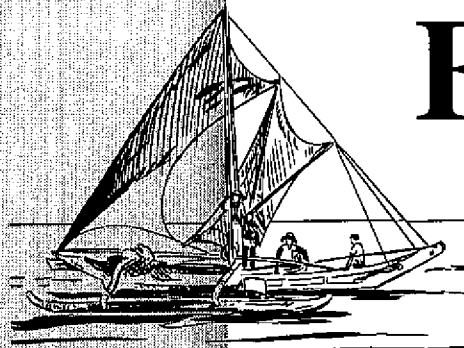


FISHERIES

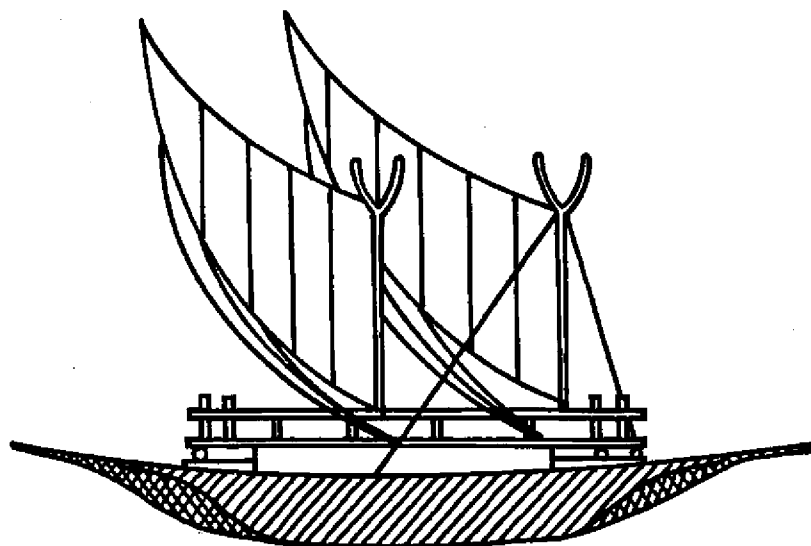
Newsletter



NUMBER 69
APRIL — JUNE 1994

IN THIS ISSUE

SPC ACTIVITES	Page 2
NEWS FROM IN AND AROUND THE REGION	Page 11
ABSTRACTS AND REVIEWS	Page 24
COASTAL FISHERIES IN THE LOYALTY ISLANDS by Marc Daguzan	Page 25



Dugout canoe used in the past by Loyalty Islands inhabitants



South Pacific Commission

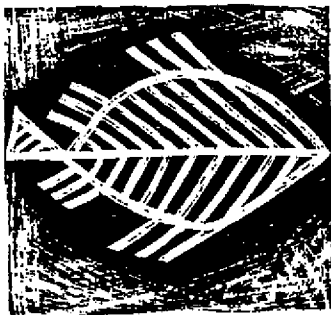
Prepared by the Fisheries Programme Information Section
Printed with financial assistance from the Government of France

■ RESOURCE ASSESSMENT SECTION

New project replaces IFRP

The second quarter of 1994 was the last working period of the Inshore Fisheries Research Project, which ended on 30 June. This British-funded project will not be renewed, but its current staff complement will be absorbed into the new Integrated Coastal Fisheries Management Project (ICFMAP), also funded by the United Kingdom.

The IFRP was a project to improve the state of research and knowledge in support of SPC member country coastal fishery resource management. It undertook small, appropriate sub-projects on a first-come, first-served, national request basis.



The ICFMAP will take a more structured approach and will be aimed at the direct development of coastal fishery management plans, rather than just the acquisition of basic knowledge.

The ICFMAP will take an integrated approach to several facets of the fisheries management problem. It will look at ways of maintaining fishing community development prospects under possible future exploitation restrictions, as well as providing advice on the most effective management options for inshore resources.

The ICFMAP will be carried out as a series of case-studies on the development of management plans for specific fisheries in specific island member countries. These case-studies will be chosen by SPC member countries at a major international workshop that is planned for June 1995, in Fiji. (A preliminary announcement about this SPC – FFA Inshore Fisheries Management Workshop will be circulated soon. Further details

can be obtained from the SPC Coastal Fisheries Programme or the FFA Research Coordination Unit (RCU)).

For the next 12 months, a major portion of project time will be spent in preparing for this workshop, which will involve the production of considerable amounts of new material, and in collating available member country historical coastal fishery data as a baseline for implementation of the case studies. This latter activity will result in the foundation of a regional coastal fisheries statistical database which may, or may not, acquire a subsequent life of its own, depending on the interest and support shown by member countries.

The Resource Assessment Section will, of course, continue to devote much of its time to providing general advisory services on coastal fisheries research. But, for the time being, it will not be able to undertake any in-country fieldwork.



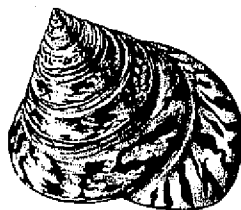
Northern Marianas trochus stock assessment

In May, the Fisheries Resource Adviser, Dr Tim Adams, took a regional team to the Commonwealth of the Northern Mariana Islands (CNMI) to advise the Department of Natural Resources on the state of the trochus resource. CNMI has had a moratorium on trochus fishing for the past 12 years or so, following a particularly heavy spell of exploitation, and the Government is under pressure to open commercial harvesting once more.

This IFRP sub-project was a follow-up to several previous IFRP activities in trochus stock assessment, including the 1991 Vanuatu trochus workshop and the 1992 Aitutaki trochus case study. Like these previous sub-projects, it involved participants from several countries. Cook Islands lent the services of Ian Bertram, Guam lent Tom Flores, Marshall Islands lent Virgil Alfred and Palau lent Asap Bukurrou. The CNMI members of the team varied with the location, with Richard Seman as project leader.

The assessment took four weeks. Saipan has by far the largest area of suitable trochus habitat on the three islands where trochus is regularly found in CNMI, but several days were also spent in the water around Tinian and Rota. It was not possible to follow up on the mark-recapture abundance estimation methods used at Aitutaki, except in one small area, because the assessment was not concurrent with a harvest.

However, transect and timed-swim methods provided a good enough picture to advise the CNMI Government on options for management of the resource.



This report is currently restricted to the CNMI Government, but, in brief, the team found that adventitious multi-species subsistence harvesting by reef-gleaners is now sufficient to take up most of the productive capacity of the trochus stock.

This sub-project was supported from a variety of sources. Apart from the substantial assistance

lent by CNMI in the form of project leadership, manpower, accommodation, transport (land and sea), and the provision of scientific manpower support by four other Pacific Island governments, some travel was supported by the FAO South Pacific Regional Aquaculture Project, and the time of the Fisheries Resource Adviser was funded by the British Government.



Tokelau trochus management advice

Under funding support from the FAO South Pacific Regional Aquaculture Project, a consultant was hired to travel to Fakaofu, Tokelau.

His task was to assess the spread of trochus around the reef, following a series of introductions by UNDP, starting in 1986, and to advise the administration (including the traditional administration) on how to manage this potential future foreign exchange earner.

The consultant, appropriately enough, was the man who organised the original introductions of trochus to Tokelau from Fiji and Cook Islands, Bob Gillett.

As expected, trochus shells were found to be established and reproducing, at least in the area close to Fale, but the resource is still a long way from being abundant enough to be commercially viable.

There is currently no restriction on the taking of trochus in Tokelau, and it was advised that harvesting should not be carried out for the time being, until the resource is properly established (something which is likely to take 12-15 years, judging by previous experience in Tahiti and Aitutaki).



Trochus specimen collected during the 1994 survey in Tokelau

Pitcairn trial fishing

The long-drawn-out Pitcairn sub-project came to an end with the completion of the trial fishing trip to Pitcairn waters by the New Zealand expedition licensed by the Pitcairn Administration. The Resource Assessment Section's role in this was the provision of a scientific observer, Peter Sharples. He will make his report in July, and SPC will provide the Pitcairn

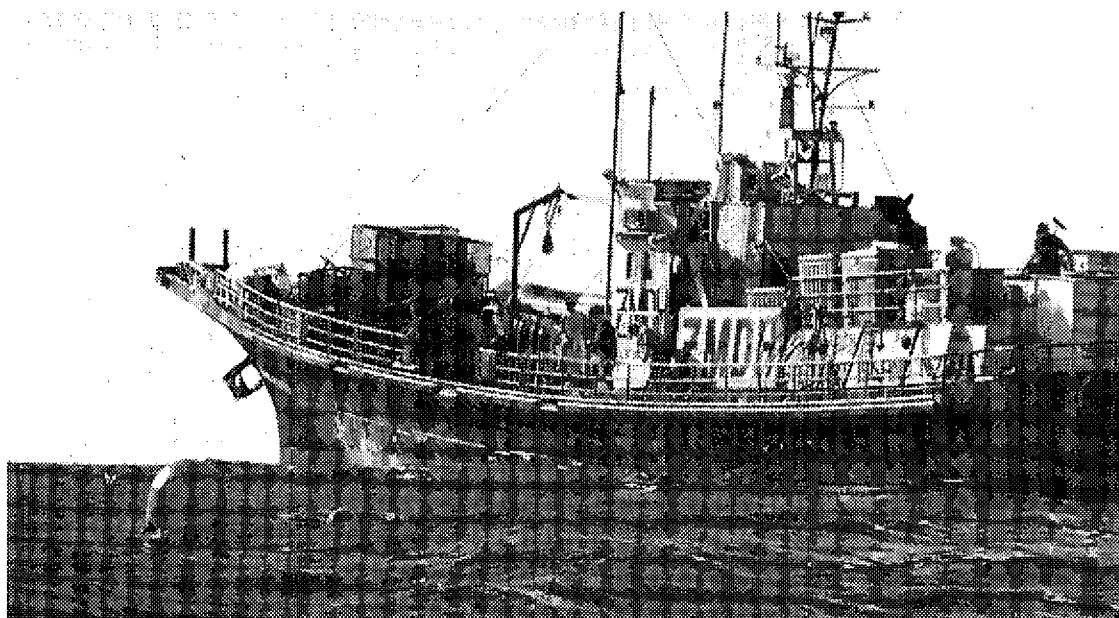
Administration with some options for management.

The details of the report will be confidential to Pitcairn and to the fishing company, but it would not be giving anything away to say that trap-fishing showed that Pitcairn is no lobster 'Eldorado' (see *Fisheries Newsletter* #67, page 28). Several fishing methods for finfish were

also trialled. Apart from the New Zealand fishing company, which expended considerable funds on this expedition, the SPC's role in the project was supported entirely by the British Government. We hope that, within the restrictions of commercial confidentiality, a more substantial report can be provided in the next *Fisheries Newsletter*.



Setting a lobster trap off Henderson Island



The F/V *David Baker* was one of the boats used during the survey.

Other activities

The Fisheries Resource Adviser attended the training workshop and coordination meeting for the ACIAR-supported Australia—Fiji—Solomons Underwater Visual Census of Reef Fish project in Honiara in April, under funding from the British Government. Biologists from Papua New Guinea also attended the workshop, with the aim of co-ordinating national visual reef-fish stock assessments with the developing regional standard methodology.

As usual, a considerable amount of staff time was spent on ad-hoc requests for advice and information, and on coordination work, particularly in administering the remaining activities under the UNDP-funded backstopping to the FAO South Pacific Regional Aquaculture Project. (This project has now resumed, and

the project leader, Mr Tanaka, can be contacted in Fiji on phone 313750 or fax 313985).

Another task, in collaboration with FFA, is the compilation of a review of the region's nearshore fisheries research capabilities, benchmarking eight years down the track from the Fakahau-Shephard report¹ and five years on from the FFA 10th anniversary conference research syndicate² and hence providing some measure of progress by the SPC IFRP and the FFA RCU.

This review will provide potential South Pacific input to the Strategy for International Fisheries Research, as well as some of the groundwork for the 1995 SPC—FFA Inshore Fisheries Management Workshop (see page 1). A questionnaire was sent to the fisheries administra-

tions of SPC and FFA member countries in early June, but the response has not been comprehensive. It is therefore likely that the review, the draft of which has to be completed very soon, will contain some gaps.

There is still a backlog of formal publications to clear before the IFRP can be considered to be truly closed, and all spare time will be devoted to doing this. However, formal publication has not been considered a top priority because sub-project and draft reports are always available on request, subject to national confidentiality clearance (see *Fisheries Newsletter* #67, pages 11–16). The highest-priority unfinished publication is the promised trochus abundance estimation handbook, which awaits some quality time from the Fisheries Resource Adviser.

¹ S.T. Fakahau and M.P. Shephard. (1986). *Fisheries research needs in the South Pacific*. Consultancy report prepared for FFA and the Canadian International Centre for Ocean Development.

² M.P. Shephard, A. Wright and S.T. Fakahau. (1989). *Reassessment of South Pacific fisheries research needs*. FFA Report 89/91.

■ TRAINING SECTION

Attachment training activities and perspectives

As part of the Fisheries Programme's mandate to implement strategic training activities, the Fisheries Training Section has undertaken to assist several countries with 'one-off' training programmes that will enable nominated individuals to receive subject-specific training through attachments and short courses.

During the first half of 1994, the Section organised and funded a range of successful attachments. Under the joint FFA-SPC, UNDP-funded Regional Fisheries Support and National Capacity Building Project, the ability to organise and support such training will be significantly enhanced. Opportunities for attachment training during the term of the UNDP Project, which runs till 1996, will be advised by circular letter in the second half of 1994.

Attachments organised by the Section during the first half of 1994 included the following:

- ☛ FSM aquaculture technician to Fiji Fisheries for study of clam spawning practices;
- ☛ Palauan fisheries extension officer to Thailand to attend a short course in project planning and evaluation;
- ☛ Palauan fisheries administrator to SPC (Noumea) to complete human resource development (HRD) planning exercise;
- ☛ Tongan fisheries extension officer to SPC (Suva) to upgrade skills in radio programming;

☛ Solomon Islands fisheries tutor to New Zealand and New Caledonia to develop teaching skills and enhance practical fishing skills;

☛ Tongan fisher to New Zealand to join commercial longline fishing vessel.

Attachment training can be quite time-consuming. Each attachment requires the submission to SPC of a formal request and its approval; the identification of funds to support the training; and the organisation of an appropriate venue and time-frame for the training.

The training of individuals on attachment can also be expensive, with airfares, allowances and training fees often amounting to US\$3000 – US\$5000 for a two-to three-week attachment, or even more if the organisational costs are taken into account.

However, the significant organisational and financial costs of attachment training are justified by the strategic nature and quality of the training. Attachments generally respond to a need to develop an individual's specific skills in line with the requirements of a particular project being undertaken by a Fisheries Department.

The quality of an attachment programme can be ensured by having a definite set of objectives for the training and through careful planning of tutorial or supervisory input.

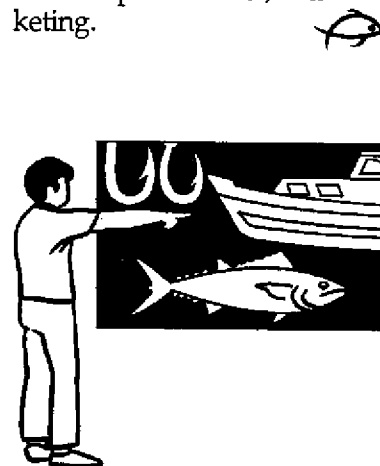
Ideally, the need for attachment training will be assessed by countries as part of a general training needs assessment and

training planning undertaken in association with overall HRD planning. When training can be provided through an established course or programme, attachment training is unlikely to be appropriate.

However, when there is no formal course on offer, or when the required skills are beyond those offered by training institutions, attachment training may well provide an appropriate solution.

Attachment training is also well suited to the needs of the private sector. Short skill-oriented programmes designed to meet specific needs within an organisation are often best carried out through contact with a similar organisation. In reflection of this, the attachment programme planned under the UNDP project has a strong private-sector orientation.

Training Section staff are presently assessing potential training venues and opportunities, particularly in regard to business and organisational management training, aspects of fisheries post-harvest, and marketing.



Fishing-vessel crew certification workshop

Following discussion of a working paper on fishing vessel crew certification, the 24th Regional Technical Meeting on Fisheries (RTMF 24) held in August 1992, made the following recommendation:

In acknowledgement of the potential for the increased employment of Pacific Island nationals in the industrial fisheries sector, the meeting recommended that the South Pacific Commission undertake a study of the feasibility of introducing standardised fishing deckhand certification in the region.

In undertaking this study, the SPC Secretariat noted keen interest from fisheries training institutions in developing a standardised approach to curricula and teaching resource materials, not only for fishing-vessel crew, but also for officers and engineers.

The Secretariat subsequently presented a report to RTMF 25 (March 1994). The report noted the potential for the development and implementation of standardised certification for fishing vessel crews and suggested that a regional workshop should be organised to review curricula already in place and to discuss the issues associated with implementing standardised certification.

After considering the report, RTMF 25 endorsed the further development of standardised certification and recommended that the Secretariat continue its efforts to develop and co-ordinate national and regional initiatives in standardising fishing vessel crew certification.

Accordingly, SPC, in association with FFA and the Forum

Secretariat, is organising a regional Workshop on Standardised Certification for Fishing Vessel Crews. Financial support for the workshop is being provided through the SPC-FFA Regional Fishery Support and National Capacity Building Project.

The Workshop will be held at Forum Secretariat headquarters, Suva, Fiji, from Monday 26 to Friday 30 September. It has been advertised through an SPC Savingram and more than 150 letters to training institutions and industry representatives.

The workshop will allow trainers, administrators, regional organisations and employers to consider fishing vessel crew certification options in detail. The following objectives have been suggested:

- ☛ After consideration of the background and options, to decide whether the development of a certificate structure for the manning of commercial fishing vessels will benefit the region;
- ☛ If there is sufficient consensus that a certificate structure for manning commercial fishing vessels will benefit the region, to determine an implementation strategy which will best reflect the region's circumstances;
- ☛ After consideration of the background and implications, to decide if there is sufficient interest and benefit to the region in the development of a Pacific Island deck hand qualification and training structure for this qualification;

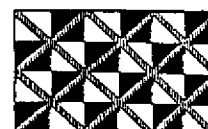
☛ To seek confirmation from overseas employers that the creation of such a qualification would have their approval and co-operation;

☛ If it is agreed that a qualified fishing deck hand structure will benefit the region, to:

- Develop an approach which will implement the concept in a manner acceptable to regional countries and to both national and overseas employers;
- List the minimum requirements which will be necessary for a person to undertake the training or examination;
- Develop a course outline and structure;
- List the main syllabus contents;
- Outline means of developing course materials;
- Develop means of regional compatibility and of maintaining parity between different countries.

A comprehensive report on the workshop and associated recommendations will be widely distributed for review by regional and national bodies.

It is hoped that the workshop will play a strategic role in consolidating employment perspectives for Pacific Island fisheries personnel.



■ CAPTURE SECTION

First SPC sub-regional FAD skills workshop in American Samoa

Fish aggregation devices (FADs) are widely used in the Pacific Islands to enhance subsistence, commercial and industrial fisheries. A study of regional FAD use showed that 15 SPC member countries deployed nearly 300 FAD units between 1983 and 1990, representing a material investment of some US\$1.5 million¹. FAD use has expanded considerably since that time.

FAD technology has steadily improved in the region since use of these units became widespread in the Pacific in the early 1980s, but many SPC member countries have continued to experience technical difficulties in FAD programme implementation, particularly in regularly maintaining FADs on station for satisfactory periods.

Regular monitoring of regional FAD programmes by the Capture Section and requests for technical assistance indicate that most of these problems arise through a local lack of comprehensive experience and skills in FAD engineering, site survey procedures, material specification, rigging techniques and deployment methods.

The Capture Section has played a significant role in developing regional FAD technology and in disseminating and promoting the regional exchange of information. It has also provided expert technical assistance and training in FAD skills in-country in support of national FAD programmes.

In response to the importance given by regional fisheries managers to the continuation and expansion of this work, a series of sub-regional FAD skills workshops has been scheduled as a major component of the UNDP-supported Offshore Fisheries Development Project executed by SPC.

The aim of the two-week workshops is to provide practical training for participants in all physical aspects of FAD programme implementation.

The first Sub-regional FAD Skills Workshop was held in Pago Pago from 16 to 27 May 1994. It coincided with a FAD deployment programme planned by American Samoa's Department of Marine and Wildlife Resources (DMWR), for which the technical assistance of the Commission had been requested.

This had the two-fold benefit of satisfying the request for expert technical assistance and providing practical training opportunities for the participants under actual field conditions. American Samoa's willingness to host

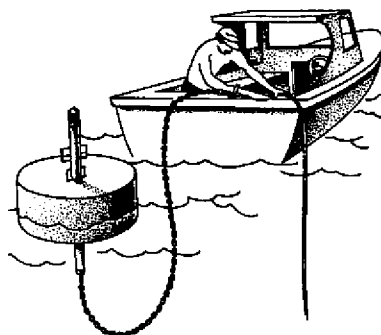
the workshop, and the co-operation provided by DMWR in providing a venue and vessel, were much appreciated by both SPC and the external participants as a good example of the value of regional co-operation and technical exchange.

Before the workshop, SPC Master-fisherman Peter Watt and Aymeric Desurmont, Master-fisherman with New Caledonia's *Service Territorial de la Marine Marchande et des Pêches Maritimes*, spent over two months developing a detailed training programme on FAD skills. The programme covers site survey techniques, preparation of bottom contour maps, FAD site navigation and charting, FAD material specifications, mooring calculation and rigging, raft and anchor construction, deployment techniques, and maintenance procedures.

Fourteen trainees, from American Samoa, Cook Islands, Fiji, Niue, Tokelau, Tonga and Western Samoa participated in the workshop.

Under the guidance of Peter and Aymeric, and with the assistance of University of the South Pacific marine studies tutor Captain Jone Maiwelagi, the trainees participated in both classroom and practical instruction in the skills required for successful, and safe, FAD planning, rigging and deployment.

Much of the training included work at sea on board the



¹ Paul D. Gates. (1990). Review of Pacific Islands FAD deployment programs. Working paper 38 presented at a Workshop on Fish Aggregating Devices (FADs) held during the 22nd Regional Technical Meeting on Fisheries, Noumea, New Caledonia, 6-10 August 1990.

DMWR research vessel *F.V. Sausauimoana*. As part of the practical work three FADs were deployed offshore from the main island of Tutuila.

Most were able to show that they were now capable of managing the physical aspects of FAD programmes in their home countries without further external assistance.

In order to assess their progress, students were set a series of theoretical and practical problems at the end of the workshop.

A second workshop in this series is scheduled to be held in Palau in October this year. All SPC member countries in Micronesia, as well as Tuvalu, have been invited to nominate

participants. If demand is evident, and resources permit, a third workshop may be organised in 1995 for Melanesian and francophone member countries.



American Samoa's fisheries research vessel *F.V. Sausauimoana*, used as a training platform during the FAD Workshop.

■ OCEANIC FISHERIES PROGRAMME

SPC 1993 Tuna Fishery Yearbook

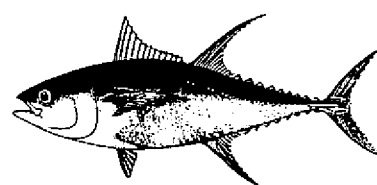
Background

At the third meeting of the Standing Committee on Tuna and Billfish (SCTB) held in Noumea, New Caledonia, from 6 to 8 June 1990, the members of the committee called for the Tuna and Billfish Assessment Programme (TBAP) to compile fishery status reports, in order

to facilitate the review by the SCTB of the TBAP work programme and to place the work of the TBAP in perspective.

The first status report, covering tuna fisheries in the SPC region during 1990, was presented as a working paper to the fourth meeting of the SCTB, held in Port Vila, Vanuatu, from 17 to

19 June 1991; this document was subsequently published as *Tuna and Billfish Assessment Programme Technical Report No. 27*.



The status report covering 1991, which was presented to the fifth meeting of the SCTB, held in Honolulu, Hawaii, from 17 to 19 June 1992, was published as *Tuna and Billfish Assessment Programme Technical Report No. 29*.

The third status report, covering 1992, was presented to the sixth meeting of the SCTB, held on Pohnpei, Federated States of Micronesia, from 16 to 18 June 1993; the third report was subsequently published as the *SPC Tuna Fishery Yearbook, 1992*.

1993 version

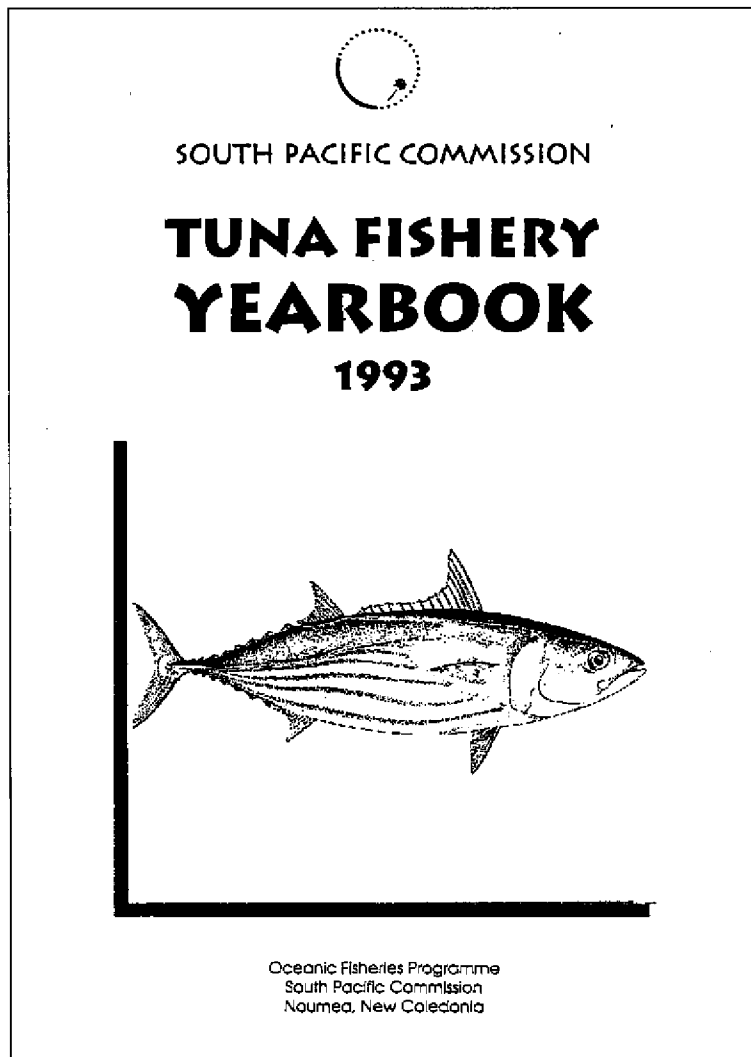
The latest report covers tuna fisheries in the SPC region during 1993. Historical statistics have been revised as new information has been made available. The reports are arranged by gear type and fishing nation.

The industrial fishing methods employed in the SPC region, and discussed in the yearbook, include longline, pole-and-line, purse seine and troll. Driftnet fishing in the SPC area ceased in 1991. Artisanal and subsistence tuna fisheries, though important in some SPC member countries, are not consid-

ered. Trends in catch and effort are discussed, with emphasis on events during 1993 for those fleets for which such information is available.

In the tables of historical catch and effort statistics presented in the document, consideration is given to the four main commercial species caught in the SPC region: albacore (*Thunnus alalunga*), bigeye (*Thunnus obesus*), skipjack (*Katsuwonus pelamis*) and yellowfin (*Thunnus albacares*).

Catches of other species are not discussed explicitly, and discards are ignored.



■ CHINESE FISHERMEN GETTING LION'S SHARE OF THE CATCH

The quantity of tuna hooked by locally owned fishing boats in the Marshall Islands dropped by half in the first three months of 1994 compared to the same period last year – although, because of the addition of a fleet of Chinese longliners, the total catch has doubled.

Local boat operators and government officials cite congestion at dockside, now that almost 40 Chinese boats have arrived, and reluctance among local longline fishermen to share information about tuna location with other boats, as the main reasons for the downturn.

While the local boats' production is down, the overall catch for the first quarter has put the Marshalls on target for about doubling the 800,000 lb (363,200 kg) caught in 1993, according to freight figures released by Air Marshall Islands, which flies the tuna to markets in Hawaii and Japan.

The local fleet has 12 boats, but only nine are fishing regularly. They made 20 trips in the first quarter – an average of 2.2 trips per vessel. During the same pe-

riod, the 12 Chinese boats made 78 trips – an average of 6.5 per vessel. If the local boats continue at their present pace, they will make only 80 trips for the entire year compared to 149 in 1993.

Looking at it by weight, local boats brought in 204,639 lb (92,906 kg) of tuna in the first quarter of 1993. This year the total was down to 99,181 lb (45,028 kg). The Chinese brought in 398,867 lb (181,086 kg), or about 75 per cent of the total.

Although the locals have a higher per-trip average, 4,959 lb or 2,251 kg compared with 3,817 lb or 1,733 kg for the Chinese, the latter have made four times more trips so far this year.

Local officials and fishermen said a key factor in the success of the Chinese is that they sail together.

'They spread out and when one boat finds a school of tuna, it radios to the other boats and they all fish off the same school,' said Justin deBrum, general manager of the Marshall Is-

lands Development Authority, who played a central role in expanding the fishing fleet. 'They work as a unit. It makes a difference. If we want to be successful at longline fishing, we should fish like the Chinese.'

The crowded dock conditions, with nearly 50 boats competing for space to offload fish and take on ice, water and fuel, is another factor in the slow start for the Marshall boats. Co-operation and experience should help this situation, deBrum said.

'We need more time to put (the local industry) together,' he said. Because of the growing pains, the Government has decided to temporarily hold up plans for increasing the locally owned fleet by up to 30 longliners until present problems are resolved.

In the meantime, the Government plans to buy a barge to be used to supplement the present base for fish processing, cold storage, ice making and refueling.

(Source: *Pacific Magazine*)



■ 'HOT SPOTS' KILLING CORAL REEFS ACCORDING TO SCIENTISTS

Scientists are warning that Pacific Island coral reefs are dying because of bleaching from warm-water 'hot spots'.

Dr Thomas Goreau, president of the New York-based Global Reef Alliance, said the immediate danger area stretches from Solomon Islands to American Samoa.

Scientists following the bleaching phenomenon have found it occurring in ocean hot spots where the average sea-surface

temperature rises more than one degree Celsius above historic averages. Goreau said satellite images show that a hot spot formed in January was causing bleaching a month later to reefs in the Society Islands and Tuamotu Archipelago of French Polynesia.

Goreau said observers need to be on the lookout for bleaching in Kiribati, Cook Islands, Tokelau, Tuvalu, Nauru and Solomon Islands.

(Source: *Radio Australia*)



■ ANOTHER TUNA PROJECT FOR MADANG

A major tuna fishing project began operations in January 1994 in Madang Province, Papua New Guinea (PNG).

The project is operated by Akua Resources, a joint venture between Fish Pty Ltd, a wholly Papua New Guinea-owned company, and a Singapore-based firm. Fish Pty Ltd initially chartered three super purse-seine fishing vessels, for which licences have been issued, from its Singaporean partner. The vessels were expected to start fishing in January 1994.

The company plans to sell its catch to the Madang tuna cannery when it begins operation. In the meantime, it will export its tuna overseas and sell its by-catch locally.

The Minister for Fisheries and Marine Resource, Iaro Lasaro, said the project is very much in

line with the government's policy commitment to encourage development of PNG's vast fishing resources generally and the tuna industry in particular.


The project is expected to bring a number of significant benefits to PNG such as:

- ☛ Creation of 100 jobs directly and many more indirectly;
- ☛ The establishment of a permanent shore base in Madang;
- ☛ The provision of valuable data on the size and value of PNG's tuna resource through close cooperation with the Fisheries and Marine Resource Department; and
- ☛ The provision of assistance to the department in terms

of surveillance of fishing activities within PNG's domestic waters. These vessels will carry both licensed compliance officers and biologists from the department.

Fish Pty Ltd will focus on creating opportunities for small-scale business ventures to be set up by local people in areas such as fish farming and domestic marketing. It has also made a commitment to spread its share holding as broadly as possible so that it is a widely based PNG-owned business.

The company is also co-operating closely with the PNG Maritime College and the Kavieng Fisheries College in the recruitment and training of PNG fishermen and ship crews.

(Source: *The Times of PNG*) 

■ FISH CANNERIES IN PNG: PROCESSING AND DISPOSAL OF FISH WASTES

PNG industrial development strategy

In a move intended to create more employment opportunities, the government has vowed to leave its doors wide open for investors in a variety of industrial development initiatives.

The government is committed to increase the contribution of the industrial sector of the economy from its present share of 10 per cent of GDP to at least 35 per cent by the end of the present century. This vision has received repeated emphasis from the Ministry of Trade and Industry.

The goal of the ministry is to see that PNG has a dynamic and diversified industrial base

which will provide sustainable growth, income-earning and employment opportunities as well as improved living standards. The vision can only be achieved by restructuring the present economy, from that of a predominantly subsistence, primary producing and exporting country, to an industrial one as an alternative 'engine of growth'.

To get there, the ministry targets and encourages investments from foreign sources. Of special interest to the ministry are opportunities offered for downstream processing industries using PNG resources, import replacement industries, strategic and basic industries. This article addresses environmental problems that may arise

from one of the downstream processing industries – fish canning – especially those resulting from waste disposal and treatment.

Fish processing industries

Environmental concerns have recently become a matter of global agenda. Among these is the issue of pollution of the atmosphere and waterways, including the deterioration of water quality. A matter of the greatest concern in the fish processing industry is the effects of fish wastes on the marine environment.

Marine pollution is defined as the introduction by man, directly or indirectly, of substances, or energy, to the marine

environment which have deleterious effects such as hazards to human health, and hindrance of marine activities, including impairing the quality of beaches for public use.

Four fish cannery processing plants have been proposed for development in Madang, Kokopo, Kavieng and Lae. The one in Lae is already under construction next to the industrial estate at Malahang. Elsewhere, fish canneries are located along the water-front, in the vicinity of ports and harbours. Although fish processing contributes raw materials for a range of other industries, it also generates a huge amount of fish wastes.

Experiences from Canada, for instance, suggest that the fishing industry has an image problem as a result of the disposal of solid wastes (offal) in the sea. Water courses, especially the harbours, estuaries and near-shore water, become polluted.

The pollution of water courses occurs despite the fact that the liquid wastes, or effluents, are usually discharged after physical and chemical treatment.

Often, however, effluents contain organic loads high in biochemical oxygen demand (BOD), suspended solids, fish oils, and pathogenic bacteria that may contaminate the marine environment. Recent environmental impact studies, also in Canada, have detected signs of ecosystem stress in many off-shore waters. Nor are ocean fish dumping and landfill disposal desirable solutions. Both create aesthetic, health and environmental problems associated with odour, unsightly accumulation of fish wastes and health hazards to the community.

It is not uncommon that food products from fish processing comprise herring, mackerel and other seafoods.

However, fish meal and oils are also produced as by-products of the processing operation. Further experiences from Canadian fish processing plants show that 30 to 80 per cent of the raw materials are generated into wastes. For example, ground fish fillet produces from 40 to 60 per cent wastes, whereas herring roe produces from 90 to 95 per cent. Canadian fish processing plants produce (at a conservative estimate) 300,000 metric tonnes annually of fish wastes.

Fish waste management

In many fish-processing countries management of solid wastes from fish processing has received less attention. In some countries, much of the waste is reduced to fish meal and fish oil and the rest is spread on agricultural land, used as landfill or dumped at sea.

Elsewhere, the disposal of large amounts of fish wastes in landfill or by way of ocean dumping has resulted in many public complaints arising from sanitary and environmental problems.

Fish waste disposal problems

As yet, little is known about the magnitude of the problem and the long-term effects of fish offal and fish waste disposal into the marine environment. Indeed, this introduction by human activities in the waterways certainly has several potential adverse effects on coastal waters including floating solids, oil slicks, water discolouration and high organic loading of the receiving waters. All these con-

tribute to the degradation of the quality of water, unsightly accumulation of fish offal on beaches and odour problems.

On the other hand, disposal of fish offal in landfill or by spreading it in agricultural fields can cause a number of other environmental problems, including leachates of ammonia, amines and sulphate gases, as well as odour. These, in turn, attract nuisance birds, insects and vermin which lead to public health concerns as well as aesthetic problems.

Reducing fish wastes into fishmeal for pets is meant to ensure that much of the fish offal is used, thus eliminating problems associated with large-scale ocean dumping or landfill. This solution has, however, created other problems, such as production of effluents rich in BOD5 that are also responsible for the pollution of the receiving waters.

Environmental protection measures

It is important that correct methods be put in place for the disposal of fish wastes without compromising the environmental quality of the air, land and water, as well as health and safety.

The objective of any regulation should be to ensure that all fish processing operations, including those involving by-products, apply and adhere to the best applicable treatment technology. Not only does the design of fish plants require strict sanitary control to prevent the discharge of polluted waters without proper treatment, but also effluents should regularly be monitored for bacterial contamination.

In Japan, for instance, the fish processing industry is controlled by the Water Prevention Law, under which it is the responsibility of the persons concerned to observe the regulations and standards promulgated in the law.

Canadians are currently investigating methods to solve problems posed by the fish processing industry. Two of these are fish ensiling and fish composting, seen as environmentally benign and economically feasible solutions.

Fish silage is a process whereby fish wastes are preserved by lowering their PH, thus stopping the proliferation of micro-organisms responsible for putrefaction. Raw silage is used in the production of pet food and aquaculture fish feed. On

the other hand, composting is used in soil conditioning. The fish waste is biologically decomposed in aerobic conditions and the product is odourless and weed-free.

Conclusion

While downstream processing industries such as fish canneries appear to hold potential benefits, it is doubtful they can increase employment opportunities as envisaged by the government. Downstream processing industries must have linkages with other sectors of the economy, such as mining, forestry and agriculture. Additionally, to ensure that environmental contamination does not take place, it is important for the government to impose tougher, mandatory pollution standards.

This means setting up a national research centre which will regularly monitor environmental pollution, consider waste disposal limits, and regularly assess the performance of industrial plants soon after commissioning. If no special measures are taken, the risk of environmental deterioration of the beaches and the waterways is very high.

(Source: *The Times of PNG*)



■ PIONEER FISH EXPORT PROJECT

Youths from Manus (PNG) are pioneering a unique project which involves storing and exporting live fish.

Admiralty Youth Marine Supplies (AYMS) signed an agreement with Chart Wide Investments (CWI) of Hongkong on 14 March in Port Moresby to pave the way for this project.

Under the agreement, AYMS will keep all the fish caught by youths in storage facilities to be built at selected ports around Manus.

CWI will send its boat to collect the fish every month. The company will also provide technical expertise and training which will cover boat design and handling live fish.

The project is expected to benefit 200 small-holder, family-based, youth fishing groups

throughout Manus. It will enable these groups to market their catches immediately, thus eliminating the need for preservation facilities.

When in full operation, the project is expected to export on average a total of 10 t per month of live fish to the Asian markets at an average price of K60,000. This gross income would work out to about K300 per family group per month.

The project is believed to be the first of its kind in the country. But, like any business venture, it involves a risk and James Mileng, Commissioner for the National Youth Service, told the signatories to the agreement that it will take 'everybody's honesty and careful management to reap the benefits.'

'This is not the end. It is the beginning of hard work to bring benefits to our young people,' he said.

The agreement marks a milestone for youth development in Papua New Guinea. For the first time, a youth company is able to directly explore markets overseas in order to assist youths by providing them with a readily available market capable of absorbing all they can produce.

The National Youth Service, in a background paper prepared for the occasion, stated that marketing alone has presented youths with a dilemma over the years because the volume of fish on sale on the domestic market has exceeded the demand.

'Furthermore, essential infrastructure, such as road, and

electricity, is not available to outlying isolated communities to enhance food processing and preservation, resulting in a lot of effort being wasted.'

The Manus youths are looking at utilising the Mini Loan Scheme for Youth and the Less Developed Areas Scheme of the Rural Development Bank to finance their equity in the project through the AYMS.

On current estimates, this would involve up to about K60,000, which would mainly be spent on constructing the four storage facilities in the East, West, North and South regions of Manus.

If the Manus project is successful, the Department of Religion, Home Affairs and Youth, which facilitated the negotiations for the project through the

National Youth Service, hopes to set up similar projects in other maritime and coastal provinces.

It would also explore the possibility of opening up similar market arrangements for other produce, such as vegetables and livestock, with youth groups in other provinces.

(Source: PNG Today)



■ LOGGING OPERATIONS CAUSE DESTRUCTION OF CORAL REEFS

The coral reef at Lassul Bay in East New Britain Province (PNG) has been destroyed as a result of logging operations, an investigation conducted by authorities has shown.

The investigation was carried out on 7 October 1993 by two senior officers from the Department of East New Britain's Primary Industries Division and a senior officer from the national Department of Fisheries. It followed a report from the East New Britain Sotel Komiti (ENBSEK) based in Rabaul that a logging company, Niugini Lumber, a subsidiary of the Malaysian company Rimbunan Hijau, had dug out a reef from a beach front for road construction purposes.

The report of the investigation by government officials showed that:

- ☛ There was no proper consultation with government authority prior to the company's action;
- ☛ The total area was covered with coral substance;
- ☛ There are signs of aquatic substances;

☛ There is destruction of other organic substances; and

☛ The machinery was used to cause destruction.

Investigation officers Cletus Lucas, Marcel Tokurewaga (provincial DIP) and Yapa Titiwonga (national Fisheries Inspector) said they discussed the purpose of the investigation with the Assistant Coordinator of Lassul Bay Station, Gabriel Peniamo.

Mr Peniamo told them that there was no consultation between the company and the government authority at Lassul Station before the activity was carried out.

Mr Peniamo said if there had been any form of consultation, the assistant coordinator could have prevented the company from proceeding any further pending clarification from higher authorities within the provincial headquarters.

The report stated that the total area covered with coral was about 400 m². The coral substance was preferred by the company over other rock substances as packing for the swampy area.

The coral substance theoretically soaks up liquid, thus the company intended to use it to dry up waterlogging in the 400 m² swampy area prior to further road engineering work.

Apart from the above area of 400 m², another 50 m², which form the logging pond area, and the camp site entrance area were also surfaced with coral substance.

The report stated that evidence of coral substance was actually seen on the surface of the areas mentioned, such as the logging pond and the camp site entrance.

In the swampy area packed with coral, greyish to bluish colours were seen on the surface as they discharged from the packing.

It was also revealed that Niugini Lumber site manager, Richmond Young, when interviewed, stated that he had been granted permission by the owner of the area, Nakikus Konga, the member for Gazelle, to dig out the reef from that particular beach for road construction purposes.

(Source: The Times of PNG)



■ FIJI FISH WINS SUCCESS WITH SASHIMI

Graham Southwick, the boss of Fiji Fish Co. Ltd, put it this way: 'All of a sudden a number of factors came together that made it viable and we were ready to spring.'

So, three years ago, the company sprang. Last year 18 boats supplied it with \$US16.5 million worth of tuna and other species of fish. With great care, they were packaged and rushed by air to Japan and Hawaii. The company's success was recognised when it won the the main award in the Fiji Trade and Investment Board's Exporter of the Year awards.

This year Southwick wants to double the size of the fleet, a mixture of independent and company-owned craft run as joint ventures. But first it needs a jetty, now being built, an expanded fish handling plant and, above all, more space on the Air Pacific, Air New Zealand and Qantas jets which carry the fish to the markets. Since the holds of the airline jets are choc-a-bloc, Southwick is exploring hiring all-cargo jets.

Market

Last year Fiji Fish was shipping fish out at the rate of 70 tonnes a week. That, said Southwick, was a mere five per cent of the market which could be supplied if there were more boats and more air cargo space.

Compared with fishing for canneries such as the Fiji Government-owned one at Levuka, 100 kilometres from Suva, fishing for the sashimi market is very lucrative. Cannery-grade fish is worth \$US6400 a tonne. Fiji Fish works in a freezing factory across the harbour from Suva, built with Japanese aid.

Southwick fished for abalone in Australia before returning to Fiji, where he was born, to fish for tuna and later briefly run the government-owned Ika Corporation pole-and-line fishing fleet.

From the late 1980s he began exploring sashimi market possibilities, but discovered that too many factors were against exports from Fiji.

He said: 'In the early days it was not really viable because the Fiji dollar was too strong, we didn't have direct flights to Japan and there were too many things against it. We were doing it, but it was really marginal. It was not until the Fiji dollar was rationalised and Air Pacific put on direct Tokyo flights that it became viable. We had the fishing information, we knew what to do, we had the market set up and we were ready to move.'

Handling

Now, all fish are caught well inside the Fiji exclusive economic zone by boats making seven-day trips. Correct handling of the fish from the moment they're caught is imperative for meeting market requirements.

Fish are swiftly killed, bled clean and iced aboard a boat. At the Fiji Fish packing station, where less-than-perfect fish are ruthlessly rejected, fish are scrubbed, graded, frozen and despatched 200 kilometres to Nadi airport, from which they

will reach the market less than 12 hours later.

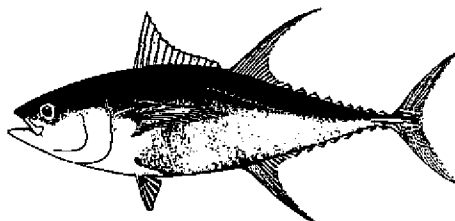
Southwick said his company had developed its own processing techniques, which it didn't want to disclose. These ensured its fish were of a quality far superior to those from Philippines, Indonesian, Micronesian, and Hawaiian suppliers who had big cost advantages over the far more distant Fiji supply. 'We can't compete on price; they sell at half our price,' he said. 'They sell on volume. We sell on consistent good quality.'

Fiji Fish generates jobs for more than 400 fishermen and factory staff. 'We can expand the fleet immediately but there is a lot of pre-planning to be done and a lot of investment needed', Southwick said.

'To double the fleet means we will have to spend another \$F2-3 million on ice plants, freezer trucks, port facilities and increasing the production lines. It could be done in six months. Air cargo space is the big problem; we have to sort that out. There are other things like jetties. We've got nowhere to unload the boats. That's a dreadful situation. We have to build our own.'

Fiji Fish is 70 per cent owned by Southwick's Wasawasa Fisheries, with the balance held by Saheb Holdings and Labella Holdings.

(Source: *Islands Business Pacific*)



■ CENTER FOR TROPICAL AND SUBTROPICAL AQUACULTURE FUNDS ORNAMENTAL FISH CULTURE PROJECT

Aquariums filled with brightly-coloured tropical fish are said to soothe and calm people. But the prospects of finding a niche in the US\$ 4 million ornamental aquaculture industry are exciting, rather than soothing, Hawaii aquaculturists!

Ornamental culture appears to be the wave of the future for Hawaii's aquaculture industry. The University of Hawaii (UH) and the State of Hawaii Department of Land and Natural Resources recently published *An ornamental aquaculture research program for Hawaii*. The paper outlines a four-point research programme that will form the foundation for an ornamental aquaculture industry in Hawaii. The programme will cover:

- ☛ ornamental fish farming technology;
- ☛ ornamental aquaculture systems;
- ☛ ornamental aquatic plant production; and
- ☛ technology transfer and industry development.

Florida currently leads the nation in aquaculture of ornamentals. Its ornamental fish culture industry has a farm-gate value of US\$40 million annually.

However, 80 per cent of the aquarium fish in the United States are still imported, leaving a wide berth for Hawaii to enter.

The prospect of filling that berth is being explored in a project titled 'Ornamental Aquaculture Technology Transfer.'

The project is funded by the Center for Tropical and Subtropical Aquaculture (CTSA) in co-operation with Sea Grant Extension Service and the Hawaii State Aquaculture Development Program. Investigators include Paul Olin and Richard Bailey of the UH Sea Grant Extension Service, Dr Christopher Brown of the Hawaii Institute of Marine Biology and Dr Frank Chapman of the University of Florida.

The first step in the project was to employ someone with an appropriate educational background and technical expertise in commercial production. Brian Cole, an expert with more than 10 years of experience in ornamental production, was hired to oversee project operations.

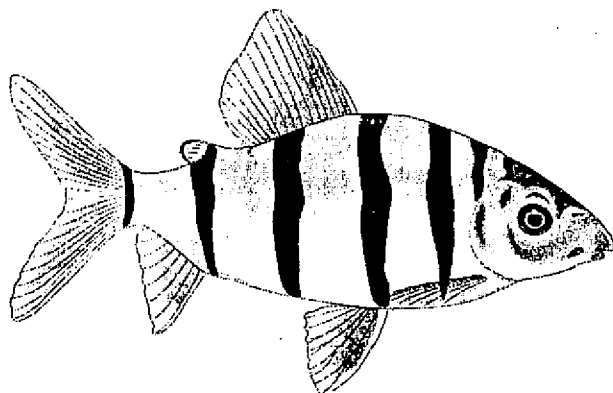
After earning a Master's degree in fisheries and allied aquaculture from Auburn University, Cole managed an ornamental

culture facility in Colorado. A state in which the temperature dips to 20–30° F below zero for two months a year seems an unlikely place for a tropical fish farm. But fish culturists are *nothing if not innovative*. They grew the fish in geothermal spring water and floated closed-cell foam insulation on the ponds during the winter.

Cole then moved to Plant City, Florida, to work in the research and development department of an ornamental aquaculture facility. In his first 18 months there, he was able to perfect reproduction of six species, including redbell and albino sharks.

Cole is currently directing reproduction growth and stocking density trials for 12 ornamentals, including both live-bearers and egg-layers. The fish are:

- ☛ Tiger barbs (*Copoeia tetrazona*),
- ☛ High fin rosy barbs (*Puntius conchionius*);
- ☛ tinfoil barbs (*Barbodes swinhonis*),
- ☛ Firemouth meeki cichlids (*Cichlasoma meeki*),
- ☛ Jack Dempsey cichlids (*Cichla soma biocellatum*),
- ☛ Jewel cichlids (*Hemichromis bimaculatus*),
- ☛ Two varieties of *Labio erythrurus*: albino rainbow sharks and rainbow sharks, and



Four varieties of *Xiphophorus helleri*: pineapple swordtails, sunset swordtails, redwag swordtails and neon swordtails.

'At this stage of the programme, we're interested in providing farmers with things that are easily cultured. We want them to have access to a large number of fish so they can approach the markets,' Cole explained.

So far the fish are doing quite well. Preliminary data from a reproductive fecundity trial of the sunset swordtail, a live-bearer, showed a slightly better than average reproductive rate.

Those interested in ornamental culture need to look at the big picture, Cole cautions. 'What you see in the pet stores is misleading. The retail consumer is paying US\$ 2.25 each for a 1.5 inch (3.8 centimetres) Jack Dempsey cichlid (*Cichlasoma biocellatum*).'

However, a farmer sold the cichlids to a wholesaler for 25 cents each in lots of 150 fish. The wholesaler then tripled the price and sold the fish to a retailer, who tripled the price again.

'I've had a lot of discussions with farmers who said they were interested in raising ornamentals, but they complain that

they can only get 25 cents each for them. My response to that is, "How much do you think it costs to manufacture a tube of toothpaste?"', Cole said.

He stressed that there is a price structure with ornamentals, just as there is with any other commodity.

Jack Dempseys reach market size in only 10 weeks, so harvests can be frequent. 'I can't think of any other aquaculture endeavour that has a higher profit margin. We used to base our (gross) at US\$ 3,000 per year for each 100- by 20-foot (60.5 x 12.1 metres) pond. That's a gross of US\$ 30,000 per acre (0.4 hectares) with only 10 ponds per acre – a conservative scenario. Profit margins can be US\$ 2,000 to US\$ 2,500 per pond,' he continued.

In addition, ornamental aquaculture make sense from an environmental viewpoint. Currently most salt-water and fresh-water tropical fish are taken from the wild. Over-collection combined with habitat destruction has resulted in drastic, worldwide declines in wild populations of ornamental fish.

Cole noted that conditions for ornamental culture are generally better in Hawaii than in Florida. Two factors stand out. The first is that Hawaii never

experiences freezing temperatures – which, for tropical fish, can be anywhere in the 50°F (10°C) range. Florida, by contrast, has had killing freezers down into the southern parts of the state during each of the last four years.

The second factor is water quality. 'Florida basically has only two types of water: one is hard and alkaline, and the other severely hard and alkaline,' Cole said. By contrast, Hawaii has a wide diversity of water quality types. 'You've got everything here from very soft, slightly acidic water to very hard, alkaline water,' Cole continued. 'As far as temperature is concerned, you've got everything from the mid-50s that trout can be grown in to 82°F (27.7°C) constant-temperature well water that's good for tropical species.'

Hawaii does face some disadvantages. Among them are the high cost of land, labour and goods. But project investigator Paul Olin pointed out that Hawaii's location and excellent air connections to the United States mainland and Japan, two of the largest markets for ornamental species, offer major advantages to a developing industry.

(Source: University of Hawaii)



■ 'BAG-TYPE' INSULATED FISH CONTAINER

The rationale behind the use of insulated containers for fish is very simple: ice keeps fish fresh and the insulated container keeps ice longer. This is particularly important in tropical countries where, due to the high temperatures, ice losses are usually an economic barrier that prevents the use of ice, particularly in artisanal fisher-

ies. This has been recognised during the last decade, and nowadays it is a key part of the technical advice on fish handling under tropical conditions. Efforts have been made to introduce industrial insulated fish containers and to develop artisanal insulated containers of a type we could call rigid.

However, rigid insulated fish containers may not always be the best solution for artisanal fisheries. Rigid containers cannot be accommodated easily in narrow canoes, and even when they can be accommodated (e.g. picnic containers), they may be too small to keep the type of fish caught and the ice.

Canoes in Papua New Guinea are very narrow and some of the fish caught are longer than the current industrial or home containers which can be accommodated in the canoe. The same situation can be found in other artisanal fisheries, for instance in the Amazonian basin.

Very often rigid insulated containers are heavy even when they are empty.

In some cases, if the quantity of fish is fairly small, it may be possible to utilise a 'bag-type' insulated fish container. The general shape and main elements of an insulated fish bag can be seen in Figure 1. The bag container has an outer and an inner wall; the insulation goes in between. The type of materials utilised for the construction can vary widely.

How to construct an artisanal 'bag-type' insulated fish container

Participants at the FAO/DANIDA Workshop in Papua New Guinea decided to construct the walls of their insulated bag fish container with woven palm leaves as shown in Figure 2. The woven palm-leaf walls are neither as mechanically resistant or long-lasting as walls if plastic material could be but, on the other hand, they are very cheap and can be replaced when necessary.

Insulation is a key part of the container. Again, different types of plastic materials could theoretically be utilised, but some of them are relatively expensive for artisanal conditions, many will require another type of wall to be effective and the most common ones are too rigid to be utilised in a bag container.

There are different materials at artisanal level that can provide insulation, including sawdust, coconut fibre, dried grass, and rejected cotton fibre. However, the use of such materials presents technical problems: the materials become wet very quickly, losing their insulating capacity and increasing the weight of the container. When wet, they also tend to rot very fast. Once placed in a waterproof container they tend to settle and, in the case of a bag container, to move around inside, leaving part of the walls un-insulated.

With a view to overcoming such problems, the concept of 'insulated pillow' was developed in various FAO/DANIDA workshops. This concept is very simple: the insulating material (e.g. coconut fibre) is placed inside a plastic tube of the type usually used to produce ordinary plastic bags. The tube is sealed by heat at both ends (e.g. every 20 cm), and with some practice it is possible to produce a pillow strip. It is advisable to press the 'pillows' before sealing them.

Plastic tubes of diameters around 10 cm are in general the most suitable. It is advisable to use a second plastic tube to reduce the incidence of punctures produced by fish spines and bones. Some materials, such as the coconut core, can be accommodated within the 'pillow' so

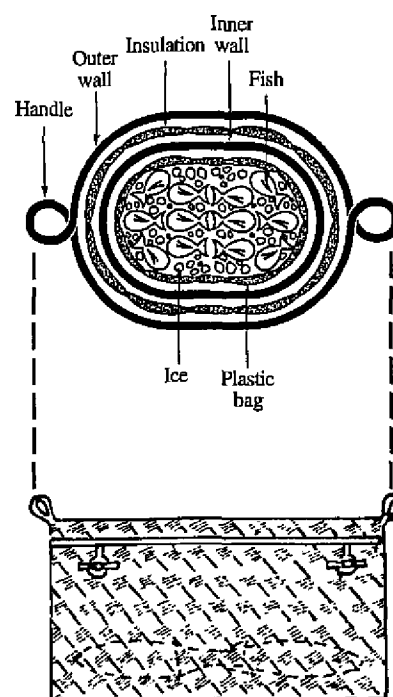


Figure 1. Insulated fish container, 'bag-type'

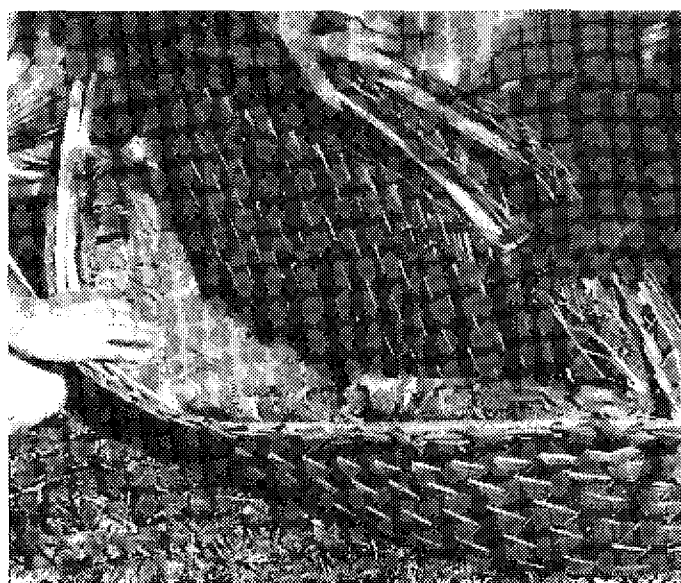


Figure 2. Insulated pillow strips between the internal and external walls

as not to settle in a reduced volume; likewise, it is possible to accommodate the 'pillows' within the bag to prevent settling. The 'insulated pillows' can also be utilised in the construction of rigid and semi-rigid containers.

The container is completed with one or more plastic bags to accommodate fish and ice, handles and a device to fasten the opening (see Figure 1).

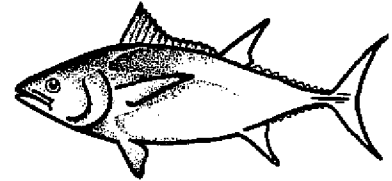
While the walls may have to be changed frequently, the 'insu-

lated pillows' can be reutilised. In many places the plastic bag for ice and fish is used only once; if used more often, it should be cleaned with water, soap and a brush and utilised again only after drying.

The insulated bag container is not designed to be stacked or to be placed below other containers or crates. This is an important point to avoid mechanical damage to the fish.

It is possible to construct an all-plastic insulated fish bag if the right materials are available (e.g. heavy duty plastic canvas of the kind used to cover trucks, and flexible insulating materials).

(Source: *Fish Tech News*)



■ TURNING TO TRADITIONAL TENURE

Management of marine resources was vital and traditional tenure could be seen as a favourable element in conservation, the French Ambassador to Fiji, Mr Jacques-André Costilhes, said recently. He was opening an international workshop on traditional marine tenure, and the sustainable management of marine resources in Asia and the Pacific, held at the University of the South Pacific.

He said fisheries was a key factor in human and economic development in Asia and the Pacific. The role of regional organisations in management of marine resources and fisheries had been commended, he said.

The week-long workshop was organised by the University's Marine Studies Programme and Ocean Resources Management Programme, funded by the International Ocean Institute through the Pacific Regional Operational Centre, the Western Pacific Fisheries Consultative Committee, and the Government of France.

The Director of the Ocean Resources Management Pro-

gramme, Joeli Veitayaki, said in an introduction that the world's fisheries resources were being over-exploited and were likely to be depleted unless proper and appropriate management systems were used. Most major management measures taken so far had proven inadequate and unsuccessful. There was an increasing awareness and appreciation of the value of traditional management systems.

Through better understanding of traditional communities, made available through socio-cultural studies, it had become evident that for effective management of coastal fisheries resources throughout the world, indigenous people needed to be involved. They not only had vast knowledge of their environment, but were also custodians of significant portions of coastal areas where fisheries were concentrated.

Increased mobility of people and decline of traditional authority made total reliance on traditional management inadequate. But given the intricate knowledge accumulated by traditional societies, it would be idiotic of contemporary users

not to put it to good use. Mr Veitayaki warned that the traditional system of management was unique and needed to be recorded, shared and discussed, because the knowledge which took centuries to work out and accumulate was quickly being lost as the people most informed in its use were dying.

He said nearly all management systems now being tried in contemporary societies were used in some form in traditional management systems. They included closed seasons, closed areas, size limits, equipment control, limits on the number of users and quotas.

Appropriate management of fisheries resources in the future lay with a system of management which would cater for both the old and the new, he said.

Speakers at the opening session included Mr Peniasi Kunatuba, representing the Western Pacific Fisheries Consultative Committee, Professor Robin South of the International Ocean Institute and Marine Studies Programme, and Pro

Vice-Chancellor Dr Vijay Naidu, representing the University. Professor South was rapporteur and Dr Naidu chaired the first session on tra-

ditional marine tenure in the 1990's, with speaker Kenneth Ruddle, from Japan. Other sessions included speakers from the Philippines, Australia, Nor-

way, Kiribati, Hawaii, Palau and Western Samoa.

(Source: USP Bulletin)



■ TUNA EYEBALLS POPULAR IN JAPAN

The eyes, stomachs and other previously discarded parts of fish are now appearing on the shelves of retail outlets in Japan, vacuum-packed and in cans. Rich in the polyunsaturated fatty acids *dosa-hexaenoic* (DHA), and *eicosapentaenoic* (EPA) acids, the new products are said to improve brain functions and reduce cholesterol.

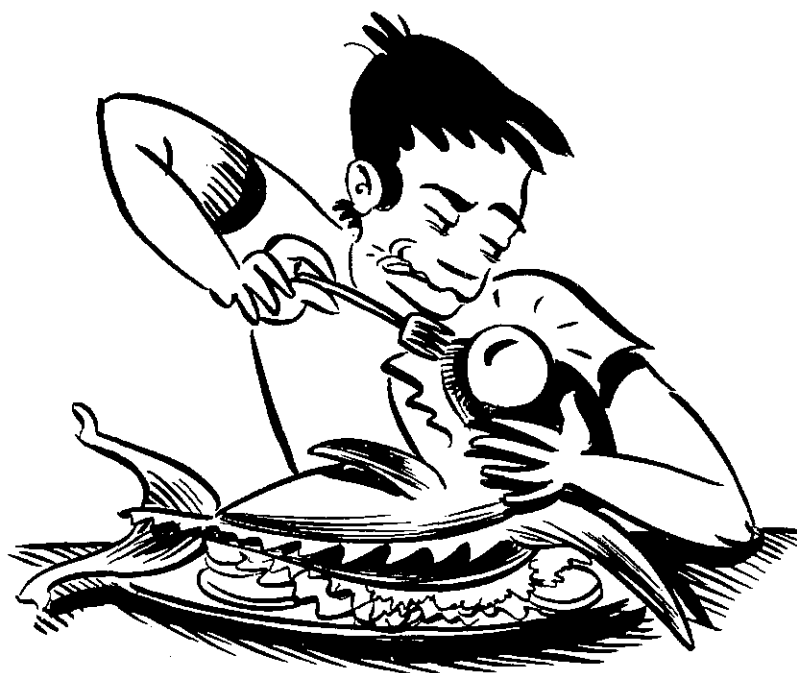
Tuna eyeballs are reported to be particularly popular. When

they first appeared in shops last spring they enjoyed strong demand, but interest soon waned as consumers did not know how to cook them.

This interest has now been reignited with the launch by Maruni Co of Tokyo of a pair of pre-cooked tuna eyeballs for ¥3,000 (US\$ 29.59). 'Our product is popular', said company president Sadao Nimura, 'because it does not need cooking'.

The new range of DHA-related fish products is apparently being purchased by parents of school-age children and students preparing for university entrance examinations. Food processors are now hoping that such 'brain foods' will be introduced in school lunches.

(Source: SEAFOOD International)



■ LAST QUARTER'S CLIMATE

In this new feature, we will try in the future to keep our readers informed with an overview of the last quarter's climate in the South Pacific Islands. We would appreciate receiving your comments about this initiative. All the meteorological information is extracted from South Pacific Climate Monitor, published by the National Institute of Water and Atmospheric Research Ltd, Wellington, New Zealand.

January 1994

The 1991-1993 El Niño Southern Oscillation (ENSO) event has now ended. The Southern

Oscillation Index (SOI) was close to zero for the third consecutive month; the equatorial easterly winds continued to increase in intensity and west of

the dateline were stronger than normal for the first time in three years; atmospheric convection became weaker than normal in the equatorial central Pacific;

and sea surface temperature (SST) anomalies were weaker than those of previous months (though a little above average, in some places by +1°C).

The rainfall data indicate that the location of the South Pacific Convergence Zone (SPCZ) was slightly further south than usual for January, with areas to the south being wetter than average and those to the north being drier than average. Overall, most parts of the region were drier than average.

The above-average rainfalls occurred in a band extending eastward from New Caledonia to Fiji, and across the southern Cook Islands and southern French Polynesia. The only record-high rainfall was 311 mm (249% of average) at Mururoa, in the Tuamotu Archipelago.

The main drier-than-average area extended eastward across Kiribati from the dateline to northern French Polynesia (all with less than half of average rainfall). Canton Island measured just 3 mm (4% of average). Other drier-than-average areas included parts of Papua New Guinea (also with less than half of average), and the Coral Sea, Solomon Islands, and northern Vanuatu.

Air temperatures in January typically remained 0.5°C above average, in keeping with the adjacent warmer than average SSTs around most islands. Pressure anomalies were small, a marked change from the pattern of most previous months of higher-than-average air pressures extending from Australia across Fiji and beyond.

TOGA Sea Level Center readings for the previous month (December) showed a return to

near-normal sea levels, but sizeable anomalies were present from Fiji (+15 cm) across to Rarotonga (+16 cm).

February 1994

Climatic conditions in the Pacific were generally near average during February. The SOI remained close to zero for the fourth consecutive month. There were some remaining patches of positive anomalies in SST, by +1°C, but there were negative anomalies along the Equator, and north of New Zealand.

For the first time in three years, the warmest equatorial water shifted far west of the dateline. Equatorial easterly winds became stronger than normal, and atmospheric convection continued to be weaker than normal in the equatorial central Pacific.

The Pacific Islands rainfall data indicate generally weaker convergence than usual, and a tendency for the SPCZ to be more westward than usual. The only areas with high rainfall (around twice average) were the Tuamotu Group in southern French Polynesia, the northern islands of Papua New Guinea, and south-east Australia. Rabaul recorded 606 mm, (260% of average).

Much of the region was drier than average, with many areas from the Coral Sea right across to northern French Polynesia having less than half of average rainfall. Kiribati sites were especially dry, with only 1 mm measured at Christmas Island and 3 mm at Canton Island. Record-low February rainfall was measured at Willis Island (40 mm; 18% of average) and at Niulakita in Tuvalu (63 mm; 19% of average).

Air temperatures in February remained typically 0.5°C above average (and 1°C above average in the Cook Islands and French Polynesia). This was in keeping with the adjacent warmer-than-average SSTs around most islands. Mean sea-level pressures were 1 hPa above average south-west of New Caledonia and 1 hPa below average in a broad band from Western Kiribati south-east to the Cook Islands.

TOGA Sea Level Center readings for the previous month showed relatively small anomalies across the region, ranging up to +10 cm in the Central Pacific.

March 1994

Pacific atmospheric and oceanic conditions during March were close to average overall, as part of what appears to be a slow transition from the recent El Niño state. There were no great changes compared to February.

The La Niña trend is reflected in the below-average SSTs at points along the Equator, especially in the east near the Americas, and the stronger-than-average equatorial easterly winds (though weaker than in February). The residual effect of El Niño is shown in the continuing pattern of El Niño SST anomalies of about 1°C or more outside the equatorial region. A large area of warm ocean, from 29° to 30°C, extended from Papua to south-eastern Polynesia.

Pressures remained close to average over the tropics, but because of unusually high pressures at Darwin (associated with an early end to the Australian Monsoon) the SOI fell to -1.5, from its near-zero values for the previous four months. Large fluctuations of the SOI are

not uncommon at this time of year.

Pacific Islands rainfall data indicate generally weaker convergence than usual over most of the region, but with the SPCZ more active at its eastern end (similar to February's pattern.)

The only areas of unusually high rainfall (at least twice average) were the Cook Islands and the Southern Tubuai Group of southern French Polynesia. Penrhyn Island (northern Cook Is) recorded 566 mm (316% of average). Drier-than-average conditions generally occurred elsewhere.

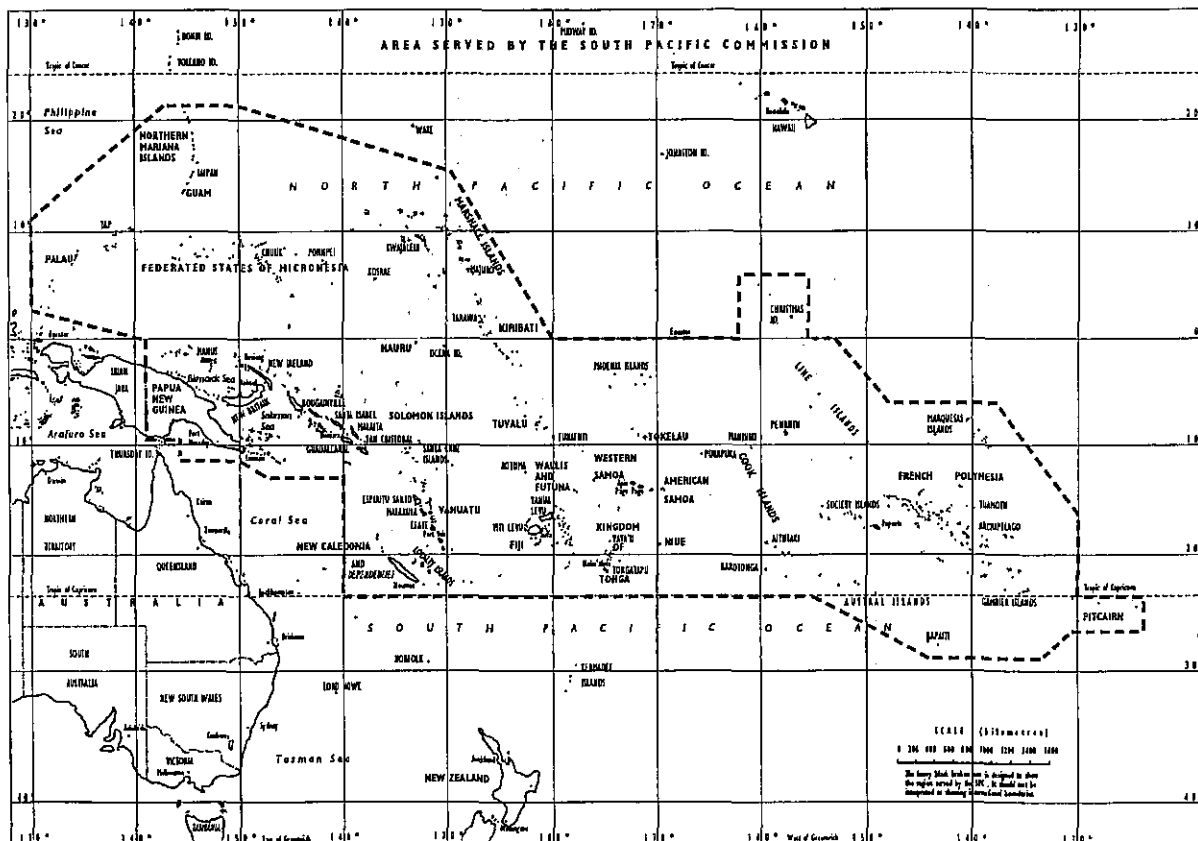
Areas from the Coral Sea right across to Tonga experienced less than half average rainfall, and western and central Kiribati sites were again especially dry. No rainfall was measured at Canton Is. The rainfall measured at Nuku'alofa, Tonga (51 mm; 19% of average) was a record low for March.

Air temperatures were typically 0.5°C above average, and were 1.0°C above average in island groups within the 15–20° S latitude band. This was in keeping with the adjacent higher-than-average SSTs around most islands. Higher-than-average mean sea-level pressures ex-

tended into the tropics from anticyclones centred near Tasmania, while weak negative anomalies prevailed from Western Kiribati south-east to the Cook Islands.

TOGA Sea Level Center readings for the previous month (February) showed generally small above-average sea-level anomalies, reaching +16 cm near Fiji.

(Source: *South Pacific Climate Monitor*)



■ REVIEW OF THE FISHERIES OF HAWAII AND US ISLAND TERRITORIES IN THE PACIFIC

The most recent edition of *Marine Fisheries Review* (vol. 56, no. 2) is a special issue dedicated to the fisheries of Hawaii and the other US island territories in the Pacific. These include American Samoa, Guam and the Commonwealth of the Northern Marianas (CNMI).

The inspiration for this volume was the growth and diversification of fisheries in Hawaii during the last decade and the possibilities for similar growth in the other US Pacific Islands. Examination of the status of fisheries in the US insular Pacific by fisheries scientists led to the conclusion that the availability of information on fisheries and fisheries resources was limited largely to annual reports and internal administrative documents.

A meeting was convened during 1991 in Hawaii at the US National Marine Fisheries Service (NMFS) Honolulu Laboratory to address this problem and produced an agreement to draft a series of review papers on the fisheries of the US Pacific Islands. This volume of *Marine Fisheries Review* contains these review papers.

Besides the introductory article, there are 14 papers in this volume: nine about fisheries in Hawaii, one on fisheries in American Samoa and two on fisheries in Guam.

The remaining articles include an overview of fish and fisheries in Hawaii and the US Pacific Islands, and a description of the fisheries data collection methods employed in the US insular Pacific. Missing is a review of fisheries in the CNMI and readers are referred to other

papers and reports for information about the fisheries of this archipelago.

The articles on the fisheries of Hawaii include reviews of Hawaiian marine fisheries, the lobster fishery of the North-west Hawaiian Islands, Hawaiian deep-slope fisheries, black coral harvesting, inshore coastal fisheries, the decline of the Hawaiian skipjack fishery, and the growth of longline fishing for swordfish and other high-value large pelagic species.

Hawaii differs from most other Pacific Islands in that there is little subsistence fishing. However, recreational fishing generates a substantial volume of fish from the coastal zone and many of the management problems faced by fisheries managers in Hawaii are similar to those elsewhere in the Pacific; how to maintain sustainable yields as fishing effort increases?

The review of the Hawaiian deep-slope fishery provides an excellent example of the problems facing fisheries scientists and managers in the region, where information on catches and the biology of the target species are insufficient to use with conventional approaches employed in fisheries science. Equally, the review of the NWHI lobster fishery suggests that even when data requirements are met, external events such as environmental and oceanographic processes can confound the models used for fishery management.

Both Guam and American Samoa are the bases for large fleets of foreign fishing vessels, (mainly longliners and purse seiners) targeting tuna on the

high seas. However, the coastal fisheries in American Samoa and Guam are probably closer in character to those of other Pacific Islands, where much of the inshore fishing activity is directed towards subsistence fishing. Both territories have rapidly increasing populations, with a concomitant rise in the demand for fresh fish, and limited inshore fishery resources.

Many economically important species have disappeared from the waters around Guam through overfishing, and increasing amounts of reef fish are now imported from Palau and the Federated States of Micronesia. This and other management issues in these two territories are discussed in detail in the respective reviews.

The appearance of this special volume of *Marine Fisheries Review* is timely, given the increasing interest by fisheries scientists in the coastal fisheries of the Pacific Islands over the past ten years. Scientists in the region will now have useful summaries of information on nearshore fisheries in three socially and economically diverse regions of the Pacific.

Those scientists who are fortunate to work in an institution with a subscription to *Marine Fisheries Review* will be able to read these excellent articles when this volume arrives in their library.

Other interested persons should contact the NMFS Publications Office at the following address to obtain a copy: NMFS Scientific Publications Office, 7600 Sand Point Way N.E., BIN C15700, Seattle, WA 98115, USA.



COASTAL FISHERIES IN THE LOYALTY ISLANDS

Fifty nautical miles off the windward side of the main island of New Caledonia, rising more than 2,000 m from the ocean depths, lie the coral formations of the Loyalty Islands, which over the course of geological time were first uplifted and then tilted.

The three main islands (Mare, Lifou and Ouvea) are situated in ocean waters more than 20 n mi from each other and do not allow easy access by small-scale coastal shipping services.

Hostile coasts and natural constraints

Except for the waters of the Ouvea's vast lagoon, the coasts of these islands do not appear conducive to the sustained exploitation of ocean resources. The islands are high, often ending in cliffs from a few metres to 30 or 40 m in height, and are bordered by fringing reefs, broken here and there by small passes which open onto shallow coastal basins.

A few hundred metres from the shore, where the outer reef slope starts, depths quickly exceed 200 to 300 m, then sink to 1000 m and more. Exposure to the strong, south-easterly, prevailing winds, the lack of protection from swells and the open sea, and the scarcity of sheltered sites have restricted the interest of people on Mare and Lifou islands dwelling in their nearshore zone, at least from the point of view of fishing.

Seasonal risks associated with tropical depressions further explain the modest size of the

by Marc Daguzan
Economic Development Division
Loyalty Islands Province
(New Caledonia)

vessels present. In the event of a cyclone, protection of large vessels would become very difficult.

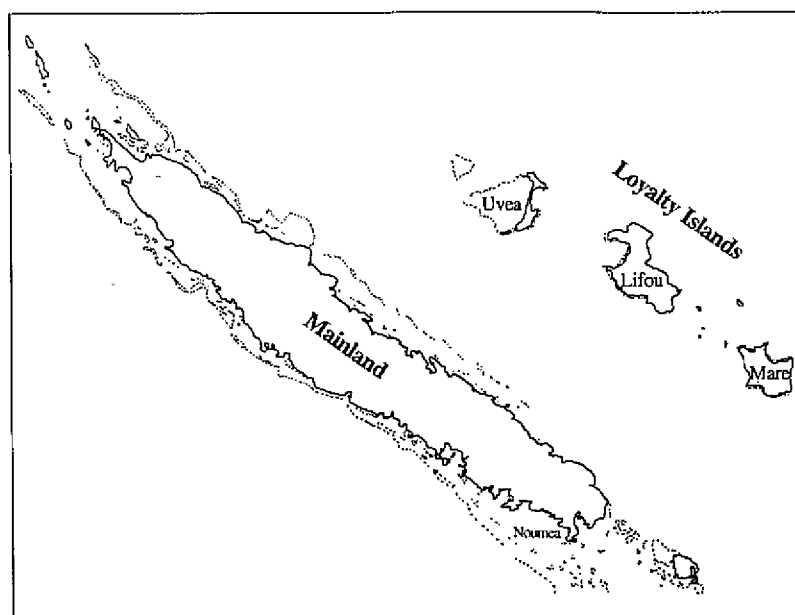
These natural constraints have contributed to the emergence of a traditional nearshore fishery which mainly exploits the resources of the lagoons and fringing reefs, by fishing on foot or from small boats (outrigger canoes, but also tree trunks and rafts) which are easily hauled up onto the shore and which only rarely sail any great distance. This kind of fishing allowed coastal populations to take advantage of nearshore resources (fish, shellfish) using only the limited technical resources of a traditional society. Under such conditions, it seems that the control of physical risk

and lack of specialisation are the Loyalty Islands' traditional society's response to the natural constraints on exploitation of their inshore resources.

Diverse but sometimes fragile resources

The abundance of the most easily accessible resources is limited by the extent of their biotope. Lagoon species (parrot fish, rabbit fish, emperors, mullet, rock cod and small near-shore pelagic species) would have difficulty sustaining an increase in their exploitation along the shorelines. Except for Ouvea, then, no significant increase in catches can be foreseen.

The resources of the outer-reef slope as well as nearshore, underwater shelves (2–10 miles offshore) are mainly a variety of snappers and jobfish, sea-breams (*Gymnocradus japonicus*), jacks, groupers (rock cod – *Epinephelus* spp.) whose often unexploited or poorly exploited stocks represent a definite potential.



Map showing the location of the Loyalty Islands

Their exploitation, which has just begun, should however be closely followed and the fishing effort monitored to ensure the continuity of this resource. In some of the most easily accessible places, an increase in fishing pressure could, in fact, quickly place them in jeopardy. For this type of activity, the relative distance of fishing zones, their depth (80 to 250 m) and the gear required (hand reels, possibly mechanised bottom long-lines) require proper fishing vessels, which only first appeared in the Loyalty Islands about 10 years ago and which are still very limited in number.

At greater depths, from 600 to 800 m, one finds the shelves and sea mounts (particularly along the Loyalties ridge). Knowledge and cartography of these regions will make great strides with the research being conducted over the whole New Caledonian economic zone (IFREMER-1/Atalante).

Any exploitation planned for the resources located at these depths will, however, require vessels and investments far beyond those of artisanal fishing. The abundance of the species identified (alfonsin in particular), should it prove sufficient, could in the long run be a prom-

ising option for fishermen in the Loyalty Islands.

Pelagic species, especially tuna but also billfish (marlins, sailfish) and mahimahi (dolphin fish) are present along the reef edges and in the deep waters off the islands. Trolling for these species is conducted by a very few artisanal fishermen at a scale which is still extremely limited.

With the recent creation of a joint industrial fishing company with the Islands Province, it could be possible to intensively fish tuna resources in the waters of the Loyalty Islands in the same way as mainland New Caledonian waters or adjacent international waters. Finally, some of the first local investments in the tourism sector target game fishing for large pelagics, a prospect which certainly should not be neglected.

Today, coastal fishing conducted in the Loyalty Islands lands about 200 t per year – far below its potential.

Ouvea: the advantages of a well-stocked lagoon

In contrast, the atoll of Ouvea appears to have been particularly well favoured by nature

from the point of view of the development of artisanal coastal fishing. The very large, 800 km² lagoon sheltered from prevailing winds, the abundance of fish resources, which a recent ORSTOM survey estimated at almost 1000 exploitable metric tonnes annually and the absence of 'la gratte' (fish poisoning) are some of its extraordinary natural advantages.

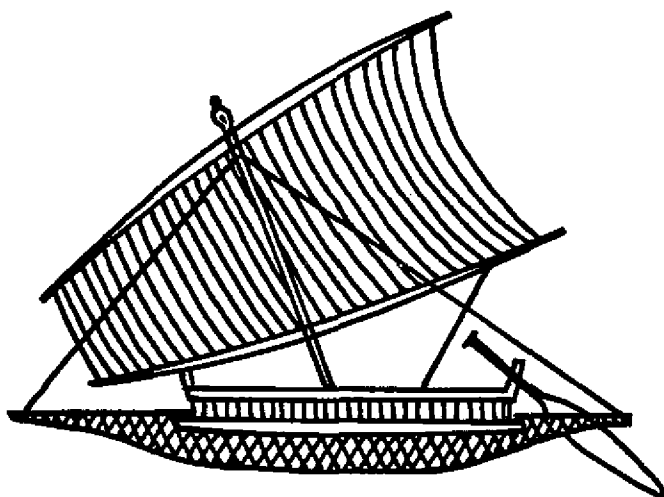
However, exploitation of this potential will require a serious effort to organise production, marketing and access to markets located outside Ouvea. Development of this fishery is thus an important objective for the Islands Province, which is devoting considerable resources to it.

Fishing's predominant role as a food source

Even today, the views of the people and fishermen of the Loyalties regarding their coastal zone and its exploitation remain very traditional. For Loyalty Islanders, the shoreline is a mythical, symbolic and social realm rather than an economic one, especially in the sense of trade or even production. This social view significantly affects not only fishery activity but also its prospects for change.

Fishing in the Loyalty Islands could be divided into the following categories:

- ☛ so-called 'customary' fishing, which continues to be more or less actively pursued;
- ☛ subsistence fishing, which has a real social and economic role and has evolved more in its technical forms than in its functions;



newly emerging artisanal fisheries;

the potential for recreational fishing.

Customary fishing

Certain clans traditionally have custody of the shoreline. On certain occasions, often linked to seasonal cycles or to important moments in the life of society, the fishing clans organise group fishing or the catching of a selected species of fish. Such fishing also helps feed those gathered for the occasion. This type of fishing, which plays a deeply social role, has only a very limited impact on nutrition. It mainly provides an opportunity for young people of the clans involved to work together.

The persistence of customary fishing attests to the social importance of group activities, in which, however, it now figures less frequently than in the past. On the other hand, access to certain coral flats, islets and coastal areas still depends heavily on the traditional organisation of the coastal zone. Any intensification of its exploitation will have to take this factor fully into account.

Subsistence fishing

Commonly practised by people living near the coasts, who fish alone or in small groups, subsistence fishing is an important source of animal protein for the coastal villages.

Fish (rabbit fish, mullet, groupers, emperors, etc.) are highly sought-after. They are eaten by the families and close friends of

the fishermen. Little fish goes to market, although fish often contribute to customary exchanges and family ties between the villages and those who have left for Noumea.

Some newly salaried Loyalty Islanders, who are employed in local services, businesses and government, fish at weekends and during their free time and so help provide food for some families.

The spread of this more recreational type of activity cannot in any way be compared with the casual fishing which occurs in the lagoon of mainland New Caledonia. It can be interpreted more as the continuation of a subsistence activity deeply rooted in local habits.

Finally, subsistence fishing can be a small-scale money-making activity. Lobster fishing, for example, by diving at night, allows occasional, quite large financial returns in line with the needs to be met. This practice is often a response to special 'orders' from family, local businessmen or restaurant owners in Noumea. Some of these subsistence fishermen, especially in the fishing clans, devote more of their time to fishing, tending towards specialisation, although it is not their sole occupation.

This type of fishing, in spite of technical developments (most often motorisation and small aluminium boats), still remains characteristic of a subsistence economy, where the notions of subsistence and occasional income prevail clearly over specialisation and the market place.

An emerging artisanal fishery

Over the past 15 years, some fishermen and groups of fishermen have acquired larger boats (5 to 10 m). Very often those boats have been purchased with the financial assistance of the various Territorial agencies successively charged with 'advancement of Melanesians' then with 'development programmes' in 'the interior and on the islands'. These different programmes tried to promote groupings of fisherfolk, with relative and generally very short-lived success.

In reality, even if fishing is a common, traditional activity in the Loyalty Islands, the profession of 'fisherman' has yet to be invented. Up to now, the subsistence sector alone has not brought about either organised production or collective or private management of fish storage and marketing.

Inventing a profession and finding a social balance

The Referendum Act of 1988*, which since 1989-90 has allowed transfer of responsibility for economic development to the Loyalty Islands Province, must also allow the achievement of better-defined fisheries development objectives.

This sector must be made a more active provider of fish, as the biological potential allows this to be envisaged and the heavy food demands clearly call for it;

This sector must be structured and organised. Fishermen need assistance through training, establish-

* Act of 9 November 1988 legislating statutory provisions in preparation for self-determination in New Caledonia in 1998 and resulting from the 'Accords de Matignon'.

ment of infrastructures, and support for investments in present and future activities with a view to growth in production.

Those are the 'classic' goals of economic development, but:

- ☛ To allow fishermen and the coastal population to define development objectives themselves; and
- ☛ To try and find a balance between economics and social organisation and habits;

are however more complex objectives which provide a difficult challenge for the Loyalty Islands Province.

To remain a promising option, the plan for professionalisation of fishermen must encompass both subsistence activities and the various social uses whose importance has been stressed.

The gradual formation of a core group of regular fishermen seems, however, to be an unavoidable initial step for this sector.

In exchange for helping supply the 'commercial' sector as it develops, part-time and subsistence fishermen will benefit from infrastructures, training, safety equipment and markets for their products. Young people in particular are likely to be attracted to this profession, at least such is the current hope.


To this end, it seems essential that channels be set up in the very near future for harvesting, marketing and routing products towards markets in New Caledonia, and Provincial services are working toward this goal.

The ferry *Président Yéiwéné*, which arrived in early 1994, is an important tool for opening markets and exchange within

the Loyalty Islands and between the islands and New Caledonia. The challenge now is to make the best possible use of this tool. The most pressing need is to set up a marketing system.

Conclusion

Can subsistence fishing and a production-oriented artisanal fishing industry coexist? Succeeding with this mutually complementary scheme is not a foregone conclusion. It will take time. It is to be hoped that the obvious potential of Loyalty Island fisheries will be better exploited.

Some people may think that it is taking a long time for appropriate exploitation systems to emerge. But this time will not have been wasted if it results in that much sought-after balance between the resources, economy and customary social life of the Loyalty Islands. 

© Copyright South Pacific Commission 1994

The South Pacific Commission authorises the reproduction of this material, whole or in part, in any form, provided appropriate acknowledgement is given.

Original text: English

South Pacific Commission, B.P. D5, 98848 Noumea Cedex, New Caledonia
Telephone: 26-20-00 - Cable: SOUTHPACOM NOUMEA - Telex: 3139NM SOPACOM - FAX: (687) 26-38-18