), which

at the same time is cheaper to manufacture.

The minced skipjack work had promising results but more product development studies are needed before a final product is available.

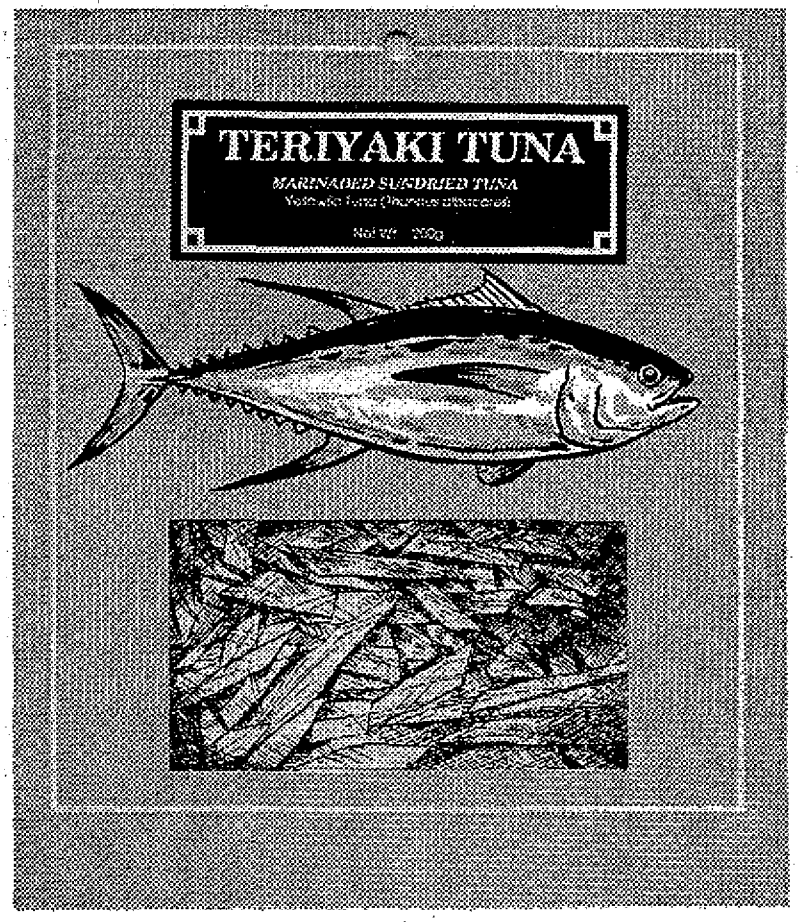
An informal working group on the processing of novel tuna products in the Pacific has been established as a consultative and advisory body for future project activities.

The action plan for 1993 includes continued support to existing novel tuna processing operations (Tokelau, Kiribati and Marshall Islands), refinements to some of the product development work carried out by UNSW and IFIQ, improvements to packaging design and formats, marketing studies at retail outlets in Australia, and future publications based on the results of the studies undertaken by the project.

Action plan activities completed or in progress include:

- a mercury content analysis of products from Kiribati, Tokelau and IFIQ's studies which showed that these products are within import regulation limits in force in Australia;
- an advisory visit to Kiribati to evaluate the two tuna processing operations there;
- a new packaging format and label for Kiribati being developed, with marketing studies at retail outlets in Australia soon to commence;
- a socio-economic study on Atafu, Tokelau, to establish the constraints to tuna processing at the community level; and
- the SPC's recipe leaflet for home-made dried marinated tuna updated to include modified processing procedures (see box).

(Contributor: Steve Roberts)



Tokelau 'Teriyaki Tuna'

HOME-MADE RECIPE FOR MARINATED DRIED FISH

Introduction

Marinated dried fish is a simple product to make. It is a dry savoury fish that can be eaten as a snack, like chips or peanuts, and served up in bars and parties to go with drinks. It may also be cooked, for example with tomatoes, onions and coconut milk.

It can be made from tuna (yellowfin is best), wahoo (kingfish), marlin, swordfish and many other fish species. Oily fish are not so good. To produce a high-quality product you must use fresh fish. It is best to use medium and large fish (more than 2 kg or 4 lbs) so that sizeable fillets or loins can be cut from which thin pieces of flesh can be sliced.

Preparation

To make approximately one litre of base marinade, mix the following ingredients together, ensuring that the sugar and salt are all dissolved:

1 litre (2 pints) soy sauce
Juice from 5–6 lemons
150 g (6 oz) of sugar
50 g (2 oz) of salt

Other ingredients that can be finely ground and added according to taste include garlic, pepper, chillies, ginger, mixed spices, etc.

Fillet or loin the fish, remove the skin, and carefully trim away the dark red muscle. Cut thin slices of fish flesh along the length of the fillet to a thickness of approximately 5 mm (1/4 inch). Wash the slices in lightly salted water, then place them in the marinade. Either use a plastic container with a good sealed lid or put the mixture of fish and marinade in plastic bags, one inside the other. Secure with a knot or an elastic band.

The fish slices must be completely covered by the marinade and left to soak for about 15 to 30 minutes with occasional mixing. If a stronger flavour is preferred, leave the fish to soak for a longer period.

Remove the marinated fish after the required time. Lay the flesh out on a mesh tray and place in a sunny and windy spot for one or two days. The time it takes for the product to dry will depend on the weather. An alternative method is to dry the fish in a warm oven with a fan switched on to produce good air circulation, at a temperature no greater than 40°C (100°F). Turn the fish strips over regularly.

The marinated dried fish is ready when the flesh is completely dry and has a reasonably tough and chewy texture.

Storage

Store in sealed plastic containers, bags or glass jars, in a cool place. The product is preserved and therefore requires no refrigeration. It should keep like this for many weeks or months.

TUNA AND BILLFISH ASSESSMENT PROGRAMME (TBAP)

Fifth South Pacific Albacore Workshop

The Fifth South Pacific Albacore Research (SPAR) Workshop was held in Papeete, French Polynesia, from 29 March to 1 April 1993. Participants attended the meeting from American Samoa, Australia, Cook Islands, Fiji, French Polynesia, Japan, New Caledonia, New Zealand, Republic of China (Taiwan), Solomon Islands, Tonga and the United States of America. The Forum Fisheries Agency and the South Pacific Commission were also represented.

The agenda included reviews of the fisheries, of available fishery data, and of recent research projects and data analysis, an evaluation of the status of the South Pacific albacore stock, and future research priorities.

A review of tagging programmes for South Pacific albacore was presented. Tagging programmes have been conducted in the South Pacific since the early 1960s by various fishery agencies to obtain information on the demographic traits of South Pacific albacore. Over 20,000 albacore have been tagged and released. Less than 3,000 of these were tagged in the recreational fishery along the south-east coast of Australia, while about 17,000 albacore were tagged from commercial troll fishing vessels, mainly along the New Zealand coast and the Sub-Tropical Convergence Zone. Less than one per cent of all tags released has been recovered so far.

Tagged albacore were recovered primarily in the longline fishery, after a period at large that ranged from one month to 4.9 years. Albacore tagged in areas east of 155°W were usually recovered to the east and north of the release site. By contrast, albacore tagged in areas west of 155°W were usually recovered at locations to the west and north of the release site.

Despite considerable effort in publicising the SPC tagging programme, tag returns remained disappointingly low. This indicated that non-reporting in the troll fleet is less of a factor for the low return rate than first suspected. Very low tag recovery rates by surface troll fishing suggest the level of exploitation by this fishery is minimal. Preliminary findings of the SPAR length-at-catch estimation model, now known as SPARCLE, were presented. The model is designed to integrate the available size composition, catch and effort data for the various fisheries to provide some information on the stock dynamics and the effects of fishing.

Preliminary fits of the model to the SPAR data suggest a declining trend in stock biomass in recent years, although the wide confidence limits on the estimates may mean that the trend is not statistically significant.

Similarly, recruitment estimates have wide confidence limits, but there appears to be a very strong signal in the data suggesting abnormally low recruitment of three-year-old albacore in 1985 and 1990. It was noted that both of these year classes would have originated during the 1982/83 and 1987/88 El Nino Southern Oscillation (ENSO) events. If low recruitment is induced by ENSO events as hypothesised, then low recruitment should occur during the 1993/94 season as a result of the 1991/92 (ENSO) event.

Catchability trends estimated by the model were also discussed; these suggest that longline catchability has declined since the late 1960s, which would at least partially explain the CPUE decline during the same period, while surface fishery trends are more variable.

In discussion, it was generally agreed that the SPARCLE model would be helpful, but further work was required to understand fully its complex features, such as treatment of stock availability. It was noted that efforts should be made to incorporate data on dropout and tag loss rates. SPC plans to undertake further work with the model, with the intention of completing its stock assessment objectives by the end of 1993.

In evaluating the status of the stock, it was noted that since the moratorium on driftnet fishing in 1990/91, catches of South Pacific albacore have remained near or below their historical average.

There is no evidence from stock indicators that current levels of fishing are adversely affecting the stock, although the available nominal CPUE time series are limited in the information they can provide in this respect. Accordingly, rapid expansion in the catch of South Pacific albacore should not be encouraged at this time.

(Contributor: TBAP staff)

TWENTY-FIFTH REGIONAL TECHNICAL MEETING ON FISHERIES (RTMF)

This annual meeting, which reviews the Commission's fisheries activities for the last 12 months and sets future directions for the programme, will be held from 2 to 6 August 1993 at SPC headquarters in Noumea, New Caledonia. The draft agenda for the meeting, subject to modification, is shown below.

The RTMF will be preceded by a meeting of the Pacific Island Marine Resources Information System (PIMRIS) Steering Committee on 30 July 1993. PIMRIS is an inter-agency project involving the South Pacific Commission (SPC), the Forum Fisheries Agency (FFA), the University of the South Pacific (USP) and the South Pacific Applied Geoscience Commission (SOPAC) which aims to provide a variety of information services to the region's marine workers.

(Contributor: J.P. Gaudechoux)

Draft agenda: 25th SPC Regional Technical Meeting on Fisheries

2 August
- Opening formalities
- Fisheries Coordinator's report
- **Technical session 1**: 1992 Western Pacific Tuna Fishery overview
- **Technical session 2:** Update of assessments of yellowfin, skipjack and bigeye

3 August
- Tuna and Billfish Assessment Programme report
  - Fisheries Statistics Project
  - Tuna and Billfish Research Project
  - Report of Standing Committee on Tuna and Billfish
  - Report of South Pacific Yellowfin Research Group
  - Albacore Research Project
  - Report of South Pacific Albacore Research Group
- **Technical session 3**: South Pacific Regional Tuna Resource Assessment and Monitoring Project and billfish research
- **Technical session 4**: The status of Pacific Island inshore fisheries

4 August
- Coastal Fisheries Programme report
  - Capture Section
  - FADs/broadbill longlining
  - Resource Assessment Section
  - Information Section
  - Report of PIMRIS Steering Committee Meeting
  - Training Section
  - Post-Harvest Section
- **Technical session 5**: Processing novel tuna products in the Pacific

5 August
- Review of regional institutional arrangements in the marine sector
- Reports by other organisations
- Other business

6 August
- Adoption of the report

BONES FROM THE LAGOON

New Caledonian coral is spreading its branches into international surgery. A local company gathers and prepares the future bone. The 'biocoral', cut to size in Paris, is a world monopoly. New Caledonia is the main supplier.

Each weekend, hundreds of Caledonians gather corals in coastal waters. The Caledonian lagoon meets most of the international medical demand. Osteopathic and dental surgery are coming to rely more and more on the *Acropora* genus.

The use of coral in surgery is certainly not new. The first experiments were conducted in 1977. In 16 years, it has established a solid reputation as a magic 'guide' as much among doctors as patients. Numerous articles and reports have been devoted to the subject.

Medicorail

For several years the City of Noumea and the Aquarium have collected *Acropora*, *Porites* and *Lobophyllia* (the three types of coral used) for 'research' purposes. Approximately two tonnes have been sold yearly, without profit, to the metropolitan firm Inoteb. With a world monopoly, it is their task to produce 'biocoral'.

However, this is not a job for the Aquarium or the Municipality. They have withdrawn and handed the torch on to private investment.

A Caledonian company, Medicorail, set up a year and a half ago, obtained special permission to gather and export the coral (it should be noted that the Washington Convention prohibits coral exports).

This exclusive permit, issued by the *Affaires maritimes* (marine service) contains various restrictions: harvesting must be conducted outside reserves in a specific quantity and the coral must be processed before leaving the Territory.

From this, coral has opened up an international market.

Ecological preservation

Caledonian coral supplies most of the demand owing to several advantages. First of all, the sole buyer, Inoteb, is French. It can count on the quality and reliability of deliveries. Local species assure the necessary chemical, physical and mechanical homogeneity.

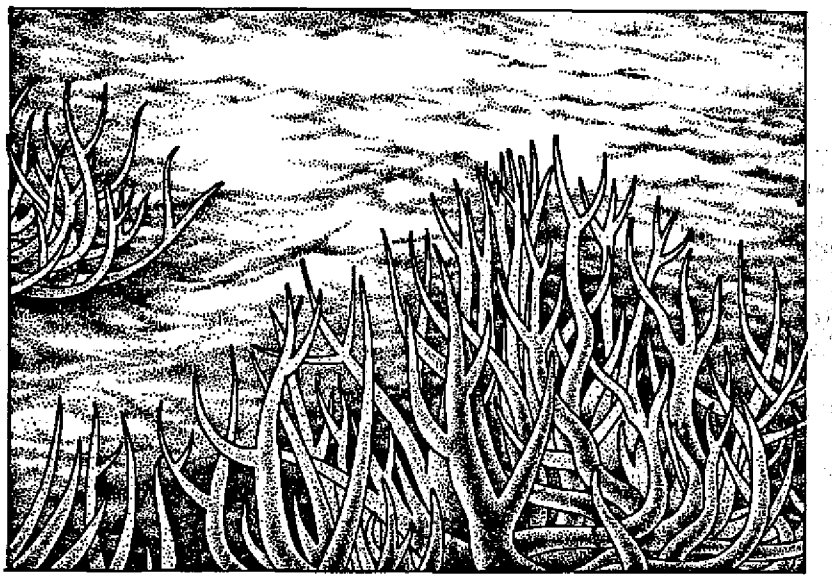
Above all, it knows that the Caledonian lagoon is free from pollution and the supply is enormous. Two or three harvests per year are possible without noticeable damage.

'The exploitation is less than the yearly renewal rate of the coral', explains Dr Michel Jorda, Operations Manager for Medicorail. 'We receive advice from the Aquarium and only work in areas outside the reserves. We gather ten times less coral than a company using it for decoration.'

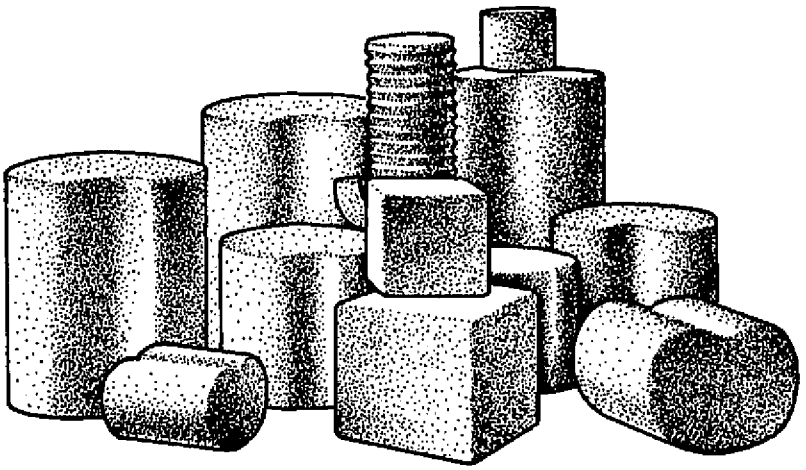
As an example, 100 kg of *Acropora* are collected in an area of 20 m². The annual harvest therefore covers a total area of 600 m² spread out over several sites in the lagoon. The loss is minute, undetectable, the ecological balance safe.

Hitting the jackpot

Leaving the lagoon, the coral is washed and dried before being cut to size.



***Acropora* sp. is widely present in the lagoon; it is one of the three coral genera used in surgery.**



Coral processed into 'biocoral' is ready to be grafted

'To date Inoteb has not advised us on what type of pre-treatment they want', explains Michel Jorda. The French company is not used to this.

Until now, they received the raw branches which they then transformed into granules or spheres. On the medical market, their 'biocoral' sells for an impressive sum. Four 300 mg units of granules sell for 12,254 CFP francs. This puts the price per kilo at 10,211 million CFP francs. A 3–4 mm sphere weighing 1.5 g costs 37,727 CFP francs (or 21,818 million CFP francs per kilo). Inoteb has hit the jackpot. In Noumea, Medicorail remains much more modest. In the absence of further processing, their production does not attract these high prices.

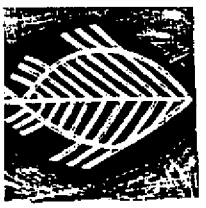
It is unfortunate because 'biocoral' has proven its medical qualities for many years. 'It acts like a path on which bone grows', explains Dr Jorda. 'It has the same composition and the same structure. It is the only material which is not rejected.' Better than plastic or metal, coral integrates perfectly. Like bone, it has spans and cavities where cells become established. Some of them contribute to its growth while others break it down. The bone however is living and renews itself, so well that in time the 'biocoral' is consumed by the cells and is replaced by new bone material. The implant has disappeared. No foreign matter remains after a return to normal.

Research on the giant clam

'Biocoral' is used in pieces for chins, sockets or cheekbones. In cube or spherical form, it can fill a gap or replace a vertebra. In granules, it can replace the root of a pulled tooth. The applications are multiplying, except where it is necessary to replace a large bone which supports a significant weight. The coral is too fragile for that. For example, it cannot be grafted to replace the neck of a femur.

Nevertheless, the Caledonian lagoon may conceal another prothesis of the future. Research is currently under way into the giant clam. The shell, which is very solid and harder than coral, could replace an entire bone some day.

(Source: *Les Nouvelles Calédoniennes*)



WHO SHOULD PAY FOR FADS?

While the use of fish aggregation devices, or FADs, is familiar to fishermen in the Pacific islands and South-east Asia, they are less well known in other parts of the world.

In 1991, following growing interest in the use of FADs in the USA and private sector development of FAD technology, the United States Agency for International Development (USAID) decided to fund a study on the potential for FADs to contribute to fisheries development in developing countries. As an agency supporting economic and social development, USAID was naturally also interested in looking at the sustainability of FAD programmes, that is, in assessing whether or not, after initial funding, FADs could generate sufficient benefits to ensure that developing countries would find a means of continuing FAD programmes without further assistance.

Consequently, the International Centre for Marine Resource Development (ICMRD) of the University of Rhode Island was awarded funds to carry out studies in Cape Verde, Barbados, St Lucia, St Vincent, Grenada, Indonesia (Sumatra), Costa Rica, Tonga and Western Samoa. ICMRD contracted a number of consultants to visit

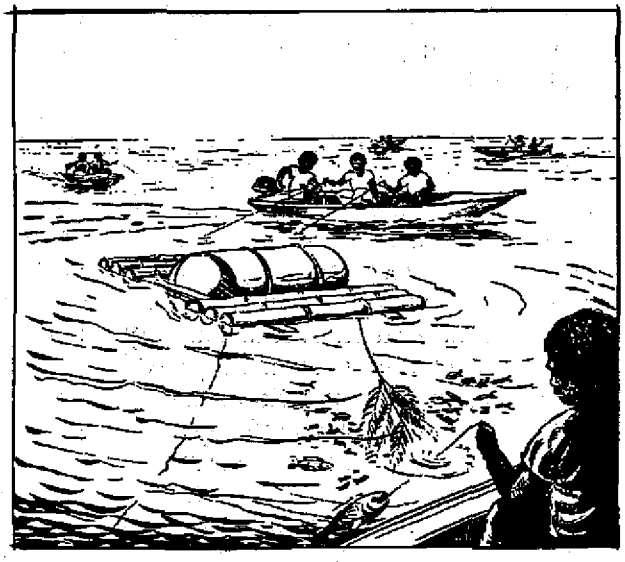
the selected countries to research the technical, economic and socio-cultural aspects of establishing sustainable FAD projects. After the ICMRD team completed the visits, a workshop was organised to determine the criteria required to establish sustainable FAD projects. Organisations involved with FAD development in the Pacific region were invited to take part in the workshop, held from 1 to 2 June 1993 in Suva, Fiji, with participants from Tuvalu, Tonga, Western Samoa, USAID, and the South Pacific Commission.

The ICMRD team found that, of the areas visited, only Sumatra and Western Samoa had on-going FAD projects supporting their artisanal and commercial fisheries.

The other countries had either experimented with FADs and terminated the projects after initial trials due to lack of funding, or had no experience with FADs at all. The countries where FADs were deployed believed that the fishermen had increased catches, reduced their search time for pelagic schools and reduced their operating expenses.

Government departments of all the countries expressed concern about over-harvesting of inshore fish resources and were supportive of FAD projects that encouraged fishermen to exploit resources further offshore. The possibility of extending the pelagic fishing season, the positive impact on the sports and tourist industry, lower fish prices for local consumption and the chance of developing an export industry were also seen as potential benefits of the FAD programmes.

Sumatra was the only area studied where FADs were financed by the private sector. FADs evolved there from fishermen's experience with the aggregation of fish on naturally occurring floating debris. Both inshore and offshore FADs are extensively deployed around Sumatra. Inshore FADs are mostly deployed by individual fishermen in relatively shallow, calm waters. These are constructed from locally available materials. The designs range from a bottle tied to an anchored monofilament line to a bamboo raft similar to the payao of the Philippines. These FADs are deployed in traditional village fishing grounds and can only be used by fishermen from the community.



Offshore FADs are generally deployed by commercial fishing companies. The companies form a relationship with fishermen's associations whereby the company deploys the FADs and sometimes provides onshore infrastructure, while fishermen using their own craft and crew fish the FAD and sell their catch to the company.

In other countries studied, the public sector has become responsible for financing FAD projects. In most cases this happens because although FAD use was never developed by local fishermen, fisheries authorities had introduced FADs as a means of supporting and developing national fisheries.

After initial trials, FAD projects were usually either re-financed by governments or were terminated for one reason or another, sometimes due to lack of funds. The Government of Western Samoa has maintained a FAD programme for almost 14 years. Fishermen there have increased their catches by 40 per cent, but have never contributed to the cost of the FAD programme. As FAD time-on-station was around 12 months, recurrent funding was required to maintain the programme.

The ICMRD team felt it was un-realistic to expect that governments, or external donors, would carry the full burden of on-going FAD projects indefinitely, and that users should be required to contribute to costs. They recommended a number of methods whereby users might contribute financially:

- Fishermen could contribute a percentage of their catch towards a revolving FAD fund. The fund could be managed by fishermen's associations to cover the costs of redeploying and maintaining FADs.

- Fishermen could make an annual contribution to a fishermen's association for the privilege of using FADs. The FADs would be managed and controlled by the associations.

- Private companies could be responsible for deploying and maintaining FADs. The companies could either collect fees from the fishermen using the FAD or collect a percentage of the catch.

- Governments could introduce a tax on the sale of fish. With tax funds the government could either finance its FAD programme or contract a private company to deploy and maintain the FADs.

- Fishing vessel fuel could be taxed and the revenue raised devoted to FAD programme costs.

A number of difficulties with these suggestions were raised during the workshop discussions. Participants from the Pacific region felt that there would be many logistical, social, and economic problems with levying fishermen for FAD costs. They felt too that if private interests financed FADs, conflicts could arise over control of access. In many areas, private interests would not have the vessels, equipment and trained personnel to deploy FADs properly. Often government departments required external technical assistance to initiate FAD programmes.

Reports were presented outlining the criteria for designing sustainable FAD programmes. The first consideration was that the design of the FAD should be appropriate for the local marine environment. In areas subject to extreme weather conditions and where limited maintenance was possible, FADs should be rigged from strong, durable materials.

This has been the approach taken in the Pacific region. If, however, the pelagic fishery is seasonal it may be more cost-effective to deploy cheaper FADs with estimated life spans approximating one fishing season, the rationale being that there will be a fair chance that the cost of the FAD is recovered by increased catch before the unit is lost. (SPC's Fisheries Programme is presently working to develop cheaper FAD systems that may answer these concerns.)

Secondly, social and cultural factors must be taken into account before designing a FAD programme. It is possible for instance that not all members of a community will view the introduction of FADs positively.

Fishermen who are usually more successful may feel that the FADs will reduce their competitive advantage over other fishermen and also that an increase in catch may reduce fish prices. Several incidents of FAD vandalism in the Pacific have been attributed to this cause. Local customary and religious practice may not be compatible with the establishment of commercially oriented fisheries. The recognition of traditional tenure over fishing grounds may cause difficulties for FAD programmes too.

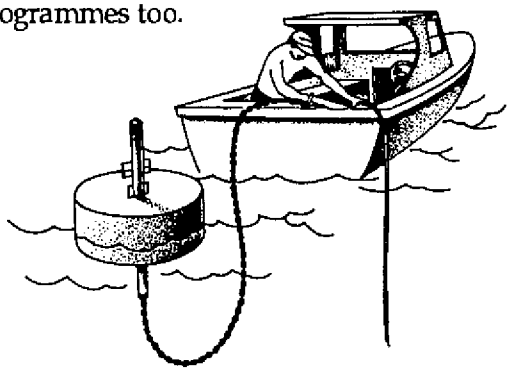
Thirdly, monitoring systems must be put in place to evaluate all aspects of FAD programmes. Properly designed monitoring programmes should determine seasonality of the species occurring around FADs, productivity, profitability, catch per unit of effort and the most successful fishing methods used by fishermen. Data from a monitoring programme will determine an appropriate model for designing other FAD projects.

Analysis of data collected from fishermen and fish markets will determine production levels, revenues and operating costs. Comparing these data with pre-FAD data will give a measure of a FAD's value to a fishery. This information will, in turn, assist fisheries managers and planners decide what level of resources should be devoted to FAD programmes.

It is expected that ICMRD will publish papers arising through the study and workshop later this year. Those interested in receiving the publications should contact:

Richard Pollnac Ph.D., International Center for Marine Resource Development, University of Rhode Island, 126 Woodward Hall, Kingston, R.I. 02881, U.S.A.

(Contributor: Peter Watt)



KEEPING AN EYE ON SHARKS

John Naughton is a shark man. For nearly 30 years, he has studied the 30 or so species that naturally populate Hawaii's seas. That list includes tiger sharks, which have been making front-page headlines with alarming regularity since Ms Morrell was attacked and eaten by a large tiger shark off Olowalu, Maui, three days before Thanksgiving 1991. Since then, it has seemed as if tigers are the only sharks in local waters.

Naughton was called as an expert in the Morrell case, as well as in three other fatalities and several 'incidents'. His work with sharks goes back to the state-funded Shark Research and Control programme run by University of Hawaii Professor Albert Tester from 1967 to 1969. Naughton, then a graduate student in marine biology, worked closely with Tester.

Over the years, no one in Hawaii has got up-close and personal with more tiger sharks. He estimates that he has examined the contents of the stomachs of 'hundreds' of tiger sharks.

Knowing the diet of tiger sharks is the best way of learning – and predicting – their behaviour patterns. And what Naughton and colleagues continue to find argues against several theories that have been advanced to explain the dramatic rise in encounters of the worst kind.

Naughton thinks that the tiger shark is clearly a near-shore species, which many people have difficulty accepting. One of the theories is that longliners are reducing the tuna and billfish supply offshore and that is driving the tigers closer in.

'Well', says Naughton, 'that's just not the case at all. I have been through the stomachs of hundreds of tiger sharks and rarely, if ever at all, do you find tuna. What you find is other sharks, sting rays, turtles, nearshore porpoises, a whole array of reef fish – mostly the slower-swimming reef fish like big spiny puffers and uhu (parrotfish).

'I have checked logbooks and I have been on a lot of longline boats, and sharks are the most abundant thing they catch – mostly blues, white-tips, silkies, an occasional thresher or mako, but very few tigers. If tigers were out meandering around the open ocean between islands, fishermen would be catching a lot more.

'The other thing people mention is sea turtles. There's no question that sea turtles are an important prey for tiger sharks. But in Tester's programme, we found that turtles only made up 13 per cent of the stomach contents. Of course, we were going through the stomachs very carefully. We found small hard parts, eyeball lenses, spines from puffers, lobsters, bird feathers, to indicate other things they were eating.

'The problem with sea turtles is that you get so many big hard parts that last longer in the stomach, so if you open the stomach of a shark, it gives a disproportionate bias to turtles as the only thing they are eating. Tigers are very indiscriminate feeders. The sea turtle theory is one that I feel is being over-emphasised', he said.

'What I think might be happening, and it involves turtles, peripherally, is that the tigers are looking for prey up on the surface. Such things as wounded and dead fish and seabirds will be up on the surface. At stream mouths, animals come down the stream and float on the surface. One of the big tigers caught recently off Haleiwa had a wild pig in it.

'We have found goats in them off Kahoolawe – we suspect the goats were knocked into the water by the Navy's shelling. Once we found a can of red lead paint – you know how toxic that is! They will hit almost anything that's drifting.

'Now sea turtles, when they are up on the surface breathing, they're much more susceptible to predation. They're silhouetted against the sky and then, bang. My feeling is maybe that's the reason swimmers, surfers and boogie-boarders are taken. It's not that they look like turtles necessarily, but that they're up there on the surface with the rest of the prey.'

Naughton also refers to a list compiled by NMFS colleague George Balazs, documenting every known shark-human incident in Hawaii dating back to 1779: no confirmed attack on a scuba diver has ever been attributed to a tiger shark.

'I have made 3,000 to 4,000 dives in the Hawaiian Islands over 30 years and I've seen two tigers underwater. One followed me all the way to the surface, which was a little frightening. But the other paid no attention. Then you hear from people who have to fend them off with spears and just barely make it into the boat', Naughton says.

And then there's the story of rock legend Stephen Stills, who

in the late '60s and early '70s lived on Maui and spent much of his time diving for black coral.

'There was a tiger, about 13 feet, that used to come around. We called her Uggums', Stills recalls. 'Sometimes we'd feed her and she would literally keep other sharks away from us.'

'We have heard stories like this', Naughton admits, 'but it's such a big animal and so unpredictable, and they can do so much damage in such a short time, it's terrible. My advice is to act like you belong there, *but to get out of the water as quickly as possible*'.

Today, Naughton runs the National Marine Fisheries Service Habitat Conservation Branch in the Pacific islands, and he is involved principally in reviewing projects as to their impact on fishery habitat and threatened and endangered species. The job takes him from Alaska to Palau, through Micronesia, to American Samoa and all throughout the Hawaiian archipelago.

But above all, Naughton knows sharks. In addition to Tester's programme, Naughton did some studies on sharks and the predation of Hawaiian monk seals and green turtles, because the tiger shark is the main predator for both.

To study that, Naughton dropped down in a shark cage in the middle of 'this plume of predators'. The reason for more attacks, simply, is that there are more sharks and more people in the ocean. A state programme, after Billy Weaver was killed by a tiger while surfing off Lanikai in 1958, removed 87 big tigers from Oahu waters. Tester's programme removed another 137. At the time, Naughton says, 'estimates then were that we had reduced the tiger population by about 60 per cent. Another state programme in 1971 removed 27 more. Now, the population has bounced back'.

As a scientist, Naughton sees tiger sharks as the top of the food chain in the seas around Hawaii. 'Tiger sharks are a very important part of the nearshore ecosystem. They are the apex predator. Tigers feed on the eight or nine other species of sharks in our near-shore waters and are their major predator. And they are the great rubbishmen of the sea.

'They have a valuable role as scavengers. They are like lions or grizzly bears in a terrestrial ecosystem. They are not just eating the dead, but the sick and injured. So it makes for a stronger gene pool. They're taking care of the malformed animals, the sick and diseased. We suspect many of the sea turtles that are being taken could be the ones who have been blinded by tumours' (a disease that affects a significant percentage of sea turtles).

What bothers Naughton is that 'there is still so much we don't know'. The Task Force and independent shark hunters have removed 32 large tigers, and Naughton says he would like to catch a couple that continue to be seen on the North Shore and off Waimanalo. But he would also like to shift the focus of the Task Force to public education and research.

'I have high hopes for our tagging programme', he says. Of course, tag and release takes on a whole new meaning when the tagee is a large tiger shark.

'When we used to put our strap tags on the dorsal fins of the big ones, we had to lash down the dropper (a line that had the hook in the mouth) to the powerhouse and then get a loop around the tail and lash that to the other end of the boat – and the thing would just be going crazy! – and then we'd take turns, one guy would hold the other by the ankles and lower him down and you'd grab the dorsal and put a metal tag on it like a cattle ear tag. Now we use a dart tag that just goes right in – it's a much more rational approach.

'We had one recently that was tagged and was caught two and a half years later not very far away. So we feel that there is a lot of good evidence that these guys have a home range. So if you have an attack, or there is a large animal that is seen consistently in the same area, go out and remove two or three animals from that area, and that's it.

'We have had identifiable sharks – one they call 'The Landlord' in Kaneohe and the 'Maili Tiger' – and since we have removed a couple of animals from those areas, there have not been any more sightings. Those were just accidents waiting to happen.' Naughton also talks excitedly about a sonic tagging programme that will begin soon.

Meanwhile, Naughton admits: 'I wish the problem would just go away. But I'm afraid it's something we'll be dealing with for a long time. The best of all worlds would be to get a managed fishery, like we manage our other fisheries – harvest a specific number. But I don't see that happening soon'.

(Source: *MidWeek*)

TWO MANUALS ON GIANT CLAM PUBLISHED BY ACIAR

The Giant Clam: a hatchery and nursery culture manual, R.D. Braley, ed., 1992. *ACIAR Monograph No. 15,* 144 pp.**The Giant Clam: an ocean culture manual,** H.P. Calumpong, ed., 1992. *ACIAR Monograph No. 16,* 68 pp.

These two volumes arise out of the research sponsored by ACIAR under the International Giant Clam Project and co-ordinated amongst eight countries between 1984 and 1992. Together, they form an up-to-date, hands-on guide – essential reading for all interested in the culture of giant clams in the Indo-Pacific region, whether for conservation, subsistence nutrition, or commercial purposes.

Giant clams have attracted considerable research interest for several reasons:

- they are considered endangered: their high value in certain markets coupled with ease of harvesting has rendered them extremely vulnerable to over-exploitation;
- they are largely photo-trophic, particularly as adults, thanks to their commensal zooxanthellae, and clam culture offers many potential advantages over organisms that have to be fed continually;
- they are of great cultural importance to many of the indigenous peoples of the Indo-Pacific. Giant clam husbandry already has a place in certain island lifestyles, thus giant clam culture may offer appropriate opportunities for income-earning activities in rural areas.

These manuals do not provide a comprehensive or academic review of all the results of the International Giant Clam Project, rather they synthesise the available knowledge from the several institutions that are involved in culturing giant clams, with particular emphasis on extensive, cost-effective, and workable techniques. References to further information are provided in both volumes.

The *Ocean Culture Manual* is published separately from the *Hatchery and Nursery Culture Manual* since many institutions or individuals are interested in importing juvenile giant clams from established hatcheries, either for preliminary trials or where hatchery facilities would not be feasible.

An important adjunct to both manuals is a discussion of the potential side-effects of translocation, including genetic implications and the possibilities of spreading parasites or diseases outside their existing ranges. Quarantine protocols for both exporting and importing institutions are described in detail, and these will hopefully become the basis for guidelines for all organisations or individuals broadcasting marine organisms, of whatever species, over long distances: a safeguard that has all too often been overlooked in the past.

The *Hatchery and Nursery Culture Manual* covers all aspects of setting up a hatchery for giant clams, from site selection through broodstock collection, spawning, larval rearing, feeding and settlement to transfer of the resulting 'seed' to the ocean nursery (or to the retailer, if a market for small clams is being targeted). All these chapters assume little previous experience with hatchery operation and provide basic instructions as well as a description of the more specialised aspects of giant clam culture, synthesised from years of practical experience.

Those of us who have struggled to set up a giant clam hatchery in the past will particularly appreciate the appendix of suppliers and prices which, whilst quoting only Australian firms, is comprehensive enough to enable a detailed preliminary costing.

The *Hatchery Manual* also briefly covers the economics of producing seed from a hatchery based on the James Cook University Orpheus Island Research Station model. This chapter provides a useful description of what sort of factors need to be taken into account when working out the economic feasibility of culturing an organism with a relatively long 'cropping cycle', but readers are urged to perform their own economic analyses from scratch, given the widely differing costs of goods and services in different countries.

The discussion on the genetic implications of giant clam culture is necessarily abridged in this practical manual, since the breeding of improved strains incurs a considerable production overhead that is most appropriately borne by larger experimental institutions, and the

practical implications of reef reseeding on the population genetics of natural stocks are subject to considerable debate. The manual gives sound advice to maximise the number of parents contributing to any one spawning.

Apart from the sections on practical hatchery and nursery operation, economics and quarantine, the *Hatchery Manual* also contains an up-to-date summary of known parasites and diseases of tridacnids in culture, together with advice on prevention and treatment. This is a most useful reference in its own right.

The *Ocean Culture Manual* is for those field workers or farmers running a giant clam grow-out unit, using seed supplied by a hatchery. Many grow-out methods for giant clams have been tested over the last decade. This manual provides a practical description of different designs for cages, enclosures and exclosures, and guidance as to which are most effectively used in different situations. This is still a developing research area, since it is time-consuming to perform rigorous trials, but the manual provides a most useful summary of the methods that have been tried to date and which are most likely to be effective.

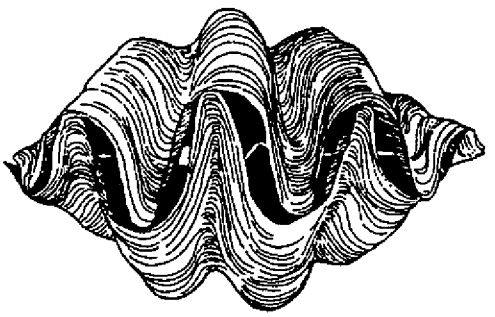
The main cost of grow-out is the necessity of protecting the young clams from natural predators and pests, and good site selection is essential both to minimise predation and to provide the optimum conditions for growth. I felt that the narrative on site selection was a little too general and didn't take into account enough of the differences between the different species under cultivation. But then again, this is an area where a great deal remains to be learned, which only comes about through growing experience with practical extension work over the coming decade.

The manual contains a comprehensive summary of the pests and predators likely to be encountered in the field, and how to control them. For a description of diseases the reader is referred to the companion volume since much more is known about diseases in hatchery situations, but a protocol for specimen preparation is given for the referral of suspect cases to a laboratory.

All in all, this pair of manuals provides a practical, appropriate guide to the current 'state of the art' in giant clam cultivation, and will be essential reading for anyone thinking about, or engaged in, running a giant clam hatchery or farming or reseeding giant clams.

They are not the last word, of course. The greatest potential for advance remains in the ocean nursery and grow-out phase, and these advances will only emerge as current and proposed current trials of practical reef-reseeding and clam-farming reach maturity. These manuals provide a basis for making those further advances.

(Contributor: Dr Tim Adams)



PROCESSING AND MARKETING OF ANCHOVY

The Post-Harvest Fisheries Project of the Bay of Bengal Programme (BOBP) has been working with the Kanniyakumari District Fishermen's Federation with the aim of providing assistance in resolving several problems associated with the traditional practice of drying and marketing anchovy.

As a result of this work, a paper has been published, from which the summary below is extracted.

The district of Kanniyakumari is very active in fisheries, producing some 15 per cent of the total catch of the State. Despite an increasing trend towards fresh marketing outside the district and especially towards lucrative exports of crustaceans and cephalopods, local markets still represent around 90 per cent of the volume and about 60 per cent of total revenue.

Kanniyakumari boasts the highest landings of anchovy (*Stolephorus* spp.) in the State. Although data are scarce and generally unreliable, landings in the district probably vary

from 5,000 to 10,000 t/year, representing some 60–70 per cent of the State's total.

The three principal target species of anchovy are described, as are the locations, seasons and the gear used to catch them. The traditional markets and marketing channels within India and to Sri Lanka are then examined and information on current price structures is presented.

There is much concern, backed up by several anecdotal reports, about heavy losses on anchovy as a result of poor processing and restrictive marketing. The fishermen themselves were the first to point these problems out through their own representative body, the Kanniyakumari District Fishermen's Sangams Federation (KDFSF), a non-governmental organisation made up of active fisherman from several of the local communities.

BOBP was approached by KDFSF in 1989 and asked to provide advice on what was clearly a major issue of considerable local concern.

The resulting studies carried out by BOBP and, at the request of BOBP, by the Central Institute of Fisheries Technology (CIFT), Kochi, indicate that glut landings of these fish during certain periods of the year create a vast oversupply to local fresh fish markets. In order to avoid gross financial losses, the only realistic option open to the fisherman/processors is to dry the anchovy on the sand.

This is, at best, a hazardous operation, being carried out in direct contact with, more often than not, filthy beach sand which adheres to the product and often comprises 20 per cent of the final product weight.

Other problems are caused by:

- Seasonal rainfall and the difficulties in drying when in close contact with humid sand;
- Excessive heat of the sand during sunny periods, when the product becomes cooked and very fragile; and
- Poor product storage and prevalence of insect infestation.

Ignorance of many of these factors by the fishermen is the rule rather than the exception. Few attempts have been made in the past to alleviate the situation.

The extremely poor quality product which results from this is downgraded to low-value animal feeds. Losses are, therefore, characterised in terms of 'economic loss' i.e. loss in potential revenue to the producer, and to actual physical loss, where the product is sometimes buried or used as fertilizer in local coconut gardens.

Realistic estimations of loss are extremely difficult to make, largely because it is unlikely that glut landings could ever be fully and adequately converted into value-added (i.e. improved quality) product and lost revenues thereby realised.

After all, who is going to invest in machinery or infrastructure capable of handling the large volumes concerned and which may only be used for short periods during the year? For the sake of illustration, however, the data presented indicate a theoretical level of economic loss, calculated assuming that downgrading is eliminated and that current market prices of the highest grade traditional product are achieved for the entire production. This indicates a level of loss in income of about 50 per cent.

The original studies of losses had suggested that the potential for tackling these problems through improving processing and marketing was good. In order to test how much impact could, in fact, be made on reducing losses, a series of practical trials were set up in co-ordination with the KDFSF.

As a first step, trials with low-cost, simple technology were carried out. Multi-layer drying racks were tested, and the trials demonstrated that technical problems of poor product quality could indeed be overcome cost-effectively.

Moreover, parallel studies of the market for anchovy in India also showed potential for value-addition in that, although the price of traditional dried anchovy was relatively inelastic, consumers were willing to pay a higher price for a better quality product.

Further market studies of dried anchovy showed that several other options existed for marketing of a value-added product. Sri Lanka has traditionally imported large volumes of anchovy from India.

A dramatic decline in imports from India from 97 per cent in 1985 to 11 per cent in 1988, combined with a huge increase in imports of high-quality product from Thailand, underlined the demise of the Indian product. As less is used for ex-

port, the demand for a raw material for low-grade animal feeds has become an easy option for the communities involved in this fishery. The potential for improved marketing and especially for redeveloping the Sri Lankan export market, led to the subsequent project.

The **second step** carried out during 1991 involved setting up, with KDFSF, a pilot processing centre in an anchovy-producing community. One tonne of high-quality product was produced and used for test material. The main outcome of this was to confirm that, as long as quality can be kept high, higher prices and wider marketing potential were appreciable for three processing options:

- The whole rack-dried product derived mainly from the seine net fishery (head on);
- The rack-dried, de-headed product from the gillnet fishery (head off), and
- A dried fillet (flake) made from the rack-dried, head-off product.

Markets for these products were identified in South-East Asia and West Asia where quality considerations are becoming of paramount importance. Moreover, it was also found that good potential exists within India, especially amongst the middle- to upper-income urban groups, who are prepared to pay for quality.

A conclusion from these initial trials was that the current level of economic loss can be partially resolved. This is achievable not through attempting to improve the quality of the total production, but though adding considerably to the value of a small proportion of the landings.

Indeed, as the paper goes on to demonstrate, the enhanced-quality (i.e. value-added) products, such as those produced by the project, have the clear potential to achieve market prices much higher than those currently obtainable for the highest-grade traditional product. This is achieved through the application not only of simple technology, but also through several marketing strategies described.

Through the development of close working relationships between participating fishermen and Federation officials, this 'pilot' study also helped clarify the social feasibility of the project.

A significant social benefit resulting from any development of this activity would include the potential to create employment for village women within the target areas. The manufacture of the flake product, for example, is extremely labour-intensive, requiring one woman-day to produce half a kilogram of finished product. Product packing would also create employment.

A **third step** is now proposed. This involves the development of a commercial, community-level project, co-ordinated and managed initially through the KDFSF members. This builds upon the experience already assimilated and continues to rely heavily on complete participation of the target communities and community organisations at all levels. Costed proposals are presented and they demonstrate the economic and social feasibility of the options.

The commercial project involves the establishment of 120 drying-rack units in two communities in Kanniyakumari District. These would be operated by fishermen's family units selling the product to the project through the village *sangam* (fishermen's village-level association linked to KDFSF).

The project would be implemented through a simple organisation operating, initially, under the direct control of KDFSF (with advice from BOBP) and possibly later becoming an independent company.

This organisation would be responsible for controlling quality, manufacturing flakes, organising packing and marketing the product; it would be accountable to the Federation itself.

The level of production initially proposed for the project is 59,400 kg/year, comprising a mix of the three products described above. There will be up to 29 flake processing units, each employing five women, with an aggregate annual capacity of 12,090 kg of flakes. These units will manufacture flakes from dried, head-off anchovy previously purchased from the fishermen. The total annual turnover is expected to be in the region of IRs. 2,632,000 (1 US$≈ 28 IRs).

The success of the project hinges on the assumption that the per kilogram revenue achieved by the new and better quality products is considerably higher than at present – whereas weighted average prices for sand-dried anchovy bought from the target communities over the last two years indicate a sale price of only 7.40 IRs/kg, the project would

purchase the rack-dried product from the fishermen at a minimum initial payment of 20 IRs/kg and sell at a minimum of 35 IRs/kg. The flake would sell at 130 IRs/kg.

The fishermen would also receive a bonus payment of 90 per cent of net profits on a shared, *pro rata* basis. Ten per cent would be retained by the project/KDFSF for reinvestment purposes.

These payments would be deferred for some time until annual profits had been calculated. At the rates indicated, however, the fishermen could expect to earn about three times the current rate per kilogram of dried anchovy sold. Moreover important employment opportunities would be created for village women involved in the flake-making.

A calculated internal rate of return of about 80 per cent for the project prior to financing is very acceptable.

However, the means of financing is clearly an area which must be carefully assessed. Although the fixed capital outlay is small, working capital requirements are high, due to the labour-intensive nature of the project and likely delays in payment for the finished product.

Apart from finance, the project appears to be sensitive to product price.

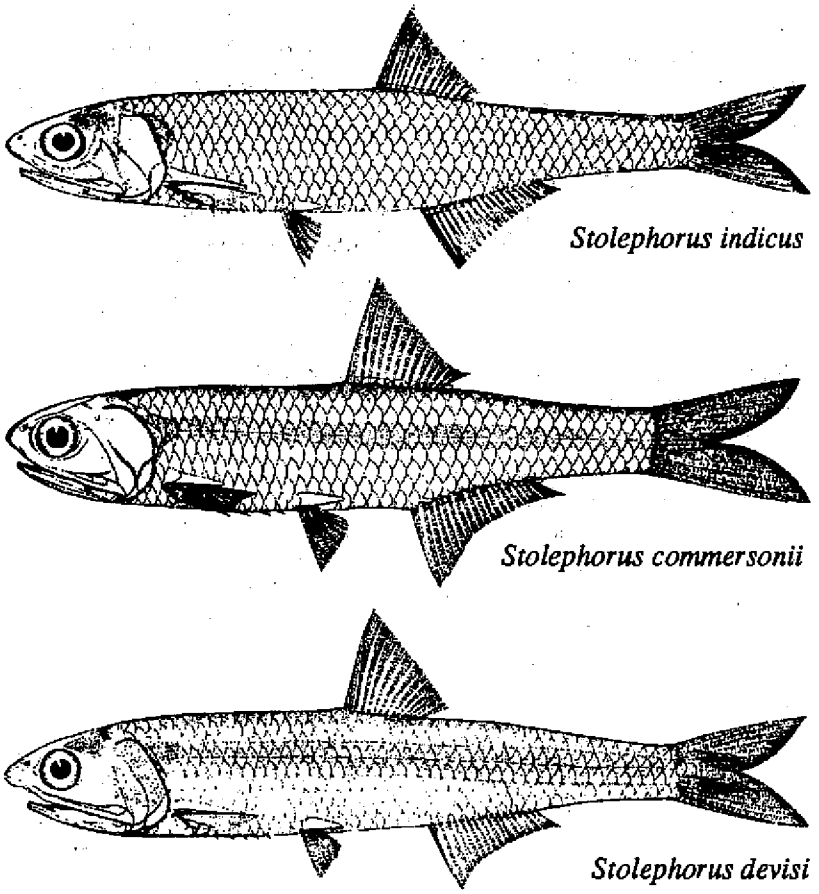
Flake production is the preferable option, as this yields a higher return at the product price assumed. An increase in flake production would also have great social benefit in terms of increased employment.

A problem, however, would be the increasing difficulty in controlling product quality. Doubling the production level of simply head-on or head-off product yields the same return as the standard model.

The commercial project is regarded as a preliminary stage to a much wider, district-wide or even regional activity. This, and the activities which led up to its implementation, could serve as a model for other communities with similar socio-economic structures which face similar fish processing and marketing problems.

(Source: Bay of Bengal Programme)

Bostock, T.W., M.H. Kalavathy & R. Vijaynidhi. 1992. Processing and marketing of anchovy (in the Kanniyakumari District, South India), Bay of Bengal Programme, *WP 85*, 58 p.



Anchovy species of commercial importance in South India

INTRODUCTION TO PAYAO DEVELOPMENT AND MANAGEMENT IN OKINAWA, JAPAN

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After the success of the fish aggregation device (FAD) experiment in Hawaii in 1979, FADs were rapidly introduced to Pacific Island countries, and their development has been recognised as one of the most important areas in fisheries development in the region.

SPC's Coastal Fisheries Programme has provided technical support to FAD development programmes.

This article outlines the development and management of payao FADs (the name payao originally came from the Philippines) in Okinawa, Japan, and hopefully will be useful in their future development in the Pacific Islands.

Due to the limited number of references available in this study, fisheries-related institutions and agencies in Okinawa should be contacted for further technical details.

The author acknowledges the kind assistance of Mr Kunji Maeda, Okinawa Prefectural Fisheries Experimental Station, Mr Shinichiro Kakuma, Fisheries Administration Division of the Okinawa Prefectural Government, and staff of the Itoman Fisheries Cooperative Association, the Motobu Fisheries Cooperative Association and the Yaeyama Fisheries Cooperative Association.

Okinawa

Okinawa is located in the southernmost part of Japan (between 24°N and 27°N) and the sub-tropical zone (Figure 1). It consists of about 60 islands (Ryukyu Islands) scattered over 400 km from north to south and 1,000 km from east to west, which divide the Pacific Ocean and the East China Sea. Okinawa has a population of about 1.2 million.

In 1990, fisheries production in Okinawa recorded a total of 46,0000 t with a value of 26.6 billion yen. There has been considerable development in the following areas in recent years:

1. Kuruma prawn (*Penaeus japonicus*) and seaweed of the family Spermatochnaceae (*Nemacystus decipiens*) in the coastal waters;

2. Payao development in offshore waters;

3. Tuna fisheries (by longline fishing vessels under 20 tons) in Micronesian waters.

It is generally known that Okinawan fishermen were very active in fishing for skipjack, trochus shell and other resources in the South Pacific before World War II.

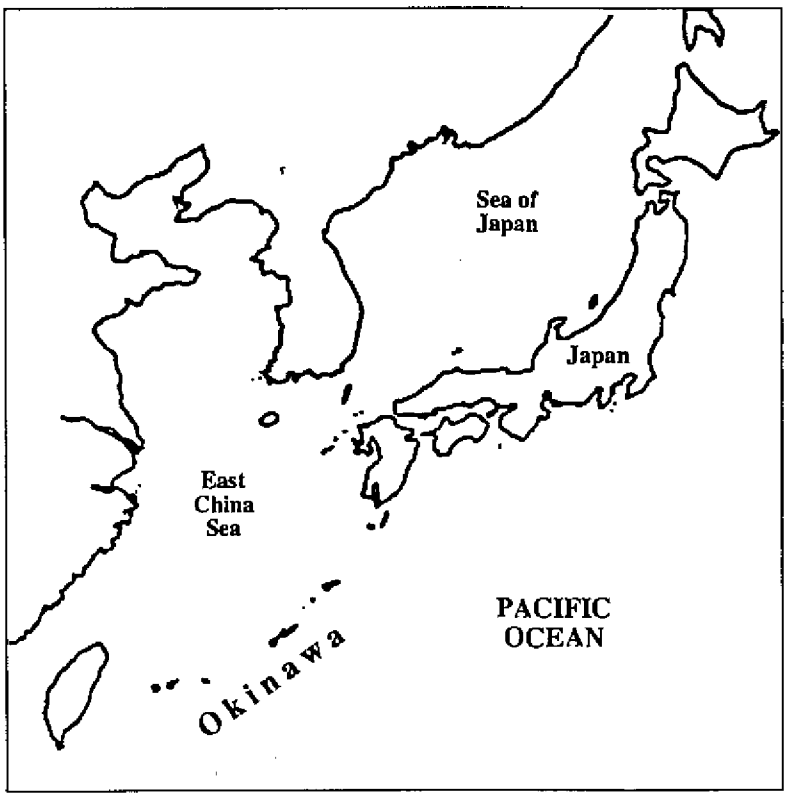


Figure 1: Map of Japan

Progress of payao development

In Japan, there is a traditional fishing method called 'Dorado's bamboo shelter', which is similar to the payao.

However, the payao was introduced by the Okinawa Prefectural Fisheries Experimental Station in December 1980, when twelve payaos were deployed by two fisheries co-operative associations. The successful fishing results at these payaos encouraged other fisheries co-operative associations in Okinawa to develop payao fisheries rapidly, and by January 1991 134 payaos were active in Okinawan waters (Figure 2).

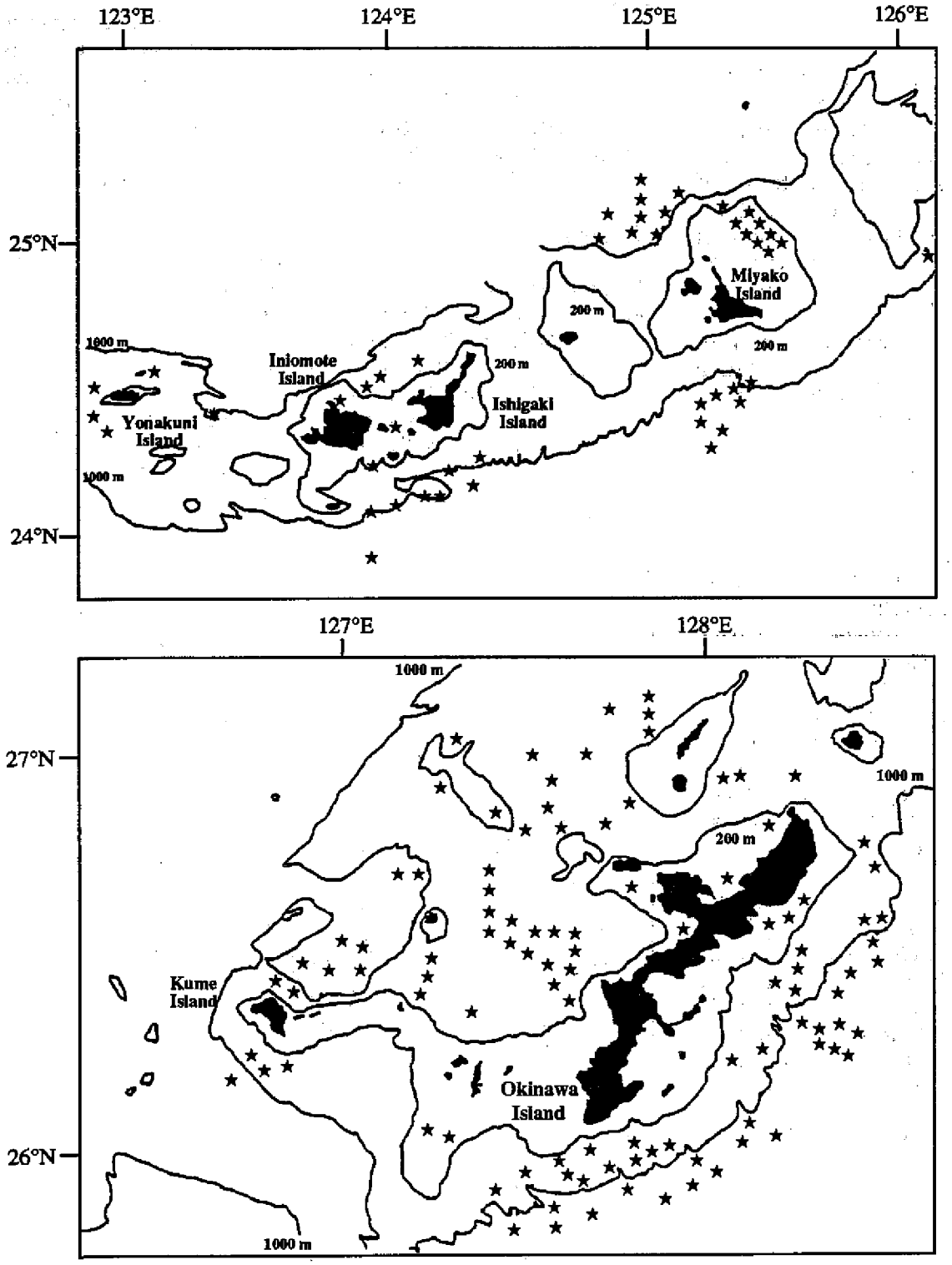


Figure 2: Payao locations (★): Yonakuni Island – Miyako Island (above); Kume Island – Okinawa Island (below); maps redrawn from figures cited in Oshima, 1987.

It should be noted that most of these payaos are operated and managed by fisheries co-operatives (a total of 34 such associations exist in Okinawa). The Okinawa Prefectural Fisheries Experimental Station also deployed five of its own payaos for the purpose of a payao fisheries development study between 1982 and 1986.

Development and management

The main aspects of payao fishing in Okinawa are:

- Boat tonnages are mainly less than five tons;
- Payaos are located within two hours of fishing ports, usually 19–20 miles offshore along the 1,000 m isobath on the Pacific Ocean side (see Figure 2);
- A set of payao costs between 1,000,000 and 1,500,000 yen.

Payao models

During the payao introduction period, ready-made payao models manufactured by well-known fishing gear companies in Japan were used. Since then, the models have been updated; aside from those manufactured, various other models are in use such as those modified by users, and self-made models. Schematic figures of some of these are shown in Figure 3.

Management

Payao deployment projects are subsidised by the Okinawan Government and municipal offices, and have been implemented under the authorisation of the Okinawa Marine Zone Fisheries Regulation Committee since November 1985.

Each fisheries co-operative deploys and maintains its own payaos and develops its own operation and management regulations with regard to safety, effective use and smooth management. Activities include:

- Model development, site selection and manufacturing workplan;
- The collection of 10 per cent of each fisherman's landing charges for maintenance and management of payaos;
- Development of fishing gear and methods, e.g. trolling gear must be used around a payao in a clockwise direction; and
- Technical and information exchanges between associations.

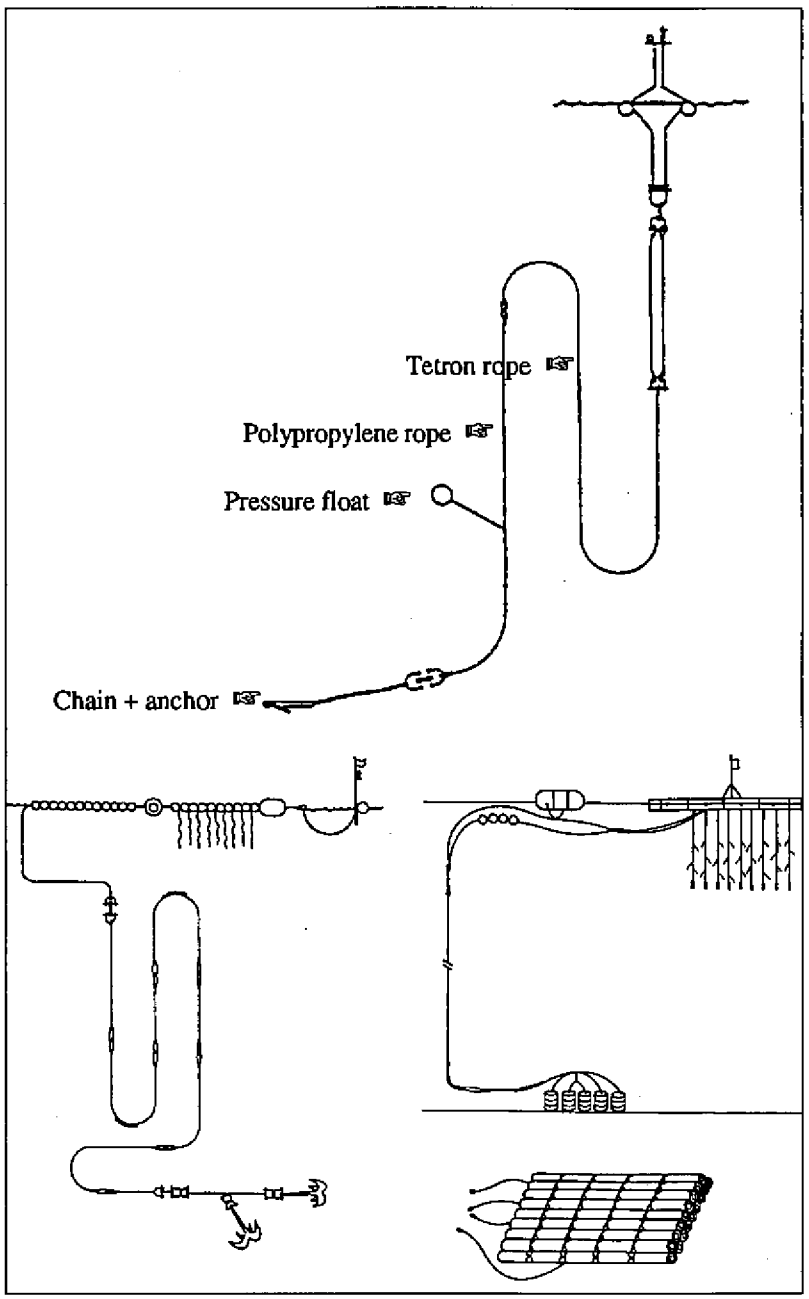


Figure 3: Schematic figures of self-made or modified payaos used in Okinawa

In addition, each fisherman is required to report his monthly catch record to the association to which he belongs.

Fishing methods and catch

Because payao fisheries developed rapidly throughout Okinawa after their introduction, the improvement of fishing techniques became a major concern among fishermen. Growing interest in preserving the freshness of fish led to increased co-operation between fishing businesses. The main fishing methods (jumbo tuna trolling, marlin trolling and drift tuna handlining) used for payao fisheries are shown in Figure 4.

Over 750 tons of fish were landed from payao fishing in Okinawa in 1986, and 1,250 tons in 1989 (see Table 1). In one typical case, fish landings quadrupled after payaos were deployed. The loss of a number of payaos was more than compensated for by the profit from the catch.

In the past few years, production from payao fishing did not increase because a number of fishermen preferred to use bottom longline fishing which is more productive. This is because the demand for pelagic fish in Okinawa and on the main island of Japan is limited, and because it appears that catches from payaos are affected by changes in oceanic conditions such as El Niño and Kuroshio (the Japanese warm current).

Research

Much research work on payao fisheries has been carried out by the Okinawa Prefectural Fisheries Experimental Station since 1982 (see Table 2).

The average life of a payao is estimated to be between one and two years, while some payaos last more than two years because of improved mooring techniques, and thorough maintenance and management.

There are several theories on the factors influencing fish aggregation such as feeding behaviour, protection from predators, aggregating behaviour in shade, sound attraction, etc. One report states that payaos function only as shelters for skipjack and young yellowfin tuna. The main baitfish are not observed around payaos, and the stomachs of skipjack and young tuna caught around payaos were virtually empty.

Information on fishing and oceanic conditions is provided to fisheries-related offices in Okinawa as 'payao information'. All survey reports have been published in the annual reports of the Okinawa Prefectural Fisheries Experimental Station.

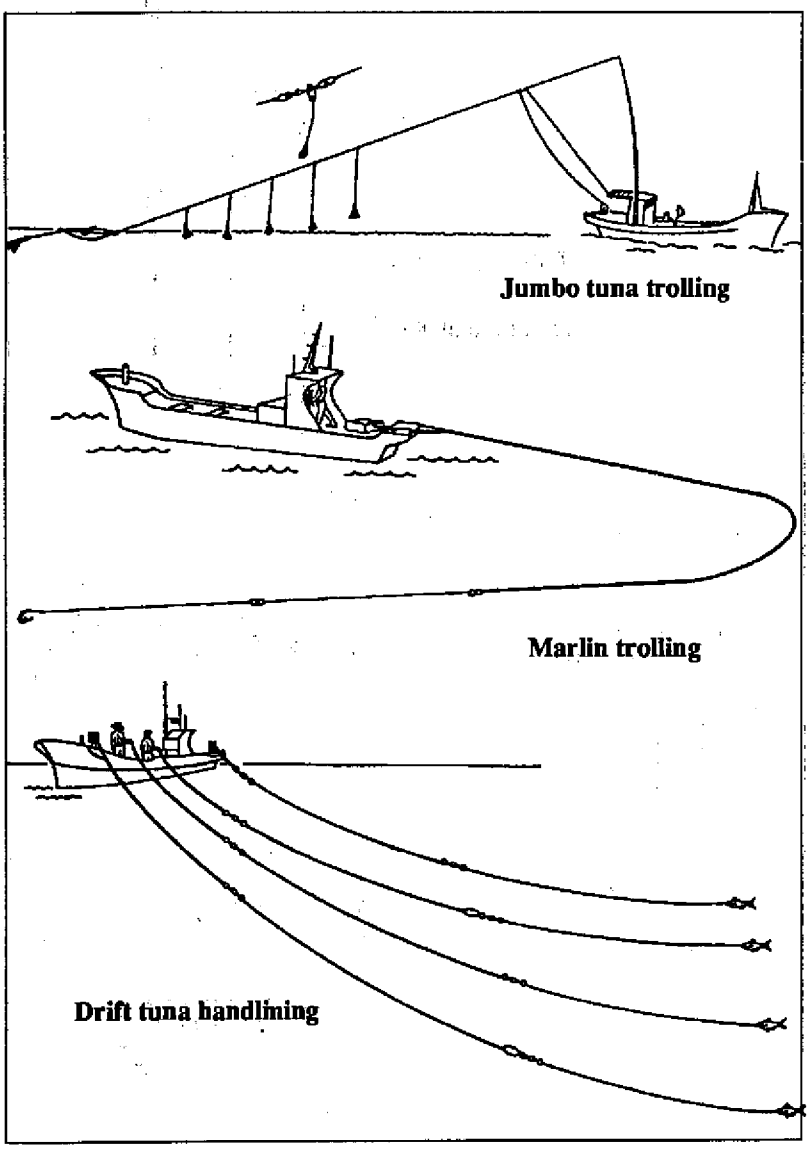


Figure 4: Payao fishing methods

Table 1: Catches from payaos

Species	1985	1986	1987	1988	Average
Small tuna (≤10kg: mainly yellowfin tuna)	262.4	278.8	322.6	618.5	370.6
Yellowfin tuna (≥10kg)	117.4	170.3	249.8	220.9	189.6
Dolphinfish	64.0	79.2	154.6	184.1	120.5
Skipjack	77.8	82.7	99.4	142.5	100.6
Blue marlin	96.5	117.4	80.1	59.0	88.3
Spanish mackerel	30.7	14.5	26.8	25.6	24.4
Others	30.5	43.1	34.9	35.5	36.0
Total	679.3	786.0	968.2	1,286.1	929.9

Table 2: Research conducted by the Okinawa Prefectural Fisheries Experimental Station since 1982

Purpose	Research area	Survey item
•Efficiency of fishing operations •Establishment of deployment technology •Data collection	•Payao conditions •Movement of fish school •Period of stay around payaos •Fish aggregation conditions •Fish landing at each place •Composition of fish species •Fishing grounds	•Confirmation of payao locations •Survey on fish school •Fishing survey •Tagging survey •Biological survey •Survey on oceanic conditions •Survey on fishing conditions •Experiment on fish preservation •Experiment on live bait

Conclusion

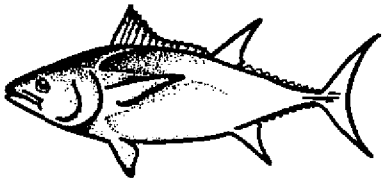
It is important to note in the above comments that the management and technical development of payaos are carried out by the Fisheries Cooperative Association, the experiments and research on payaos by the Okinawa Prefectural Fisheries Experimental Station, and the administrative guidance for the payao fisheries by the Okinawa Prefectural Government.

The fact that the payao users themselves actively participate in the development of payao fisheries is also important.

It is hoped that this article will initiate the exchange of technical information on payaos between regional and international organisations and fisheries departments throughout the South Pacific, and the Okinawa Prefectural Government and fisheries-related offices in Okinawa.

The author strongly recommends that persons in charge of extension work and the technical development of payao fisheries in countries in the region, visit Okinawa.

In recent years, there has been an increasing number of official visits to Japan and training programmes attended by Government officials and fisheries officers from South Pacific countries, including those on payao fisheries in Okinawa. It is hoped that the knowledge obtained will be put to effective use in the development of payao fisheries in the Pacific Islands region.



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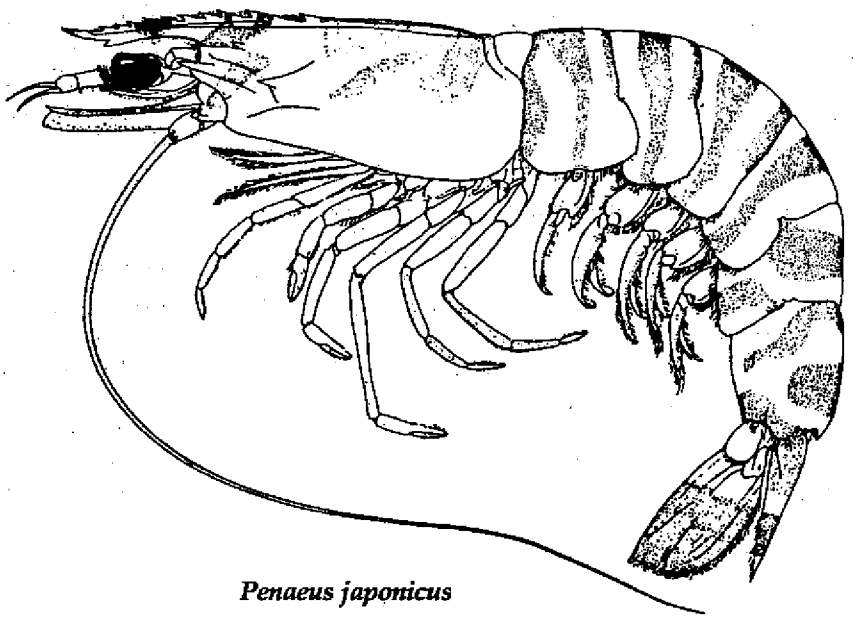

Penaeus japonicus

AN OVERVIEW OF CIGUATERA FISH POISONING

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Ciguatera is a disease caused by the consumption of fishes contaminated with lipid-soluble toxins called ciguatoxins (Gillespie et al. 1986; Lewis et al. 1991). At present there is no simple and reliable means of detecting these toxins in fish and there is no known culinary method that renders a contaminated fish safe to eat. The disease is characterised by distressing and often debilitating short-term gastrointestinal and longer-term neurological symptoms (Gillespie et al. 1986).

Distribution and incidence

Fish that cause ciguatera (ciguatoxic fish) are restricted to those inhabiting the warmer waters, particular coral reef waters.

Outbreaks of ciguatera typically occur sporadically in both time and space. Ciguatera is a significant health concern (especially from a Western perspective) to inhabitants of island countries in tropical and subtropical waters, especially the smaller island nations of the Pacific Basin which have a high per capita consumption of fish.

The figure on the next page shows the incidence of fish poisoning (mostly ciguatera) reported by national medical authorities of Pacific Island countries and territories. Of these, it is the atoll island countries that are worst affected. The incidence of ciguatera in Queensland (0.16 cases per 10,000 population) is similar to the incidence in Tonga.

These figures are likely to represent only 10 to 20 per cent of actual cases, with the extent of under-reporting likely to vary between countries and over time. Reasons for under-reporting of ciguatera include non-reporting of confirmed cases and mis-diagnosis, with mild cases often mistaken for more common illnesses by victims.

Fish implicated in ciguatera

Many warm-water fish may potentially carry ciguatoxins. Cod species, red bass, other snappers, surgeonfishes, parrot-fishes, emperors and moray eel are often implicated in ciguatera-prone locations throughout Pacific Island countries. Few demersal reef fish species are always free from contamination by the toxins that cause ciguatera (ciguatoxins). Fish that often cause ciguatera in Australia include coral trout, narrow-barred Spanish mackerel, reef cod, barracuda, emperor, grouper, trevally, queenfish and kingfish (Gillespie et al. 1986). The moray eel, red bass, chinaman and paddletail are reputed, based on anecdotal evidence, to be regularly toxic in Australia. As a consequence these fish are not widely sold by Queensland marketing authorities.

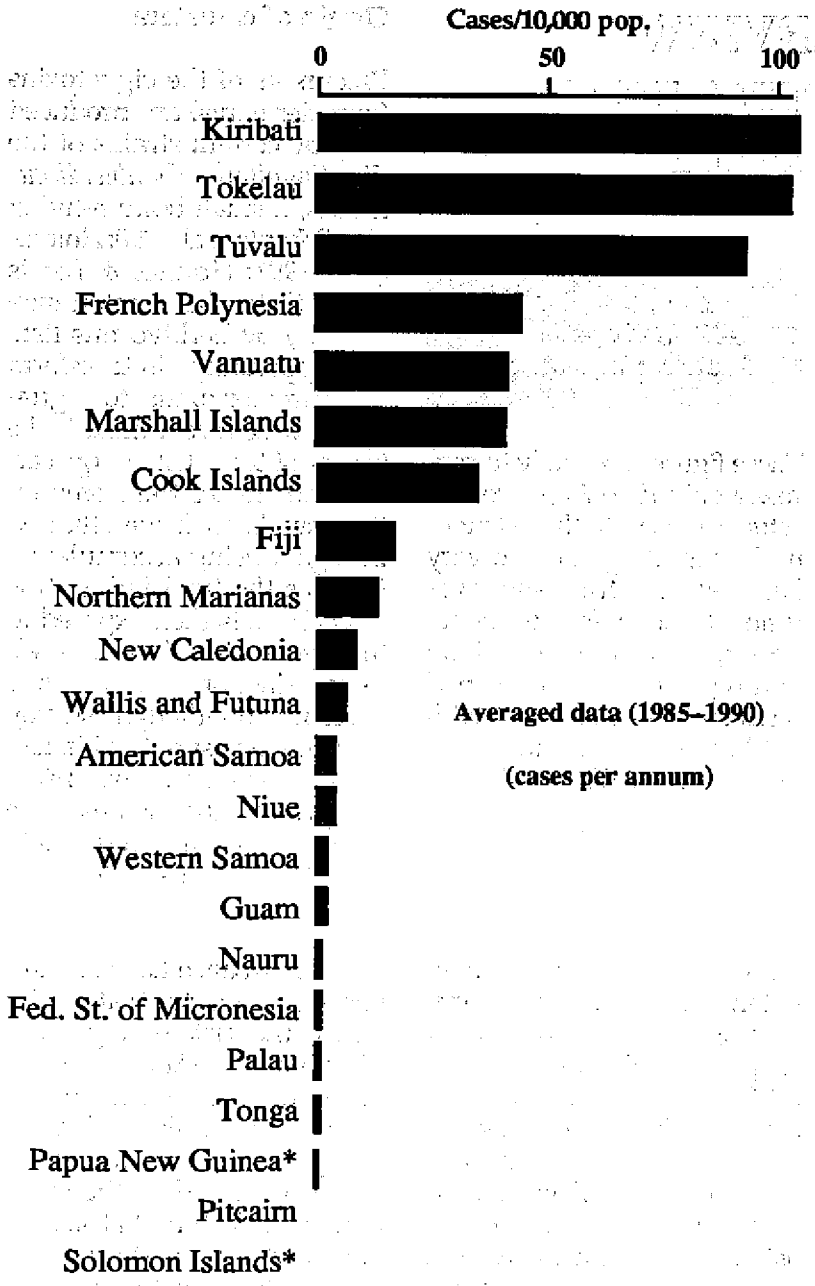
Origin of ciguatera

Precursors of the ciguatoxins (gambiertoxins) are produced only by certain strains of the dinoflagellate *Gambierdiscus toxicus*, a small bottom-living alga (Murata et al. 1990; Holmes et al. 1991; Holmes & Lewis 1992). *G. toxicus* is eaten incidentally by herbivorous fish. Fish apparently bio-transform the gambiertoxins to ciguatoxins, which accumulate in the tissues of these fish. Large carnivorous fishes then prey on these smaller fish, with the toxins again being accumulated. Man, as the final link in this food chain, is then exposed to the ciguatoxins. At low levels these toxins appear to have little effect on fish, although fish may die from exposure to high levels of ciguatoxin (Lewis 1992). It is possible that fish may die before they can accumulate sufficient toxin to be lethal to humans.

Reef disturbance has been implicated as a factor that can increase the risk of ciguatera (Bagnis et al. 1988). However, many instances of reef disturbance do not result in a flare-up of ciguatera. Research is required to elucidate the environmental factors that favour the growth and toxin production of *G. toxicus* before it will be possible to minimise the risk of ciguatera through controls on human activity.

The toxins

Structures for the toxins responsible for ciguatera have recently been determined (Murata et al. 1990; Lewis et al. 1991; Lewis et al. (in press)). Three major ciguatoxins (CTX-1, -2 and -3) are present in the flesh and viscera of ciguatoxic fish (Lewis et al. 1991; Lewis



Reported incidence of ciguatera in Pacific Island countries. Average annual cases per 10,000 population are indicated for countries within the South Pacific Commission region. Asterisks indicate incomplete reporting by these countries. Data are from reports of fish poisoning (mostly ciguatera) to the South Pacific Epidemiological and Health Information Service.

1992). These toxins are closely related polyether compounds that arise through oxidative metabolism of ciguatoxin precursors (i.e. the gambiertoxins produced by *G. toxicus*). CTX-3 is an intermediate in the biotransformation of gambiertoxin-4b to CTX-1. Interestingly, this bio-transformation amplifies potency of the ciguatoxins tenfold.

The ciguatoxins activate voltage-dependent sodium channels to which they bind with high affinity (Lewis et al. 1991). This action results in the depolarisation of excitable cells, especially nerve cells (Gillespie et al. 1986). The high potency of the ciguatoxins means that levels as low as 0.1 part per billion in fish may result in mild ciguatera. Detection of these low levels poses a major obstacle to the development of a simple method for the detection of ciguatoxic fish.

Symptomology and differential diagnosis

Symptoms of ciguatera commence <1 to 24 hours following the consumption of a toxic fish meal. The time to onset of symptoms varies with the toxicity of the fish, the amount of fish eaten and the susceptibility of the consumer.

Symptoms of ciguatera have been well documented (see Gillespie et al. 1986 and references therein) and may include:

- tingling and numbness of the hands and feet and lips;
- reversal of temperature perception (particularly a burning sensation upon contact with cold objects);
- general weakness;
- itching of the skin;
- joint, dental and muscle pain (possibly including cramps);
- nausea, vomiting, abdominal pain and diarrhoea;
- mood disorders e.g. irritability, depression, anxiety;
- severe cases may experience walking and breathing difficulty and hypertension.

These symptoms are similar for ciguatera reported thoughout island countries of the Pacific. Victims may experience a few or a conglomerate of the signs and symptoms listed above.

Usually the more severe the case, the greater the number of symptoms experienced. The gastrointestinal symptoms last for one or two days, whereas some neurological symptoms typically persist for several weeks. In some victims the neurological symptoms can persist for many months.

Within the first 3–6 months after an attack, the symptoms of ciguatera may in some cases be exacerbated by alcohol or by the consumption of certain food(s), especially fish. Consequently it is recommended that people refrain from eating fish in this period (if alternative foods are available).

Medical examination should exclude other conditions such as botulism or scombroid poisoning. A small percentage of sufferers complain of an allergy-like syndrome that can last several years. In these cases, symptoms typical of ciguatera can be brought on by the consumption of non-toxic fishes e.g. cold-water fish species. Non-fish products such as chicken and pork may occasionally cause similar problems.

Treatment

Until recently, the treatment of ciguatera has been only symptomatic and supportive. The recent uncontrolled observation that intravenous mannitol can significantly reduce the severity and duration of ciguatera symptoms (Palafox et al. 1988; Pearn et al. 1989) is a forward step in the management of ciguatera. The treatment involves an intravenous infusion of 10 per cent or 20 per cent mannitol solution over 30 minutes, given as soon as possible after ciguatera is diagnosed. A dose of 1 g mannitol per kg body weight (i.e. 5 ml of a 20 per cent solution per kg) should be administered.

Recent evidence suggests that the treatment is most effective if given early, within five days of the onset of symptoms and before the patient begins to recover. Most patients report a dramatic improvement in the neurological symptoms, usually within several hours of the infusion.

Some people report a recurrence of symptoms 24 hours after a first administration of mannitol. In these instances, a second infusion of mannitol is recommended. Mannitol should not be administered until the patient is adequately rehydrated. The treatment has proved safe when these guidelines are followed.

Research into the mechanism by which mannitol can reverse the symptoms of ciguatera has revealed that mannitol does not chelate ciguatoxin, nor does mannitol displace ciguatoxin from its site of binding (Lewis et al. 1992; Lewis, unpublished observations). Pearn et al. (1989) have suggested that mannitol may reverse ciguatoxin-induced oedema of adaxonal Schwann cells. This remains the best hypothesis to explain mannitol's therapeutic value in cases of ciguatera.

Prevention

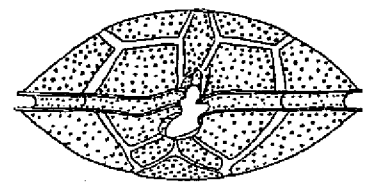
There is no certain way to avoid ciguatera, since the toxin cannot be simply detected at present. However the following measures will reduce the risk of contracting ciguatera from warm-water fish:

- Fish species locally implicated in ciguatera should be avoided where possible, especially moray eel and red bass;
- Small portions (<100 g) from several fish should be consumed in a single meal, rather than a large portion from any one suspect fish. This would be facilitated by the distribution, on a communal basis, of portions of reef fish and non-toxic species;
- The liver and viscera of potentially toxic fish should not be eaten.

Portions of fish known to be toxic should be forwarded to interested laboratories for analysis, or discarded. Further meals of a toxic fish will result in a progression to more severe symptoms.

Future research

Future research will be directed at ways to improve the management of ciguatera. Areas of research may include: (i) determining precisely the factors responsible for the appearance of ciguatoxins in fish; (ii) development of assay(s) that reliably and cost-effectively distinguish toxic from non-toxic fishes; and (iii) development of improved treatment regimes, including simpler, orally effective therapies.



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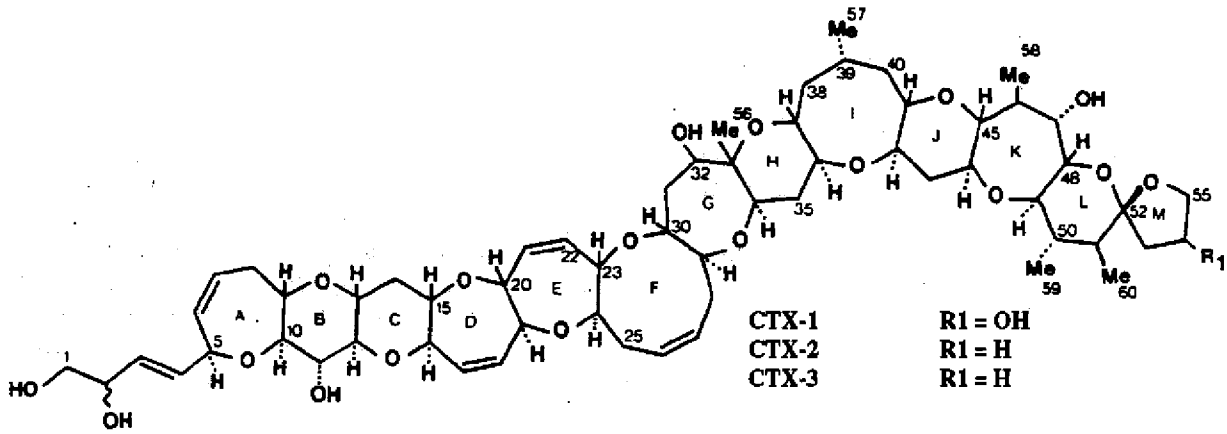

Structures of the three major ciguatoxins (CTX) found in the flesh and viscera of ciguateric fishes. An altered stereochemistry at carbon 52 is the only difference between CTX-2 and CTX-3. The stereochemistry for CTX-1 and CTX-3 is shown.

DEVELOPMENTS IN PELAGIC FISHERIES IN PAPUA NEW GUINEA

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Introduction

Papua New Guinea (PNG) is the largest nation in the South Pacific and has within its Exclusive Economic Zone (EEZ) abundant stocks of tunas and billfish.

Tuna and billfish stocks have been fished in PNG waters since 1970 by foreign-based fishing fleets using pole-and-line vessels, longliners and purse seiners. Greater emphasis is now being placed on improving catches of tunas and billfish by local fishermen to improve supplies for domestic markets and to take advantage of high prices for these types of fish in overseas markets.

Artisanal fishermen catch low-value coastal tunas such as mackerel tuna (*Euthynnus affinis*) and bullet tunas (*Auxis* spp.) by trolling. Catches of more valuable tunas such as skipjack (*Katsuwonus pelamis*), yellowfin (*Thunnus albacares*) and bigeye (*Thunnus obesus*), and billfish such as marlin (*Makaira* spp.) and swordfish (*Xiphias gladius*) require improvements in fishing techniques and technology.

One of the most significant regional developments in fishing for these large pelagic fishes has been the deployment of fish aggregation devices (FADs) or payaos. These are rafts, anchored in deep water where pelagic fish will concentrate in large numbers and thus become more easily targeted by fishermen.

It is well known that schools of tunas and other pelagic fishes will associate with floating objects such as logs, seaweed and even whales and whale sharks. The use of FADs capitalises on this behaviour to the benefit of the fishermen.

FADs have been deployed by foreign fishing fleets around PNG to improve catches from purse seining. More recently, the Government of PNG requested the assistance of the South Pacific Commission's Fisheries Programme to develop and deploy FADs for PNG coastal fishermen.

Through SPC's Offshore Fisheries Development Project, funded by UNDP, the first phase of this work was conducted during 1992 in Port Moresby, when in June a FAD was deployed near the capital city, Port Moresby, to the south of Daugo Island (Beverly & Cusack, in press).

The FAD has been used principally by the fishermen of Daugo Island who are some of the main suppliers of fresh fish for the capital's population. Anecdotal reports were soon received that the FAD had become very productive and was being fished both by professional fishermen and by sports fishermen from the local game fishing club.

Little quantitative information was available, however, on the production of fish from the FAD.

During February and March 1993, the Fisheries Programme's Resource Assessment Section's biologist, Paul Dalzell, visited PNG to assist in the production of research reports from the Department of Fisheries and Marine Resources (DFMR).

In addition to this work, Mr Dalzell was also asked by the Fisheries Programme's Capture Fisheries Section to follow up on DFMR's progress in establishing a monitoring programme for the Daugo Island FAD. Mr Dalzell was also asked to look at the potential for supplies of locally caught baitfish for a planned longline fishery based in East New Britain.

The Bismark Sea, bounded by New Ireland and New Britain in the east, is one of the richest tuna and billfish fishing grounds in the Pacific. The PNG Government had requested the SPC Fisheries Programme to assist with deployment of FADs in the eastern Bismark Sea to increase catches of pelagic fish, initially for the Rabaul markets, but with a view to exporting fish for sashimi to Japan.

Besides FAD deployment, the Capture Fisheries Section masterfishermen and DFMR staff will conduct trials with small-scale longlines, deployed near the FADs.

Longlining requires bait and the most convenient supplies of bait are frozen squid and saury (*Cololabis saira*) from Japan.

However, if baitfish can be caught locally, then there is the potential for a greater number of people to benefit from the establishment of a longline fishery in East New Britain.

Observations were made by Mr Dalzell on catches of small pelagic fishes in the area around Rabaul to see if there was potential for a local baitfishery to supply all or part of the baitfish for longlining.

Daugo Island FAD

During January 1993, the DFMR Extension and Training Branch began collecting catch data from the Daugo Island fishermen who were fishing around the FAD.

The Daugo Island fishermen tend to dispose of most of their catch at Koki Market, the oldest produce market in Port Moresby, situated on the waterfront.

Interviews conducted with fishermen disclosed that the FAD became very productive about three weeks after deployment. At present about ten boats a day are fishing on it. The fishermen commence fishing at daybreak and continue fishing for about three or four hours. They return to Daugo Island to off-load the morning's catch and for rest and food. The fishermen return to the FAD until about 3 pm when they bring the total catch to Koki Market for sale by their wives and daughters.

Fishing is usually conducted by one man in a fibreglass dinghy using between four and six lines (strung from a boom at the front of the boat) and lures made from plastic onion bags and plastic bags.

Some fishermen have begun to buy commercial squid lures from the local fish chandlers. The trolling rig is very simple and has no trace wires or swivels.

The fish price at Koki Market at present demonstrates little elasticity. The fishermen always obtain a premium price for their fish as there is a huge demand in Port Moresby. Fish prices go up in periods of persistent rough weather. The best season for fishing is between November and April.

A total of 36 trip reports was received from the fishermen of Daugo Island who were catching fish around the FAD, covering the period from mid-January to early March.

Data on catches by weight and the number of trolling lines were not included in most of the catch returns for January, but this was later corrected and included in subsequent reports. About 80 per cent of the catch from the FAD were skipjack, with a variety of other pelagic fishes such as yellowfin, kingfish (wahoo and Spanish mackerel) and finny scad making up the balance.

The average catch is 56 fish/trip, or about 120 kg/trip, generating an income of 184 Kina/trip.

For boats for which the number of fishing lines and weights were recorded, this represents catch rates of 2.33 fish/line-hour, 4.1 kg/line-hour and 6.1 Kina/line-hour. The average amount of fuel used by the fishermen is 36.4 l/trip amounting to a total cost of 15.3 Kina.

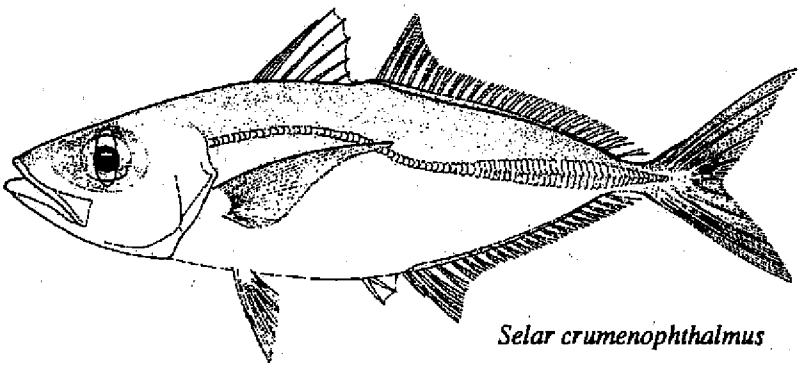
Clearly, fishing for large pelagic fishes around the Daugo Island FAD generates large profits for the island's fishermen.

A further benefit from the deployment of the FAD has been the decrease in the fishing for reef fish on the reefs around Port Moresby. Before the FAD was deployed, reef fish were the main target of the fishermen of Daugo Island.

Besides benefiting the Daugo Islands fishermen, the FAD has also been a boon to the game-fishing community in Port Moresby. Efforts are under way to quantify the amount of fish taken by sports fishing.

Rabaul small pelagic fishery

The main small pelagic fish caught around Rabaul and the Gazelle Peninsula is the bigeye scad or **malambur** (*Selar crumenophthalmus*). These small scads are caught in this area by gill nets and handlines.



Selar crumenophthalmus

However, there are three villages that deploy traditional Tolai basket traps to catch malambur and larger pelagic fishes such as rainbow runner and, occasionally, tunas (Figure 1). According to records on file at the DFMR office in Kokopo, there were between 50 and 85 traps deployed around the Gazelle Peninsula during 1992.

Figures recorded from one village, Vunamame, suggest an average catch per trap of 25 kg, although this may be somewhat optimistic. The frequency with which the traps are emptied varies depending on season, weather and presence of large pelagic fishes which drive small pelagics into the traps to seek shelter.

Visits were made to the three Tolai villages that deploy traps – Vunamame, Blue Lagoon and Karabia – to conduct interviews with the fishermen. Fish is sold by the men of the village to the women for traditional shell money or 'mis'.

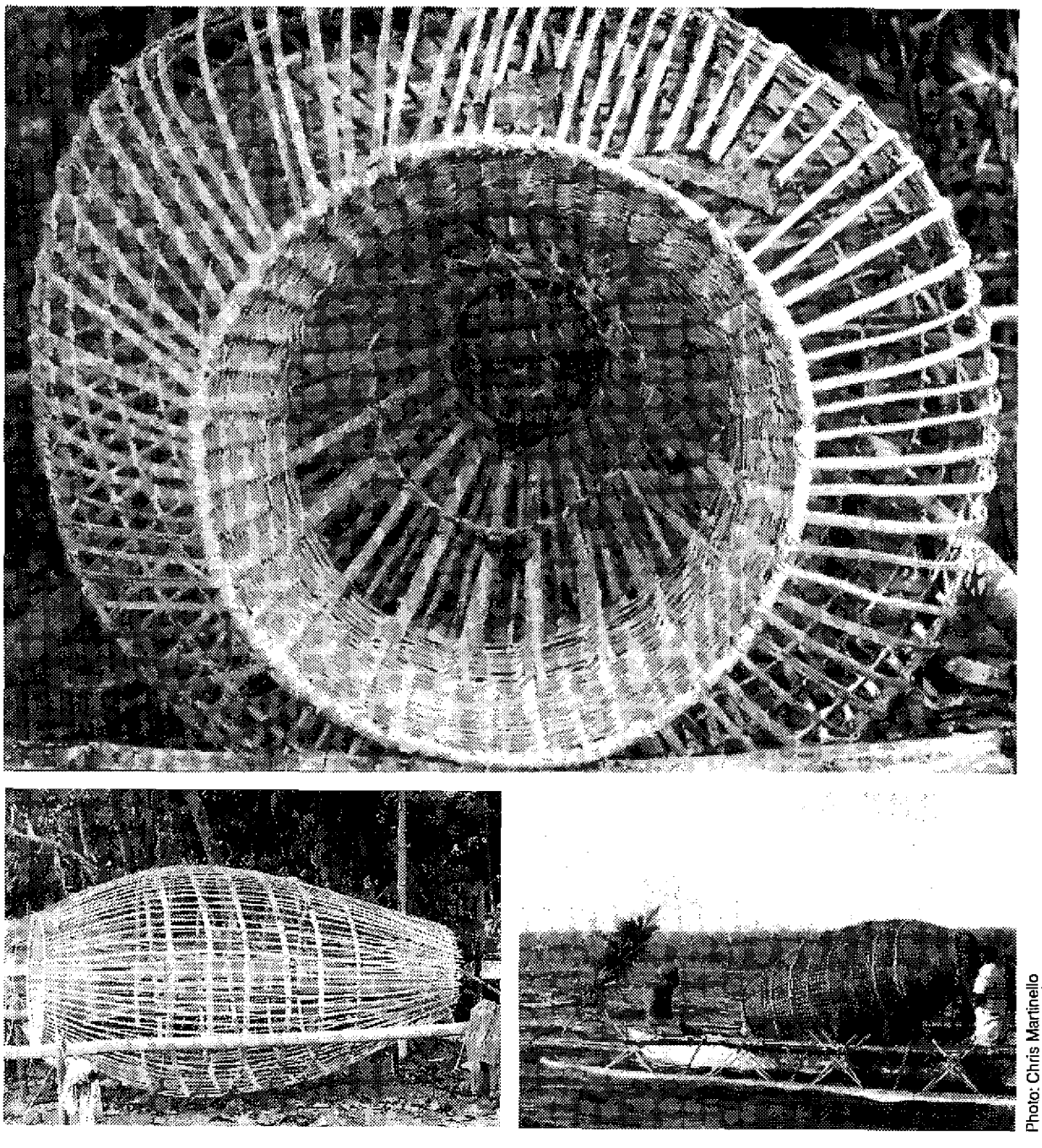


Photo: Chris Martinello

Figure 1: Different views of the traditional Tolai basket trap

The women then sell the fish on the roadside for cash, usually in lots of 15–20 fish for 1.0 Kina (Figure 2).

The Vunamame fishermen have only six traps deployed at present. They check the traps every two or three days and catch on average 3.5 baskets of fish, where one basket weighs about 25 kg. The main fishing season lasts from March to Christmas.

The village fishermen were asked about the small number of traps they were using at present and mentioned that last year they were using up to 15 traps.

They reported that a number of traps were lost in storms over Christmas and that one of their boats, a 'red snapper' canoe, was under repair. Hauling the traps without the canoe to act as a platform is quite difficult. The Vunamame villagers also deploy small-scale versions of these basket traps on the reef to catch reef fishes.

At Blue Lagoon the villagers had nine traps deployed 1–2 km from the shore and two traps close to the village. The traps are checked daily, sometimes during the morning and afternoon.

An average catch ranges between 200 and 300 fish from all the traps or about 12.5 kg/day. The rope used to anchor the trap is made from rattan cane but the villagers also interweave a forest vine on which the fish are said to feed and are hence attracted to the trap. The best season was from March to Christmas, as at to Vunamame.

The villagers at Karabai, on the north coast, have ten sites where they deploy fish traps, but during early 1993 only four traps were deployed.

The traps are emptied daily with an average catch of about 100 fish or 5.0 kg. The main fishing season is around Easter when catches of between 200 and 300 fish/trap can be expected. More traps are usually deployed around this time.

The Catholic Church has a large mission complex at Vunapope, about 2 km from Kokopo, which includes a wharf for cargo and passenger ships. The Vunapope Mission wharf is built out on pilings over the water and has a very large malambur school around and underneath the wharf.

Until last year villagers were forbidden to fish on the wharf with nets and could only catch malambur with hook and lines. Now they are permitted to fish with gillnets and have established a thriving commercial fishery.

The fishery operates seven days a week with between 10 and 15 nets deployed from the wharf. The fishermen set the net for about one hour, so each net makes between 6 and 8 sets during the day. The nets are 1.5" gillnets of between 35 and 100 m in length, costing between 88 and 166 Kina. The nets are set 2–3 m beneath the surface, with one end tied to the wharf and the other pulled out by a canoe or a villager swimming in the water.

Catches are very variable. Fishermen interviewed on the wharf stated that catches ranged from 10 to 100 fish per haul. Fishermen disclosed that catches were very good over Christmas and that they were making up to 150 Kina/week from sales of their fish. The fishermen sell their fish at 2 for 10 toea or 20 for 1.0 Kina to women from the village, who then sell them by the roadside for double the price.

Independent observations were also made on the catches made by the fishermen operating on the Vunapope Wharf. Over a two-hour period 20 hauls were recorded from 13–14 gillnets. Most of the catch was malambur but the occasional other species such as **talai** (*Herklotsichthys quadrimaculatus*), sardines (*Sardinella* spp.) and shark mackerel (*Grammatorcynus bicarinatus*) were

Photo: Chris Martinello

Figure 2: Fish being strung up for resale

caught. The gillnet catches ranged from 16 to 166 fish per set with an average of 70 fish/set.

Prior to the advent of the gillnet fishery at the Vunapope wharf, the stock of malambur at the Vunapope wharf was fished on average once a week for about ten years under the direction of Sister Mary Lenaghan from Vunapope Mission. The fish supplemented the diet of staff and students at the mission college. Sr Lenaghan, who has since moved on to another mission in PNG, very kindly recalled her experiences fishing this stock of fish.

The weekly catch from the deployment of a 200 m beach seine was about 20 bags of fish, each weighing between 10 and 15 kg. Catches were very variable and, according to Sr Lenaghan, the least productive time was during the middle of the year, with catches improving after October. In some years the malambur were absent altogether from the wharf for extended periods.

Prior to Sr Lenaghan's fishing operation, another mission staff member ran a technical school from malambur sales but encountered problems when the malambur disappeared during one year. Sr Lenaghan recalled that when malambur returned to the Vunapope wharf following a long absence, they were small, about 10 cm in length, but grew larger with time.

The size range captured by fish traps at Vunamame was very narrow (12.0–14.0 cm), with an average size of 12.6 cm and weight of about 20 g (Figure 3). Based on age and growth data from the Philippines (Dalzell & Peñaflor 1989) this suggests that the fish captured by the Tolai traps are between six and seven months old.

The size range of malabur captured by gillnets was also very narrow (14.7–16.3 cm), with an average size of 15.4 cm, weighing about 40 g each. Based on the Philippines data, this suggests that this fishery catches fish between seven and eight months old. One larger (22.5 cm = age 1.0 yr) malambur was landed whilst I was making observations on gillnet catches but these larger fish are probably selected by the mesh size employed. All the specimens examined were sexually immature.

The purpose of these observations was to estimate current and potential small pelagic fisheries production in the Rabaul/Gazelle Peninsula area and the possibilities of supplying bait to domestic longliners.

Given the limitations of the observations it is still useful to make some rough calculations on current production. There are usually on average about 12 nets fishing off the wharf at Vunapope. Using the average catch rate of 70 fish per haul and an average of 7 hauls per day, this amounts to a daily catch of 5,880 fish. The fishery operates seven days a week (despite censure from the Mission about fishing on Sundays) so the annual total catch amounts to about 2,150,000 fish, weighing about 86 t.

This of course assumes little seasonality in the fishery and that the malambur stock is fishable throughout the year. As described above, however, malambur production appears to be seasonal with the occasional year when fish were absent for several months.

Production from the traditional Tolai fish traps is harder to estimate. Using the figures given to us in discussion with the village fishermen, I have estimated a production of 13.7 t

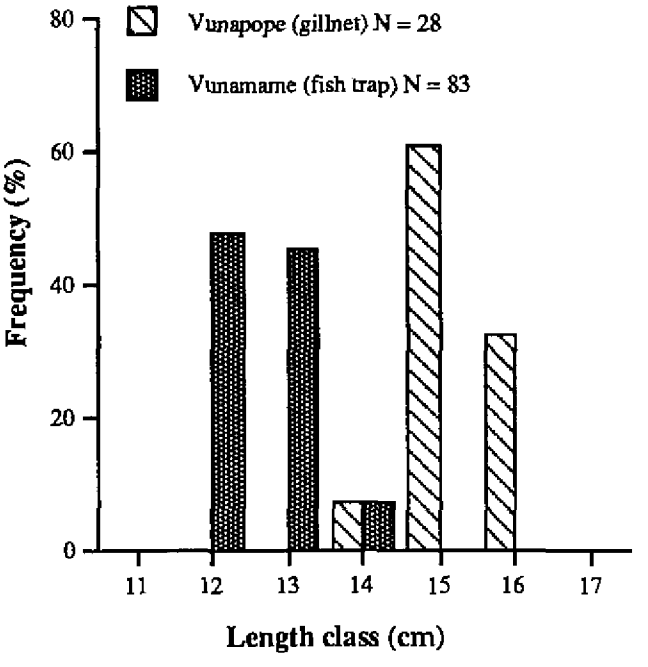


Figure 3: Length frequencies for malambur captured by gillnets and Tolai fish traps on the Gazelle Peninsula, PNG

(340,000 fish) for Vunamame, 3.7 t (91,000 fish) for Blue Lagoon and 1.5 t (36,500) fish for Karabia.

It should be emphasised that these are very rough figures indeed and should be checked by making more precise observations. However, the foregoing suggests that nominal production of malambur on the Gazelle Peninsula may amount to 100 t annually and that malambur stocks may support a limited baitfishery for longliners.

This conclusion does not, however, take account of the possibilities of conflicts between fisheries for food and bait, nor whether it is socially acceptable to target an important food fish for longline bait.

Finally, an empirical estimate of potential malambur production might be calculated for the Gazelle Peninsula area of New Britain based on actual yields from elsewhere in the Pacific. Polovina et al. (1985) quote annual yields of malambur from the Hawaiian Islands of 0.4 to 0.9 t/nmi of 200 m isobath. The length of the 200 m isobath around the Gazelle Peninsula is about 320 km.

Assuming a degree of ecological similarity between the two locations, a potential yield of 128 to 288 t/yr might reasonably be expected from the Gazelle Peninsula region of New Britain. The lower boundary of this range is close to estimated annual production from the Gazelle region based on catch observations.

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POSITION VACANT

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Applications are invited for the above mid-level professional staff position. Applicants must have a M.Sc. degree in Biological Science, preferably in aquaculture or fisheries, and good organisational skills. Demonstrated ability to write scientific papers and reports, computer literacy, data analysis, experience in handling boats and motors, SCUBA diving certification, and a driving licence are also major considerations.

In collaboration with the Senior Scientist, the successful applicant will conduct a research programme on methods for wild spat collection, artificial propagation and rearing of pearl oysters at the Coastal Aquaculture Centre and at other field experimental sites in the Solomon Islands.

There is a remuneration package, including salary, housing allowance, retirement/savings plan, medical and insurance benefits and annual home leave fares for appointee and family of up to a total of SI$60,000 per annum. The salary component is tax free for international recruits. The position is financed with funds from the Australian Centre for International Agricultural Research (ACIAR) and is for two years only.

Applications should include a full curriculum vitae, including the names, addresses and telephone or fax numbers of three persons to whom reference can be made concerning the applicant's qualifications and abilities.

Applications and inquiries should be mailed or faxed before *July 26, 1993 to*

The Senior Scientist
ICLARM Coastal Aquaculture Centre
P.O. Box 438
Honiara
Solomon Islands

Telephone (677) 20255; Fax (677) 22130

Original text: English

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

South Pacific Commission
SEAFOOD POISONING REPORT FORM

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

Details of person filling in report form:

Name _____ Job/ Position _____

Contact address _____

Date: _____ Signature _____

Poisoned person's details:

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

Address _____

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

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

What is the local name of the seafood? _____

What is the English name of the seafood? _____

Name of vendor or restaurant (if bought) _____

Name of place it was caught (if known) _____

When was the food eaten? Date _____ Time _____

When did you first feel sick? Date _____ Time _____

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

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

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

Medical data:

Pulse _____ Blood pressure _____ / _____ Pupils _____

In case of death:

Date of death _____ Autopsy findings _____

Other information

_____

_____

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

THANK YOU