

FISHERIES

Newsletter

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**Ken Harada, Quality Control Officer of the
Sydney Fish Market, demonstrating the
preparation of sashimi blocks during a SPC
workshop in PNG**



South Pacific Commission
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■ RESOURCE ASSESSMENT AND MANAGEMENT SECTION

ICFMaP (Integrated Coastal Fisheries Management Project) fieldwork starts

One of the problems of fisheries development is that it can only go so far before certain hard facts of nature begin to assert themselves. Fishing, in essence, is hunting wild animals in the natural environment, but the total amount that can be caught is limited by the carrying capacity of that environment.

Unlike agricultural management, in which, the natural carrying capacity can be massively augmented through fertilizing, weeding and sowing seed, Fisheries management has only realistic way of preventing resource damage in fisheries: this is to carefully balance the activities of the fishing community against the limits of the fishery resource.

The purpose of the Coastal Fisheries Programme Resource Assessment and Management Section is to assist fisheries administrations in SPC member countries and territories to assess what these limits are, to assist in setting up systems for monitoring fishing activity, and to advise on the best means of matching that activity to the resource limits.

Relatively speaking, so little is known about what goes on under the surface of the Pacific that the task faced by the fisheries administrations of SPC member is almost impossibly demanding. Mankind has only

scratched the surface of the knowledge that would be needed to guarantee the optimum yield from all fisheries for all time.

SPC assists member countries and territories to implement systems and methods to develop this knowledge, with a particular focus on training by attachment to SPC projects.

The Resource Assessment and Management Section performs several types of activities. Chief amongst these is the implementation of the UK Integrated Coastal Fisheries Management Project (UK-ICFMaP), which will perform six in-depth field assignments through 1996 and 1997.

These will assist Pacific Island fisheries administrations to develop management plans for specific 'problem' fisheries, as case studies for extension to other national fisheries.

The six case studies are the result of a request made by SPC to members' fisheries administrations early in the year for a list of projects to be pre-planned into the ICFMaP work programme. The choice was made at a meeting of representatives member countries and territories during the Inshore Fisheries Management Workshop in July.

Planned field activities over the next two years (September 1995 – August 1997) with starting dates, are as follows:

1. Cook Islands: Aitutaki lagoon fishery management plan (last quarter 1995 – already under way);

2. Fiji: Macuata gillnet fishery or Ba river kai (freshwater clam) management plan (first quarter 1996);

3. Palau: Helen Reef live grouper export fishery management plan (second quarter 1996);

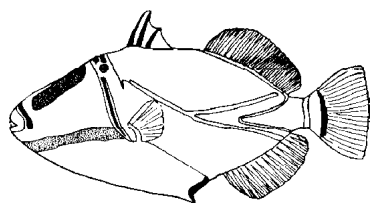
4. Tonga: Aquarium fish export management plan (third quarter 1996);

5. Papua New Guinea: Bêche-de-mer fishery management plan (fourth quarter 1996);

6. Tokelau: Fakaofu lagoon fishery assessment and management plan (first quarter 1997).

The primary output of all these sub-projects will be a fishery management plan, but most will also involve a considerable amount of supporting fieldwork and gathering of information, which will be published in technical reports. The focus will be on follow-up, particularly on the implementation and monitoring of management plans, and the projects themselves may involve more than one visit by SPC staff, as well as detailed on-going monitoring by national staff.

Another focus will be on collaboration with existing national government programmes. ICFMaP does not perform stand-alone 'consultancies', but works alongside national staff on activities they themselves need to carry out. The intention here is to build local capacity and project sustainability, as well as to maintain project relevancy.



In all cases, the national marine resource administration will have overall control of the project, with the job of ICFMaP being to provide additional expertise, motivation, and on-going advice.

ICFMaP welcomes collaboration with any other organisations and projects which may be

working in these areas. We are not in a position to provide financial support (indeed, the project funds little more than staff salaries and travel, and does not even provide financial support to national governmental fieldwork), but in many cases it will be beneficial to pool expertise. An example of this type of collaboration is planned

with the South Pacific Geosciences Commission, which may be able to help us assess the areas of coral and sand in Aitutaki lagoon from satellite imagery, in return for assistance in performing some ground-truthing of bathymetric predictions from the same imagery.



International Coral Reef Initiative Pacific Regional Workshop

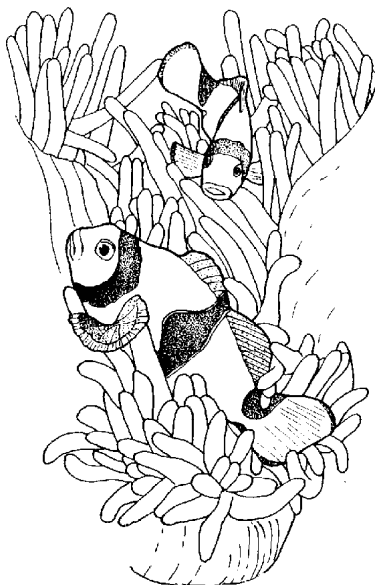
The Fisheries Resource Adviser dropped in on this SPREP-organised workshop (27 November – 2 December 1995) on the way back from the Cook Islands. The SPC Coastal Fisheries Resource Assessment and Management Section has an understandably intense interest in research on and involving coral reefs and the organisms they support, and the SPREP workshop was an opportunity to see what the International Coral Reef Initiative (ICRI) is all about.

The workshop produced a considerable number of background papers, which would be available from SPREP, and the participants were a mixture from countries and research institutions.

As with many workshops of this nature, the dialogue tended to be monopolised by the institutions, with most of the Pacific Island country representatives keeping their heads down.

As a consequence, it is likely that SPREP will have to do quite a bit of fine-tuning on the action plan produced by the workshop, particularly the research component, which more resembled a patchwork of institutional work programmes needing support, than an identification and prioritisation of actual national needs.

Teething troubles aside, ICRI is intended to provide a framework within which all institutions and departments concerned with coral reefs and their users can work collaboratively and cooperatively, as well as identifying priorities.



As such, it can be used by funding agencies as a guideline on where to concentrate resources, particularly for research, and for institutions to concentrate their activities. Hopefully, the framework it develops will be useful for years to come, and will also be responsive to changing circumstances.

As we have pointed out before, Pacific Island countries' and territories' coastal zones consist

overwhelmingly of coral reefs. The only Pacific Island SPC member that can claim to have major areas of shallow soft-bottom habitat is Papua New Guinea, which is part of the huge shelf that stretches through South-east Asia to Australia. Despite the undoubted claim of Australia to be the custodian of the largest coral reef in the world, the great majority of Pacific Island countries are so utterly dependent on coral reefs that their interests will need to be considered very carefully in ICRI. Not that it is likely, but it would be a pity, for example, if too many resources were bled off into the consideration of 'associated ecosystems' to the detriment of the primary focus on coral reefs.

On the other hand, some of the most significant problems of coral reefs are those which are also degrading associated environments: namely land-based sediment deposition and pollution. The most pressing priority for ICRI, if we are honest, has got to be social: to develop a better awareness of the downstream dangers of many short-term human development activities on coral reefs and, fundamentally, to mitigate the ever-increasing tendency of the human race to overspill its environmental safe limits in this direction.



Cook Islands ICFMaP Sub-Project

The first national sub-project of the UK-Integrated Coastal Fisheries Management Project took place this quarter, with a three-week trip to Aitutaki by the Women's Fisheries Development Officer, Patricia Tuara; Fisheries Resource Adviser, Tim Adams; Inshore Fisheries Scientist, Paul Dalzell; Post-Harvest Fisheries Adviser, Steve Roberts; and the ICFMaP Attachment Officer, Sione Vailala Matoto.

The Cook Islands has an enviable comprehensive and flexible legal framework for fisheries management, involving the designation of certain fisheries as in need of management, and providing a basis for local Island Councils to take care of their own fisheries via a Fishing Plan. Aitutaki lagoon has been declared a designated fishery, and ICFMaP is assisting the Cook Islands Ministry of Ma-



rine Resources (MMR) to develop the first Fishing Plan.

This initial trip was to draw together background information on Aitutaki lagoon fisheries, and to gather some basic information to cover the gaps. For example, there is probably more known about the trochus stock on Aitutaki than any-

where else in the world, but quantifiable information on fin-fisheries is weak.

One of the first tasks was to estimate the fishery productivity of the lagoon and roughly estimate fishing pressure, based on a combination of household survey and field experiment. Information on fishing patterns, catch rates, and catches will continue to be collected by MMR staff over the course of 1996, and will be analysed collaboratively before the final Fishing Plan is drawn up early in 1997. A written agreement between MMR and ICFMaP on project timing, collaboration and component responsibility was drawn up.

This sub-project involves a great number of different activities which will be reported more fully in the next *Fisheries Newsletter*.




Too much exposure to the tropical sun has confused Inshore Fisheries Scientist Paul Dalzell. He is unsure whether he is tagging reef fish or practising his Hawaiian guitar technique

■ WOMEN'S FISHERIES DEVELOPMENT SECTION

Women-in-fisheries training appraisals

In order to ascertain the training needs of women involved in fisheries activities in Kiribati and Tonga, the Women's Fisheries Development Project (WFDP) provided funds to support national training appraisals carried out in October and


November 1995 by former SPC Rural Development Economist, Mrs Vaine Wichman. As well as providing an overview of the involvement of women in fisheries, and the constraints that inhibit their development, the appraisals identify past and

present training, and prioritise future training programmes. Mrs Wichman worked in collaboration with Senior Fisheries Officer, Ms Tooti Tekinaiti in Kiribati and Fisheries Extension Officer, Mrs Silika Ngahe in Tonga. 

Project pamphlet

For those wishing to know more about the services provided by the Women's Fisheries Development Section, an information


pamphlet is available. The pamphlet, produced earlier in the year, has been distributed to both government and non-gov-

ernment organisations directly involved or interested in the development of women within the fisheries sector. 


Integrated Coastal Fisheries Management Project (ICFMaP)

During her visit to Aitutaki as part of the ICFMaP sub-project, Women's Fisheries Development Officer, Patricia Tuara, was able to use her background in fisheries research to participate in stock assessment field work

carried out as the basis for the fishing Plan for the Aitutaki lagoon. In addition, Patricia assisted in the co-ordination of a household survey to determine the pattern of resource use inside and outside the lagoon.

The data provided information through which the total fish catch for Aitutaki could be calculated. Data on resource users could be classified according to both age and sex. 

Training videos

While in the Cook Islands, Patricia was able to work on the production of one of the two WFDP training video which are a collaborative effort of SPC and Pasifika Communications. This video looks at the promotion of shell crafts as a potential income-generating venture for women. It features the making of shell crafts in the Cook Islands, with a focus on the equipment and techniques used to create them. The crafts range from village-level handicrafts to more 'commercial' products. The video will be ready for distribution in early 1996. 

A Cook Islands woman and her sons collect "pupu" (shells) for the making of jewellery





Two women from Ngatangiia village, Cook Islands, demonstrate the making of shell craft

■ POST-HARVEST SECTION

Seafood products and market studies

Many seafood products are processed and marketed from the Pacific without sufficient knowledge about the marketplace in which those products are finally sold.

Marketing specialists would argue that this lack of knowledge puts primary producers at a disadvantage in obtaining the best possible prices, modifying their products to more closely match consumer preferences, identifying new opportunities, being aware of and complying with changes in quality standards of the importing country, etc.

The markets for a number of Pacific Island inshore marine products are in fact changing very rapidly. Such changes can bring about new, improved commercial opportunities.

However, these have to be tempered with the need to ensure that the limited resource base is utilised in a responsible, sustainable manner.

In fact, poor resource management elsewhere is one of the main reasons that traders from outside the region are turning more and more to the Pacific for new sources of seafood and seafood products.

With funding from UNDP under the Regional Fisheries Support and National Capacity Building Project, the Post-harvest Section has instigated a series of studies that will attempt to identify the technical and market requirements for seafood products from the Pacific and make it easier to understand them.

One of the key aims of this series of studies is to help identify high-value products that can be manufactured in the Pacific from local marine resources, with emphasis on quality and high return, while at the same time keeping the industry at the low volume dictated by the requirement for sustainable utilisation of the resource.

That is, commercially viable manufacturing must go hand in hand with sustainable and responsible utilisation of the marine resource.

These studies should complement trade and market studies recently completed by other agencies on topics such as the live fish trade, trochus shell and non-canned tuna products.



Cleaning and grading of boiled reconstituted bêche-de-mer at a processing factory in Singapore.
Bêche-de-mer are boiled three or four times before they are ready for selling to restaurants.



Processed and packaged sea cucumbers (Sandfish) on sale at a supermarket in Taipei

The studies will provide information of value to the work programme of the UK-funded Integrated Coastal Fisheries Management Project (ICFMaP). The results will provide a useful contribution to ICFMaP's

development of resource management plans for six Pacific Island countries.

The first study is currently under way. Its theme is dried sea-food products that are bought

by Chinese traders of South-east Asia. These include dried sea cucumbers (beche-de-mer), sharkfins and other cured sea-food products.

A trade/marketing specialist from INFOFISH and SPC's Post-harvest Fisheries Adviser visited the main trading centres

in Hong Kong and Singapore in October and November. The study team also visited Taipei in Taiwan, and Shenzhen and

Guangzhou in China. The study report will be finalised and distributed in early 1996.



Post-harvest fisheries training videos

In 1989 the Post-harvest Section produced two videos on chilling fish and chill storage of fish. These were respectively called: 'An icy tale—chilling fish on-board' and 'A chilling story—handling fish in the processing plant'. These videos have proved to be very popular—not only as training tools in workshops for fishers and fish traders, but also as general interest videos.

Four more post-harvest fisheries training videos were produced during the year. They are available in English and French and were distributed to fisheries departments and training institutes throughout the region in December. It is hoped that these will be just as popular and useful as the fish chilling videos.

Like these, they are funded by the Canadian Government through the Canadian-South Pacific Ocean Development Project. The titles of the videos are:

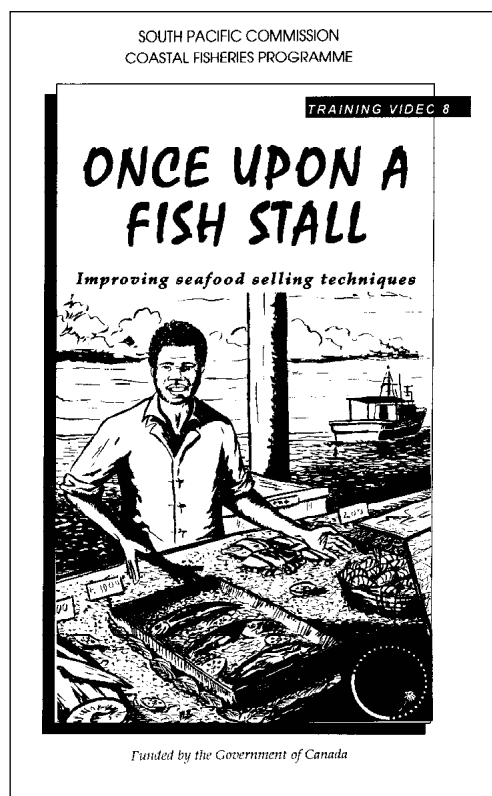
- ☞ *A visit to the fish market—better facilities for selling better seafood;*
- ☞ *Once upon a Fish stall—improved seafood selling techniques;*
- ☞ *On-board handling of sashimi-quality tuna;*
- ☞ *Air-freighting of chilled fish.*

The popular story approach of the two chilling videos has been repeated in the two retailing

videos. These are aimed at a wider audience, seafood retailers and consumers alike.

The other two videos are straight technical demonstrations on how to handle tuna on board a long-lining fishing vessel and the procedures to follow to ensure that chilled fish destined for overseas markets get there in good condition.

Copies of the videos can be obtained by writing to the Secretary-General, South Pacific Commission, B.P. D5, 98848 Noumea Cedex, New Caledonia. Please note that there is a charge of US\$ 30.00 (packing & postage included) per video.



Jerky workshop—Cook Islands

A workshop/demonstration on the processing of fish jerky (marinated dried fish) was held in Rarotonga, Cook Islands from 27 to 30 November 1995 for a number of local entrepreneurs. The request for training in this area came from a fish processor based on Palmerston Island, who has been exporting frozen parrot-fish fillets to Rarotonga for many years. In recent months he noticed that the parrot-fish catch rates were declining and concluded that this resource was currently being over-exploited. To allow this resource to recover, the catching of parrot-fish is being restricted.


However the processor is now seeking an alternative income-

earning activity that will rely on the exploitation of other marine resources. His intention is to focus on the more abundant nearshore oceanic resources and he has already started experimenting with tuna jerky as a potential replacement export product.

The workshop was organised around practical demonstrations, supplemented by lecture-type talks and videos, followed by discussions. The demonstration was fully dependent on conditions being suitable for natural sun-drying.

Unfortunately the weather could not have been worse. During the four days that were available for the workshop, the longest


daytime period without rain was about three hours. This had an adverse effect on the workshop programme.

Despite the bad weather it was possible to cover much of what was required for a worthwhile workshop. More time was spent on working on a financial evaluation of two outer islands jerky production projects. One was being proposed for Palmerston and the other for Rakahanga. SPC is providing further assistance for two entrepreneurs to be attached to a commercial operator elsewhere in the Pacific to gain more first-hand experience of a tuna jerky processing business. 

Publication: French edition of *Beche-de-mer of the tropical Pacific*

Many people have by now seen the new edition of the very popular handbook on beche-de-mer that was distributed throughout the region at the

end of 1994. It is called '*Sea cucumbers and beche-de-mer of the tropical Pacific: a handbook for fishers*'. The French version of this handbook is now available. It

was printed and distributed to the Commission's official contact points in French-speaking countries and territories during December. 

■ CAPTURE SECTION

New FAD series for Tuvalu provides training ground

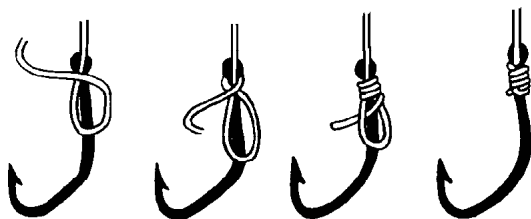
The Capture Section's Fisheries Development Officer, Satalaka Petaia, travelled to Tuvalu in October in response to a request for assistance in deploying a new series of FADs. His visit followed the earlier loan to Tuvalu Fisheries of one of the Section's deep-water echosounders and a global position-

ing system unit, to assist with the surveying of potential FAD sites.

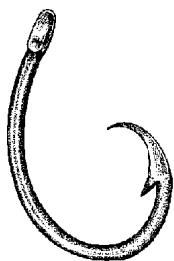
During his stay Satalaka provided a shore-side, week-long refresher course in FAD skills for the local FAD team (the senior FAD officer having previously attended one of SPC's

Sub-regional FAD Skills Workshops) and assisted Tuvalu Fisheries senior staff in formulating a sound FAD programme plan.

Then, despite engine problems and the delayed delivery of FAD materials, the training was put into practice as Satalaka and the FAD team set out from Funafuti in the 19 m Fisheries vessel *Manau* for the outer islands of Vaitupu and Nui to make bathymetric surveys of potential FAD sites.




These were completed over three days and the crew returned to Funafuti with new understanding of survey proce-



dures and practice and detailed plots of bottom depths and features in the selected areas. From these the best FAD sites can now be selected and the FAD moorings prepared accurately on shore before deployment is attempted.

With FAD materials due to arrive in the near future and their own bathymetric survey equipment on order, Tuvalu Fisher-

ies should now be able to implement their future FAD programme independently.

Follow-up training of this type, conducted in trainees' home territory and with local vessels and crews, is proving to be an effective reinforcement to the group FAD skills training conducted by the Section under the UNDP-sponsored Offshore Fisheries Development Project. 

PNG tuna fishery on the move

It has long been recognised that the waters of Papua New Guinea hold a rich tuna resource, including species of prime value in the fresh-chilled sashimi markets of Asia and elsewhere.

Following the successful emergence of domestic chilled tuna fisheries elsewhere in the Pacific, the promising results of exploratory fishing trials in PNG waters undertaken by SPC's Capture Section, and an improving legislative and investment climate, new interest has arisen recently among Papua New Guineans in taking part in this fishery themselves.



Over the past twelve months several local operators have begun longline fishing operations and have successfully exported catches. A number of

other established business interests are also considering entering this fishery, but because there is little local experience of longline fishing these potential operators face many difficulties, perhaps the most important of which is a lack of reliable information about the fishery.

In the hope of putting this right and providing potential investors with sound information about the fishery and its potential, PNG's National Fisheries Authority and Fishing Industry Association recently hosted a business seminar on tuna longline fishing (see article in the 'News from in and around the region' section p. 22).

The seminar, held in Port Moresby over three days in December, brought potential investors together with fisheries biologists and managers, vessel and gear suppliers, longline fishing operators from elsewhere in the Pacific, and local government and airline authorities.

Seminar presentations provided expert information on the local tuna resource, capture techniques and catch handling, marketing, the effect of government policy and regulation, and the economic potential of longline fishing operations in PNG.

The more than 70 participants from the local business community also had the opportunity to present their views on what was required to encourage establishment of a viable, domestic longline fishery. While endorsing recent government initiatives to promote domestic participation, participants raised a number of issues that they saw as important to further this aim, including: the need for local interests to maintain a co-ordinated front to promote the industry; better co-ordination between government departments with responsibility for overseeing various aspects of commercial fishing and exporting; tightening of government licensing policy to favour genuinely domestic operators; the need for improved airfreight services; calls for reviews of current fishing vessel manning regulations and duty levels on some fishing supplies; and the need to develop and have implemented a national tuna resource management plan.

Major sponsorship for the seminar was provided by the Sydney-based South Pacific Project Facility, while SPC and Forum Fisheries Agency staff assisted in co-ordinating the seminar and made presentations.



■ TRAINING SECTION

Update on the SPC safety-at-sea campaign

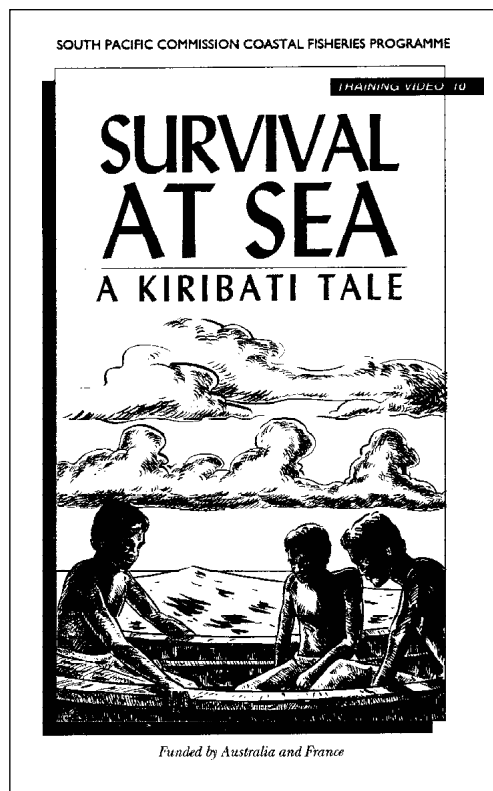
In December 1994, following requests from several member countries, the Section initiated a campaign on safety at sea for small-boat operators. The purpose of this project was to provide useful resource materials to fisheries administrations, training institutions and NGOs in order to promote better awareness of small-boat safety at sea.

The main message of the campaign is that attention to basic safety is not necessarily expensive or time-consuming and can be easily incorporated into the operation of small fishing vessels. This message obviously inspired SPC's Graphic Artist, Jipé LeBars, who was able to complete, within a few weeks, a series of resource materials including the campaign logo, two checklists and one poster.

The checklists were subsequently produced on tee-shirts, laminated cards, A4-size stickers and posters. By the end of July, samples of these articles had been sent to the Section's fisheries contacts in the region with an invitation to order more for in-country distribution. Earlier, in May, a tutor's workshop guide ('Safety-at-sea and small-boat FAD fishing') was distributed to the fisheries departments and training institutions.

The latest materials that have been dispatched consist of the English versions of two videos (*Better safe than sorry* and *Survival at sea—a Kiribati tale*) and a fourth poster, the message of which focuses on the cost of search-and-rescue operations (Who pays the price when you get lost at sea?).

To date, the Section has directly forwarded safety-at-sea articles to about 200 contacts in the region and distribution is still going on. The safety-at-sea message can now be seen in many public places in most Pacific Island countries, but can this be considered an achievement? The real success of the project will be difficult to gauge, as the overall aim is to see a reduction in incidence of small-boat accidents at sea through seafarers being better equipped to handle unforeseen or emergency situations. However, if the project message does get through to boat operators, it may be possible to document financial savings in national search-and-rescue budgets, but this will certainly require a sustained effort in reinforcing the message.



During the first quarter of 1996, the Section hopes to complete the French versions of the two videos, as well as the distribution of an audio-tape programme to be broadcast by national radio stations and used during in-country training workshops. After that, the Section will seek advice from member countries and territories (possibly through the forthcom-

ing Regional Technical Meeting on Fisheries in August) on what needs to be done next.

One possible recommendation might be that the resource kit should be produced in national languages and in-country workshop programmes be supported. In this case, the Commission would need to secure additional funding support for

the second phase of the safety at sea campaign.

Anyone interested in obtaining copies of the material produced or in assisting with in-country promotion of safety-at-sea issues should contact the Commission's Fisheries Training Section.



Flying-fish fishing trials in Futuna

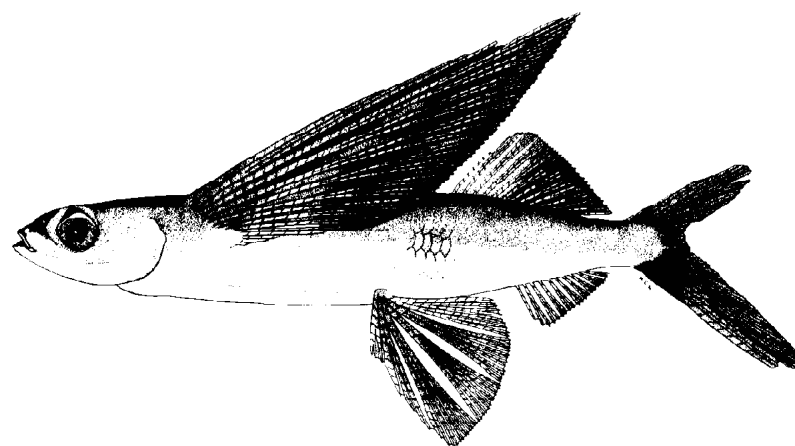
One of the Section's objectives is the implementation of training programmes in areas not covered by existing training institutions, in particular hands-on or technical disciplines.

In line with this, in November the Section carried out a one-week training programme on flying-fish fishing for the fishermen of Futuna Island (French Territory of Wallis and Futuna) and the staff of the local Fisheries Division.

This programme was a follow-up to the two-week practical fishing course that the Section ran in September 1994, during which the limited availability of bait (atule) had been identified as a major constraint to the development of commercial fishing activities in Futuna. Consequently, SPC had suggested that flying-fish fishing trials should be made to assess the potential to start a new fishery for bait and possibly for food.

The new-moon period in November being a very suitable time for flying-fish fishing in the South Pacific, fishing trials were carried out on four nights between Wednesday 22 (new moon - 1) and Monday 27 November (new moon +4).

The fishing was done by two boats each night; the fishing



effort consisted of two scoop-nets handled by SPC expert, Julian Dashwood, and a local fisherman. The boats used were different each night—4 to 5 m aluminium dinghies or 6 m sampan.

Different areas were fished, with CPUEs ranging from 4 fish per man/hour (first trip, South-East of Futuna) to 26 fish per man/hour (third trip, North-West of Futuna). Although not comparable with the catch rates obtained in western Polynesia, these figures indicate that a seasonal flying-fish fishery could be set up for the supply of bait to local fishers.

Apart from training fishers in the use of helmet/scoop-net gear, SPC staff also demonstrated the rigging of flying-fish bait for trolling and a couple of trips were made: the first fish to taste this new bait was a 32 kg

dog-tooth tuna caught on a fixed back-line with a paravane. On Monday morning, several other smaller fish were landed, including a wahoo, two trevallies and some barracudas.

One helmet and two scoop-nets were left at the Fisheries Division with the recommendation that the gear be made available to interested fishers and that catch data be collected for all trips.

At the end of the fishing season (March or April), this data will help SPC made recommendations on the possibility of establishing a flying-fish fishery. In the meantime, no doubt lots of flying-fish will have been put to good use in Futuna, either in the frying-pan . . . or on trolling hooks!



PNG workshop on the handling and grading of sashimi-grade tuna

An in-country workshop on the handling and grading of sashimi-grade tuna was co-ordinated by Section staff on 7–8 December in Port Moresby,

Papua New Guinea. Hosted by the PNG Fishing Industry Association with funding assistance from the South Pacific Project Facility (SPPF), the

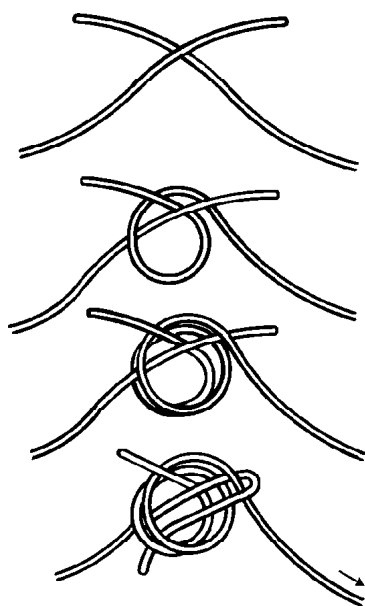
workshop followed a three-day business seminar on the development of a viable tuna long-line industry.



Ken Harada, Quality Control Officer of the Sydney Fish Market, demonstrating the preparation of sashimi blocks to the participants to the workshop



Participants to the workshop learning how to locate the position of the tuna's spinal cord



SPC was fortunate to secure the participation as a tutor of Ken Harada, the Sydney Fish Market's Quality Control Officer. Ken is already well known to the participants in the SPC regional workshop on sashimi tuna that was held in Chuuk, FSM, in August 1995. Ken's knowledge of the sashimi tuna markets and his practical experience on the assessment of tuna

quality were major assets to the workshop.

The workshop lectures comprised an introduction to the Japanese sashimi markets, tuna biology and physiology, on-board tuna handling, quality assessment, on-shore handling and packing.

Some excellent resource materials were used during the lecture including Ken's videos, slides and hand-outs, as well as the SPC videos and manual that were distributed to the 12 workshop participants. On Friday afternoon, 'hands-on' demonstrations of tuna handling and grading were carried out at the newly-built tuna packing plant of PNG Fresh Tuna, one of three domestic longline companies operating from Port Moresby.

During this session, Ken Harada simulated the on-board handling of sashimi-grade tuna, from gaffing to chilling, and compared the quality of several tunas, discussing their colour,

fat content and body shape. A tuna was dissected to show the position of the brain, spinal cord and main lateral blood vessels.

Each participant was then given the opportunity to practise these handling skills on whole tunas. The afternoon concluded with Ken's demonstration of the Japanese way of cutting a whole tuna into sashimi blocks.

Through the workshop, participants realised the importance of quality for tuna export operations to the exacting sashimi markets, and learned how to produce this quality level.

The development of domestic tuna longline operations in the region will coincide with an increasing training need in the area of tuna handling and grading. Recently, SPC received an official request for similar workshops in French Polynesia. If funding can be secured, the Fisheries Training Section will implement the training in May or June 1996. 

Seventeenth SPC Nelson Course confirmed

Funding for the 1996 SPC/Nelson Polytechnic Fisheries Officers Course was secured in December 1995 when the New Zealand Official Development Assistance (NZODA) made an additional grant of NZ\$50,000 for the course. This grant will finance the participation of two trainees from Papua New Guinea.


The 1996 course will be similar in structure to previous years' programmes, with a 19-week module in Nelson (from 12 February to 21 July) followed by a practical fishing module (from 24 June to 26 July).

The venue for the practical module is still to be decided.

The syllabus for the Nelson module has been changed to encompass the recommendations of the 1995 questionnaire survey of past participants.

One subject has been removed (Marine Engineering) and three others are reduced (Welding,

Boat Construction, Fibreglassing).

The hours gained have been re-allocated to subjects that, according to past participants, were not covered in enough detail: General Fishing Subjects, Electronics, Computers, Safety and Survival at Sea, and Business Management. 



te whare wananga o whakata

nelson polytechnic

■ CURRENT PROFESSIONAL ESTABLISHMENT— SPC FISHERIES PROGRAMMES

The regular readers of our *Newsletter* will remember that the last time we published a Fisheries Programmes staff listing was in the January – March

1995 issue. Since then, there has been a significant staff turnover and new projects and activities have been implemented. The list below show the current pro-

fessional establishment (as at 31 December 1995). We hope it will help our readers to better understand the structure of the SPC Fisheries Programmes.

Administration

Manager, Fisheries

Julian Dashwood

Coastal Fisheries Programme

Capture Section

Fisheries Development Adviser
Fisheries Development Officer
Masterfisherman

Peter Cusack
Satalaka Petaia
Steve Beverly

Post-Harvest Section

Post-Harvest Fisheries Adviser
Post-Harvest Fisheries Officer

Steve Roberts
Vacant

Women's Fisheries Development Section

Women's Fisheries Development Officer

Patricia Tuara

Training Section

Fisheries Education and Training Adviser
Fisheries Training Officer

Michel Blanc
Magnus Bergstrom

Resource Assessment and Management Section

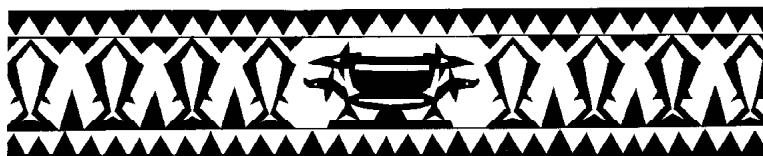
Fisheries Resource Adviser
Inshore Fisheries Scientist
Inshore Fisheries Management Associate
Inshore Fisheries Management Associate

Tim Adams
Paul Dalzell
Sione Matoto
Esaroma Ledua

Information Section

Fisheries Information Adviser
Fisheries Information Officer
Fisheries Training and Information Associate

Jean-Paul Gaudechoux
Aymeric Desurmont
Henry Yule



Oceanic Fisheries Programme

Oceanic Fisheries Coordinator
Computer Systems Supervisor

Antony Lewis
Alisdair Blake

Fisheries Statistics Section

Fisheries Statistician
Fisheries Database Supervisor
Research Officer / Analyst

Timothy Lawson
Peter Williams
Emmanuel Schneiter

Tuna and Billfish Research Section

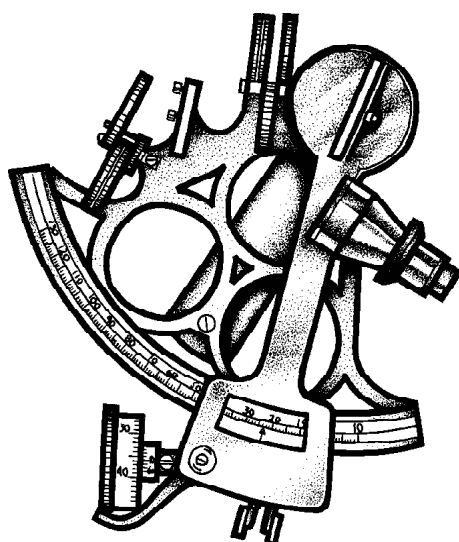
Principal Fisheries Scientist
Programmer / Research Officer

John Hampton
David Burgess

South Pacific Regional Tuna Resource Assessment and Monitoring Project (SPRTRAMP)

Port Sampling / Observer Supervisor
Scientific Observer
Scientific Observer
Scientific Observer
Scientific Observer
Senior Fisheries Scientist (Biology)
Senior Fisheries Scientist (Modeller)
Data Research Officer

Peter Sharples
Felipe Viala
Deirdre Brogan
Juan Jorge Areso
Siosifa Fukofuka
Patrick Lehodey
Michel Bertignac
Babera Kaltongga



■ OBITUARY: PROFESSOR RAYMOND BEVERTON

One of the major influences on fisheries science in this century, Ray Beverton, passed away on the 23 July 1995 at the age of 72. Anybody working in the realm of fisheries science, either in the Pacific or elsewhere, will have come across the work of R.J.H Beverton in some form or another, often co-authored with Sidney Holt.

Both were employed by the British Ministry of Agriculture and Fisheries during the 1950s and were part of a highly productive generation of young post-war fisheries scientists working at the principal fisheries laboratory at Lowestoft.

Ray Beverton and Sydney Holt will be remembered chiefly for their *magnum opus*. *On the dynamics of exploited fish populations*, originally published in 1957, but reprinted four decades later due


to the continuing relevance of much of this work to fisheries science. This work continues to be a source of reference for many fisheries scientists and is one of the foundations on which the quantitative study of fish stocks has been built.

Following his departure in 1967 from Lowestoft, where he had risen to be its Deputy Director, Ray Beverton was involved for 15 years in the administration and funding of scientific research in Britain. In the early 1980s he began an academic career with the University of Wales, where he once more became active in research and teaching of fisheries biology.

The importance of Ray Beverton's work to fisheries science is clearly outlined in a new foreword to the reprint of *On the dynamics of exploited fish*

populations by another eminent fisheries scientists of a later generation, Daniel Pauly.

Although Beverton and Holt's experiences were mostly with cool-water temperate stocks, their theories on the population dynamics of fish populations have been widely and successfully applied to tropical stocks.

Further, they dealt in a quantitative manner with topics such as the use of areas closed to fishing as a major management tool, which may be the only practicable way reef fisheries in the tropics can be successfully managed as human populations continue to grow and exert greater fishing pressure. Ray Beverton is succeeded by the legacy of his work which will continue to influence future generations of fisheries scientists. 

■ JOINT EFFORT TO SUSTAIN TROPICAL SNAPPER

Tropical deepwater snappers are commanding high prices on world markets. While these snappers can sell for an average US\$6–10/kg on eastern Australian markets, it is not uncommon for such fish to fetch US\$14–24/kg in Honolulu.

With this in mind, Australia's Northern Territory Fisheries Division, in consultation with the local fishing industry and funding support from the national Fisheries Research and Development Corporation, is developing new stock sampling techniques in an attempt to preserve the multi-million-dollar Timor Sea snapper fishery.

During the past six years the offshore trap and line fishery in the Timor Sea has grown from

a one-operator concern to a major fishery in northern Australia. The target species are the deepwater snappers, particularly goldband snapper (*Pristipomoides* spp.) red emperor (*Lutjanus sebae*), red snapper (*Lutjanus erythropterus*) and saddletail snapper (*Lutjanus malabaricus*).

Most vessels in this fishery are able to achieve significant returns on their capital investments. Although the fishing gear is relatively simple and inexpensive, new 15–20 m vessels entering this fishery are becoming more efficient by using 'state of the art' high-tech fish-finding and processing equipment.

The rapid growth of this fishery has demanded that the level of fish stocks, and the amount of fishing pressure they can withstand, must be determined.

With high capital investments being made in this fishery, industry members require assurance that the fishery will not collapse overnight.

Local fishers and researchers agreed that more specific information than monthly logbooks (submitted by fishers) and two trawl surveys of the area, is needed to successfully manage this fishery.

The industry and Government are working together to formulate and fund a pilot study. The study aims to develop a stand-

ard fishery and independent method for measuring the index of abundance for goldband snapper and other selected snappers. The findings will be used to develop regular, long-term, industry-based surveys and will supplement information already received through commercial monitoring of the fishery and logbooks.

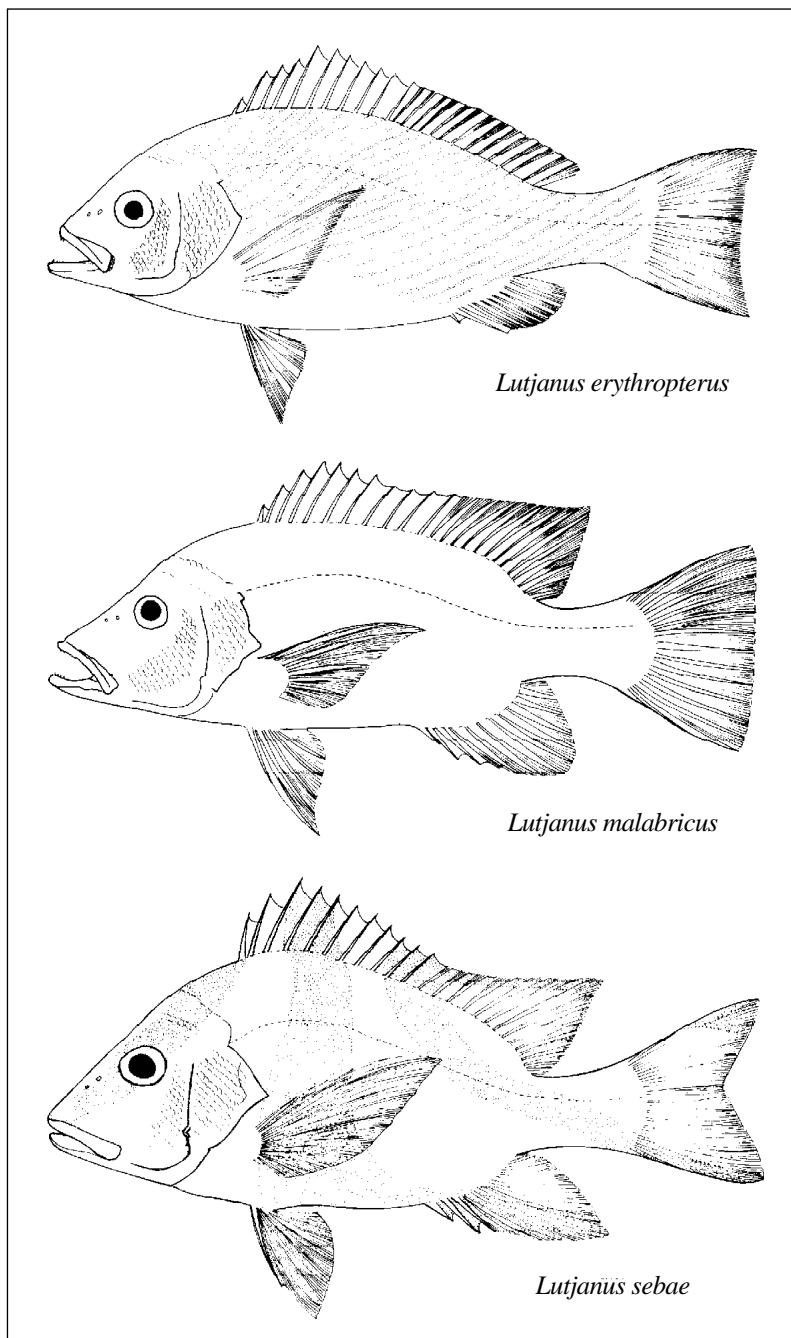
The Fisheries Research and Development Branch recently chartered the local dropline (vertical longline) fishing vessel *San Pasquale II* to undertake this work.

The study is currently under way, in an area set aside for the development of passive fishing methods (Timor Box).

The fishing techniques used in this study range from standard dropline methods currently employed by the industry, to non-selective trammel nets and traps specifically developed for capturing juvenile snapper.

This study results from close consultation between the fishing industry and the Government, and if successful could be used as a guide for other regional deepwater snapper fishery development projects.

(Source: INFOFISH International, June 1995)



■ AUSTRALIA'S PACIFIC PATROL BOAT PROJECT NEARS COMPLETION

As the A\$148 million Defence Cooperation Pacific Patrol Boat project with Pacific Island countries nears completion with the handover of the 20th Pacific Patrol Boat to Fiji on 14 October 1995, the Minister for Defence Science and Personnel, Mr Gary Punch, has assured Pacific Island countries that Australia's

Defence Cooperation commitment is on-going.

The A\$ 5.5 million RFNS *Kiro* is the last of three patrol boats for Fiji. The Patrol Boat Project was first announced at the 1983 South Pacific Forum. Recently it was extended to include the Republic of Palau, which means

that 12 Pacific countries have been involved.

The project will eventually encompass 21 vessels, and is the largest undertaken in Australia's Defence Cooperation programme. In addition almost A\$122 million has been ploughed into local manufac-

turing, training and support activities.

'The Pacific Patrol Boat project is one of this Government's first regional defence initiatives which aims to work towards continued stability in the South Pacific', the Minister said at the handover ceremony of the FRNS Kiro in Fremantle.

'The project was proving to be both enduring and effective, and it reinforced Australia's shared interest with Pacific Island countries in promoting regional security, Mr Punch said. 'In fact, it is a highly successful and practical demonstration of Australia's commitment to the South Pacific', he added.

The Pacific Patrol Boat Project has been instrumental in assisting Pacific Forum member nations to protect their sovereignty and to manage their valuable, but often vulnerable marine resources.

Our assistance in providing patrol boats is part of a wider cooperative strategy we are pursuing with Pacific Island nations to enhance maritime surveillance and sovereignty protection', Mr Punch said.

This strategy has both bilateral and multilateral facets. Australia has also maintained its focus on regional maritime information and communications systems through the Forum Fisheries Agency.

'We are also actively supporting the establishment of a Vessel Monitoring System for the Agency', Mr Punch said. The Minister pointed out that there were benefits for local economies, with the first of the vessels commissioned under the scheme now due for its half-life refit.

'And of the A\$900,000 involved in each of these refits, 85 per cent of the value of the refit goes directly back into the local economy through employment of Australian sub-contractors.'

(Source: Australia-South Pacific Newsletter)



■ CORAL REEFS AND BIODIVERSITY

WHAT DOES MANAGEMENT HAVE TO DO WITH IT?

Coral reefs carry a highly diverse and interesting fauna and flora and are the marine equivalent of the great rainforests of the tropics. They have the highest diversity per unit area of any marine ecosystem, and they may also sustain fish yields of about 15 t/km². Among their values, they provide most of the protein of many tropical coastal peoples. These great ecosystems are now under threat in many areas.

The detailed monitoring by scientists of an increasing number of coral reefs over the past two decades has alerted us to the damage and break-down of many reefs. While they stretch in a vast band around the tropics, and over at least 600,000 km² (Smith, 1978), destroyed or damaged coral reefs are nevertheless being found in every region (Ginsburg, 1994; Gomez et al., 1982; Wilkinson et al., 1994).

In the past, severely stressed coastal ecosystems have been primarily temperate, but this is no longer true. All the ills of the north that affect temperate coasts—heavy industrialisation, large coastal land developments, dredging, and pollutants (including sewage and oil)—are now affecting coastal areas of tropical nations as they add wealth and population. This is having deleterious effects on coral reefs.

Integration of shallow coastal systems

Coral reefs do not stand alone. They can have close ecological linkages to other shallow-water tropical marine systems, and also respond to changes in the seas that bathe them (Hatcher et al., 1989).

Some fish species on coral reefs range widely over seagrass flats for feeding, but shelter in neigh-

bouring reefs in their daily resting periods. Often nearby shores are mangrove-lined, preventing coastal erosion and consequent silting of adjacent reefs. Mangrove areas and estuaries are nurseries for some juveniles that are found on coral reefs as adults.

Coral reefs in turn protect shores from violent wave action. Damage to one system may affect others, and, as we learn more about tropical shallow waters, it is highly likely that we will find more rather than less biological and physical intermeshing.

Sadly mangrove systems are being rapidly lost to cutting and reclamation, and seagrass systems are being reduced by nutrient addition, other pollutants and siltation—and both these ecosystems have been seriously reduced in extent.

Little known, changeable systems

Our knowledge of reef ecology is still rudimentary; we know too little about the species present, their population sizes, or the fundamental ecological processes that shape reef communities.

A large number of reef species may be very widespread geographically, but extremely rare in any one place; they may also be subject to highly variable recruitment (Doherty, 1991) and have strongly fluctuating populations.

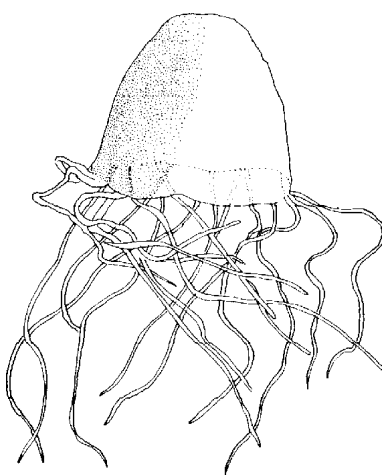
Most coral reef species also have planktonic larvae, many of which may drift for weeks before settling far (perhaps hundreds of kilometres) from the parental site. Thus a gross human-induced impact on one reef may have an effect on distant reefs. The scale of different ecological processes like these is ill-known, and is of great importance to reef conservation.

We do know that natural disturbance on coral reefs occurs frequently through such events as tropical cyclones, outbreaks of the crown-of-thorns starfish, a number of diseases, lowered salinities, or higher-than-normal temperatures.

With recovery for complex reefs taking 10–50 years (Colgan, 1987; Wells, 1988), most reefs are likely to be in some stage of recovery, particularly in areas subject to frequent cyclonic storms. It has been found that reefs under human-induced stress may not be able to recover after damage from a natural event. Reefs may also not end up as they were before—a phase shift may occur, resulting in a different state which may be stable for a time, and there is

the likelihood of differences in the ecological processes on reefs in different recovery stages or at different end states.

At present we also have very little understanding of the linkage between species diversity and ecosystem function. We do know that continuous environmental stress causes an ecosystem to lose species? but we do not know whether or when species loss may come a major change or a breakdown in ecosystem function.



Can we prevent reef degradation?

With systems so variable and ill-understood, are we able to manage them at all? The answer is a qualified 'yes'. Even with present knowledge, we can reduce adverse impact on reefs, and may actually improve some already damaged reefs. 'In many cases simple and inexpensive control measures could be implemented to reduce the rate of degradation', writes P. Hutchings, in the foreword to *Marine Pollution Bulletin's* issue on Pacific reefs (Hutchings, 1994).

We now do understand at least some of the major human impacts that are endangering reefs. Surprisingly, one serious

problem is just plain overfishing.

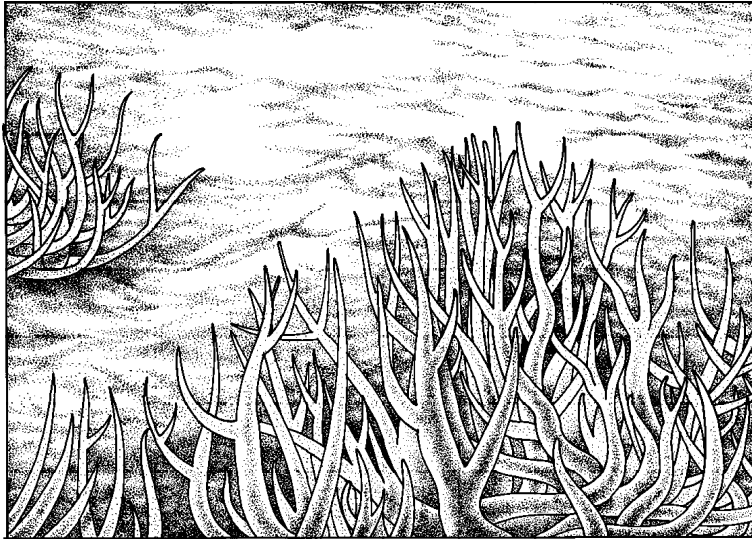
Removal of grazing fishes (often by trapping or netting) can upset the delicate balance between a healthy reef and one dominated by larger macroalgae which can overshadow corals and prevent recruitment of young corals. Siltation can kill corals or reduce their growth rate, and the addition of nutrients through land run-off or sewage pollution can also affect the coral/algal competitive balance, giving the edge to large algae.

Chronic oil spillage can also shift a benthic fauna from corals to filter feeders (sponges, tunicates) and can affect coral breeding. Over-enthusiastic and unregulated tourists can degrade reefs. There may be subtle anthropogenic changes whose effect on natural processes we will need to understand for long-term protection, but where it is possible to prevent the above basic impacts, reefs can flourish close to large populations.

The human dimension

Effective management for sustainable use and for protection of biodiversity needs much more than ecological knowledge and managerial will, however. No coral reefs can be isolated from the human communities surrounding and using them, so a local level of understanding and support is likely to be essential for the implementation of any management plans.

There have been salutary examples in the Philippines where attempts to set aside protected areas both to retain biodiversity and to enhance adjacent fisheries were successful or not de-



pendent on community attitudes (McManus; J.W., Pers.comm.; Russ, 1994). Localised efforts that are strongly supported by their communities can be remarkably successful.

In the longer term, however, integrated coastal zone management that involves linking coastal and marine systems, and which pays attention to socioeconomic factors as well as institutional and legal instruments, is clearly the right way to go (Chua & Scura, 1992).

There is still a very large lag between what marine scientists now know and are currently researching, and what information environmental and planning managers use for daily decision-making.

The results of wrong decisions have often been costly, both in environmental terms and sometimes also in expensive reconstruction or amelioration.

The scientific community is beginning to be more involved in broadening its communication and in speaking beyond its tight peer grouping, but those of us working in science must take some blame for this gap.

Biodiversity loss is as yet not great in the marine sphere. But as rich ecosystems like coral reefs are degraded, the same processes that have destroyed so many habitats and species on land are at work—the process of destruction is merely on a longer time scale (Hatcher et al., 1989).

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(Source: IMS Newsletter, International Marine Science, No.75/76, 2nd semester 1995)



■ TUNA INITIATIVE LAUDED

The Fishing Industry Seminar held in December 1995 endorsed the Government's intention to domesticate the Papua New Guinea tuna fishery, at the same time applauding recent initiatives to promote such development.

It was noted that, from both the biological and economic viewpoints, the PNG tuna resources are currently offer a great scope for development which would result in a significant contribution to the national welfare.

It was also emphasised that, in recognition of the national and regional importance of this resource, careful management must be maintained to ensure sustainability. The seminar noted that the establishment of a viable domestic tuna longline fishery is well within the capacity of local operators.

The seminar highlighted a number of issues requiring immediate attention:

- The need for the National Fisheries Authority to review all foreign longliners licences' that were recently re-flagged to PNG;
- The National Fisheries Authority to initiate a study of the economics of the tuna industry in PNG, to identify where benefits from the industry are going and how policy changes may alter this flow of benefits;
- The National Fisheries Authority, in consultation with the Fishing Industry Association, design and implement a strategic plan that uses the existing guidelines as a base document to provide for the phased domes-

tication of the tuna industry within realistic time-frames. Different licence-fee structures and inverse relationship between number of foreign, locally-based and number of domestic licences could be considered as tools that could be applied in the plan;

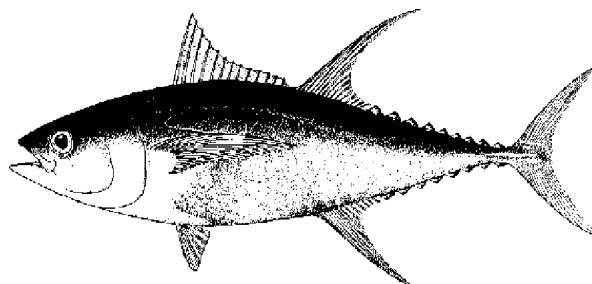
- The Fishing Industry Association to continue to make every effort to work towards overcoming important constraints still existing in the development of fishery in terms of duty on bait, export tax on tuna, duty on fuel and the lack of system for flexible depreciation;
- The National Fisheries Authority to establish consultative arrangements that would provide for regular dialogue with other departments, such as Transport and Attorney General, and statutory authorities, such as Air Niugini, on issues of mutual interest in the fishing industry;
- Members to be appointed to the Tuna Resources Management Committee, which should convene regularly; and
- Tuna Resources Management Plan to be developed and endorsed.

In the meantime, the industry should monitor the performance of exporters to ensure that consistent exports of low-quality products do not adversely affect Papua New Guinea's image as a source of prime fresh tuna. At the same time the National Fisheries Authority, working in conjunction with the industry, needs to consider ways to develop local markets for by-catch species taken in the longline fishing operation.

The National Fisheries Authority should also review government policy with respect to licensing arrangements for tuna vessels. The fishing industry should also fully support a national deckhand certification programme in line with current regional initiatives to be implemented. And the Department of Transport is to review current manning requirements for fishing vessels to reflect international practice.

The fishing industry should further bring to the attention of the Government the urgent need to plan for the development of dedicated fishing ports and an allowance of existing port space to support the fishing fleet. The seminar took note of the interest in the fishing industry in PNG and urged that mechanisms be enhanced to continue its development.

(Source: The Saturday Independent, 9 December 1995)



■ DEMAND FOR SALTWATER FISH HIGH IN THE HIGHLANDS

The people of Minj and Banz in the Western Highlands Province of Papua New Guinea will now be able to get fresh fish supplies to their towns regularly. Bobbloom Fish Suppliers, a local Morobe company based in Lae, makes regular trips four times a month to those two towns as well as Kundiawa, Goroka and Kainantu.

'People in the highlands are great consumers of fresh saltwater fish, especially in the Western Highlands and Simbu Provinces', said Marketing Manager of Bobbloom Fish Supply, Labo Kamitu, as he accepted a donation of a truck, which will be used to supply

fish to the Highlands region, from another local businessman, Robert Michael.

The donation also includes a banana boat, two coolers with a capacity of well over 4,000 litres and other administrative and field support services.

'The donation is well over K 100,000 but I believe it is for a good cause and will go a long way to help local fishermen as well as youth that are involved in it', Mr Michael said when making the donation.

Bobbloom Fish Supplies employs young men as fishermen and at the same time buys bulk

fish from small local fishermen. The fishermen sell fish either direct to the company or to the Fisheries Division in Lae where Bobbloom Fish Supplies repurchases them to supply the demand in the Highlands.

Bobbloom has recently worked closely with the Simbu Provincial Council of Women to establish a market in Kundiawa town. 'This is a good partnership because it keeps them busy and offers the Simbu women some income too', Mr Kamitu said.

(Source: The Saturday Independent, 9 December 1995)



■ WOMEN-IN-FISHERIES DEVELOPMENT PROGRAMME IN PNG

The Women-in-Fisheries Development Programme was initiated in 1989 in line with the National Policy of the Government and National Women's Policy.

The programme is implemented by the Department of Fisheries and Marine Resources (DFMR) (currently restructured as the National Fisheries Authority), and the Women's Division of the Department of Religion, Home Affairs and Youth (DRHAY), with assistance from the University of PNG, the National Council of Women (NCW) and provinces. The Programme has been supported by Government of PNG and the Canadian Government through the South Pacific Commission (SPC). The Commonwealth Fund for Technical Cooperation (CFTC) provided an expert.

The Women-in-Fisheries Development Programme objectives are listed below:

1. To improve nutritional standards of families;
2. To provide income-generating opportunities;
3. To build up skills in fish processing marketing and project management.

The women are involved in catching of fish, collection of sea cucumbers and their processing into beche-de-mer, collection of shells, sale of fresh fish, crabs, lobsters, squid, cuttlefish, mussels, traditionally smoked fish, etc. in local markets, and the inclusion of fish protein in the families' diet.

The Programme has designed an informal education package to transfer skills and knowledge on post-harvest technology of fish and shellfish, covering the following aspects:

- Basic facts about fish, nutrition, health, personal hygiene and sanitation;

- Reprocessing of fish, prawns, squid, cuttlefish, lobsters, crabs, mussels, etc.;
- Preparation of fish fillets and minced fish, packing, storing and quality control measures;
- Salting, smoking, preparation of jerky, demonstration of small-scale fish processing equipment and accessories, fabrication of low-cost smoking units by using empty oil drums or dismantling large smokers;
- Preparation of fish fingers, patties, noodles, sausages, cutlets, burgers, curry, soup, bread rolls, fried and breaded products;
- Cost-benefit analysis with special emphasis on book-keeping and management skills for the establishment of fisheries projects;

- Packing, storing, transportation and marketing of frozen and fried items to rural markets, supermarkets, fast food centres, lunch packets, etc.;
- Strengthening of domestic and export markets using women's skills;
- Guidelines on credit facilities.

The programme's activities included the following:

- A pilot project was initiated in Milne Bay Province;
- Eight hundred women sponsored by DRHAY and provincial authorities were trained directly as trainers, covering 3 regions, 15 provinces and 25 locations;
- A Provincial Steering Committee was established for follow-up training and assisting women's projects;
- A Trust Account for Women-in-Fisheries was formed in nine provinces and seed money of K 2,000 deposited;
- A tie-up arrangement was made with the Rural Development Bank for financial assistance under the mini-loan scheme;
- Fish-processing equipment and accessories were donated to 15 provinces to conduct further training at grass-roots level, utilising the skills of trainers;
- Small-scale fish-processing equipment and accessories were distributed to women at affordable cost to set up family projects;

- A two-day Project Planning, Monitoring and Evaluation Workshop was conducted to train provincial officers;
- Efforts were made to include of fisheries subjects in the curricula of Vocational Training Centres.

The programme's constraints were:

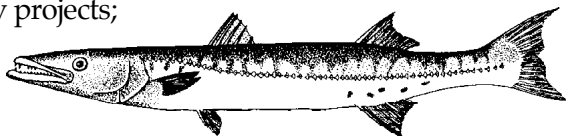
- Limited infra-structural on-shore facilities, which prevent women taking up major activities in the area of pre-processing of fish and shellfish to cater to the domestic and export markets;
- Limited access to fish markets, high cost of air transport, scattered fishing villages and land rights;
- Inadequate potable water supply, electricity and communication system;
- Religious outlook on consumption of certain types of fish and shellfish; culture and tradition;
- Inadequate extension support and access to credit;
- Inadequate marketing facilities;
- Flow of imported tinned fish and fillets to the country, inhibiting motivation in harvesting and use of fresh fish in the diet;

Future Programme

- A regional review involving the 15 provinces where transfer of technology was effected;

- Establishment of national, provincial, district and village training centres for women;
- Popularisation of diversified fish products in rural and urban markets;
- Development of cottage industries based on local fish and shellfish resources;
- Training courses on the utilisation of inland river fish and cultured fish in the Highlands region;
- Credit and other incentives for mobilising the establishment of fisheries projects;
- Integration of other areas, including making and mending of nets and fishing implements, culture of fish and prawns, hatchery management, use and culture of seaweed, ornamental fish culture and conversion of fish waste into useful by-products such as fish feed, poultry feed and industrial products for export;
- Inclusion of fisheries-related subjects in the curricula of vocational training centres and upgrading of the Fisheries Certificate Course to diploma/degree level so as to strengthen fisheries education, research and development in PNG;
- Creation of a fully-fledged 'Women-in-Fisheries Branch' in the National Fisheries Authority.

(Source: Pamphlet on Women-in-Fisheries Development Programme in PNG, prepared by Dr P.J. Cecily, Commonwealth Fund for Technical Cooperation Expert, National Fisheries Authority, Papua New Guinea)



■ SCALLOP HARVESTS BEGIN IN NEW CALEDONIA

New Caledonia's Northern Province has just exported its first shipment of scallop, (*Amusium balloti*) harvested in the Belep-Poum area. The two boats used to harvest scallops arrived in the North at the end of October 1995.

They are equipped with beam trawls and had previously spent most of their working life trawling off Gladstone, Australia. Since October, the two boats, the *Upstart Raider* and the *Mary Kain*, have carried out several night-fishing expeditions in order to test their equipment, attune locally-trained crews and provide some practical fishing experience to the two New Caledonian skippers recruited for this venture. Both skippers are graduates of the Marine Trades Training School and have followed a six-month practical training course in a Gladstone fishery.

Each is assisted by two fishing deckhands. The Australian captain who trained the two New Caledonian skippers will supervise both trawlers for a period of one year.

Fishing effort was deliberately kept low at the beginning to allow time for construction of the initial parts of the Poum processing unit. At first, this part of the work, which involves separating the animal from the shell, was carried out on the deck at Poum wharf. The two boats were used as training vessels.

After harvest, processing of the scallops begins with 'shucking'. The heart or core is separated from the shell then put into sacks weighing about 20 kg each and transported by refrigerated

truck to Navimon, a Noumea-based company.

There they are measured to eliminate small or deformed cores. The hearts are then weighed and packed in 2 kg packages to meet the international scallop standards. The first shipments will be destined for Singapore and Hongkong as well as for the local New Caledonian market, where scallops are very popular, especially during this festive season.

(Source: Les Nouvelles Calédoniennes)



Fishing under close surveillance

The average size of the shellfish harvested is 10 cm. Those kept vary from 9 to 11 cm. The other, smaller ones, which represent about 5 per cent of the harvest, are thrown back into the sea. Operations are carried out under very close control as the Northern Province, which has given financial support to the project, has decided to set up a committee of scientists, administrative and customary authorities to monitor harvests. This Committee will be in charge of monitoring the fishing effort on the stock and possible negative effects due to the trawling techniques used. The fishery's initial objective, given these precautions, is for 100 t of scallops per year. The biomass of the scallop bank in the North is estimated by scientists at between 3000 and 4500 t.

■ HARD GRAFT BRINGS RELIEF TO INJURED REEFS

Take a couple of masonry nails, a bucket of cement mix and a few carefully chosen knobs of coral . . . and you have a reef repair kit. With little more than this, marine biologists in northern Queensland have been trying to patch up dead and dying parts of the Great Barrier Reef. The success of many of their coral grafts suggests that the technique could be used for larger-scale restoration of reefs.

The Great Barrier Reef, which is made up of 2,900 individual coral reefs and 900 islands,

stretches more than 2,000 km along the north-eastern coast of Australia. The need for a tried and tested method of repairing coral is becoming urgent as more and more reefs are damaged by divers and carelessly dropped anchors.

The worst offenders are what the biologists call 'cyclone divers', inexperienced divers who try to take photographs while diving. 'They often lose their buoyancy and sink onto the coral' says Tony Roupael of James Cook University in

Townsville. He studied the behaviour of groups of divers at Agincourt Reef off Port Douglas. 'Over a month-long observation period, five dives with cameras caused 58 per cent of the damage on the reef.'

Bad weather, cyclones, oil spills and natural predators such as the crown-of-thorns starfish can all cause considerable damage. According to Ursula Kaly from James Cook University, a variety of techniques has been used to try to restore damaged reefs, but no-one has carried out a

proper study of methods or what effects they have on both donor and recipient reefs.

At Lizard Island, north of Cairns, Kaly, Geoff Jones and Rohan Pratt took fragments of living coral of five species and bonded them to rocks or patches of dead coral. Three months later, between 71 per cent and 90 per cent of the grafted corals were still alive. Underwater epoxy cement worked the best. Another technique, in which a piece of coral

is tied between two nails hammered into the reef and left to take hold, also worked in most cases, says Pratt. The early signs are that removing pieces of coral no bigger than 10 cm across does minimal damage to the donor reef.

Pratt and his colleagues will continue to follow the fortunes of the mended patches of reef, to see whether coral larvae settle normally, helping to build up the reef, and whether fish colonise the reconstructed reef

any less enthusiastically. They will also try transplants of a wider variety of corals.

The procedure is expensive, costing an estimated £ 250,000 (US\$ 380,000) to repair 1 ha of reef. But Kaly believes that the cost can be substantially reduced by repairing only a portion of reef and allowing the coral to spread naturally.

(Source: New Scientist, 2 September 1995)



■ PROTECTING LOCAL REEF ENVIRONMENTS

Reefs are probably the oldest ecosystem on the planet—up to 450 million years old. Coral organisms are responsible for creating the largest structures made by life on earth. As well as providing scuba divers with a rich world to explore, coral reefs function as a natural breakwater, protecting the land and coastal settlements from the ocean and providing natural harbours. Awareness is increasing of the potential for a huge range of medicines, of which reef animals and plants may be a source.

However, according to a report produced by Greenpeace, a shocking 75 per cent of the world's reefs are dead or dying. This tragic figure is the result of a variety of problems. These include the steady population growth and the development of a global trade in marine products.

International markets trading in marine products tend to focus on one species, which rapidly depletes the source and slowly erodes traditional fishing systems. The use of dynamite by local fishing communities is leaving large quantities of coral and marine life dead.

Other forms of resource exploitation such as large-scale logging, are also a problem. The long-term effects of logging in the form of, that is, land degradation and soil erosion, result in severe run-off and siltation. Over long periods, this can have devastating effects on the marine ecology as the top soil washes into the oceans.

One of the richest marine areas in the world is found in Papua New Guinea. This region is part of what marine biologists call the 'centre of diversity'. It is the region with the highest diversity of coral, fishes and marine invertebrates. One of the most beautiful areas of reef in Papua New Guinea is to be found at Kimbe Bay, the location of Walindi Diving Resort.

Diving here over a number of days and on a variety of different reefs, one is struck by the truly incredible beauty of this underwater world. Bright purple and yellow, royal dottyback fish swim, almost luminous, emerging from blue-tipped staghorn corals. Ragged-finned firefish drift beneath overhangs; Gorgonian fans of lacy coral stretch across the reef top; the clown triggerfish, with large

white spots on the lower part of their bodies and yellow lips, glide across the top of champagne-coloured anemones. The extravaganza goes on. Whichever of the numerous dive sites you descend into, it is always an extraordinary experience, abounding with colour and life.

The Nature Conservancy recently conducted a survey of the diversity and marine resources around Walindi Diving Resort and the Kimber Bay region and the results were remarkable.

World experts on coral and fishes were astonished at the diversity in this one small area. Over 320 species of coral were found on the reefs of Walindi—this is more than half of all the coral species in the world, just in this one bay. International experts taking part in the survey considered that the reefs were amongst the most diverse they had ever seen.

Over 700 species of fish were recorded during the survey and this number is expected to increase dramatically as more research is done. The total number of species may exceed 1,000.

Max and Cecily Benjamin, the owners of Walindi Diving Resort, are attempting to have the area registered as a marine park. This would mean no commercial fishing, no spear fishing, no shell collecting, no aquarium collecting, no dynamite fishing. Whilst creation of a marine park would not involve stopping traditional fishing rights, it would attempt to raise community awareness of the need for marine protection.

In the meantime, however, Walindi Diving Resort has been closely involved in the establishment of a nature centre which is home for the Islands Region Environmental Programme. The project is largely funded by the European Union and the land has been made available by the resort. Research facilities will be open for use by individual scientists and organisations, for research into: fish and coral identification in order to develop a more exten-

sive database; reef monitoring; environmental conservation; and marine and terrestrial biology.

The Island Region Environmental Programme will pursue efforts in eco-forestry, and eco-tourism and environmental awareness and education. The centre itself is being established with these basic philosophies in mind.

The timber being used to build the centre is all produced by the local villagers themselves as part of a training programme on community-based small-scale sawmilling. The timber has been cut with chainsaw mills under supervision and then dressed with relatively simple equipment. Sago roofing is being prepared on site and a sago treatment area has been created which will be used for the life of the building programme.

If conservation is to take place on a meaningful level, it is obviously necessary to raise the awareness of the local population as well as visitors. There will be a particular focus on developing environmentally sensitive means for generating an income to benefit the local economy.

This, it is hoped, will discourage or render unnecessary the more destructive income-generating practice of unsustainable resource exploitation, such as large-scale logging. The approach to environmental protection and conservation at Walindi is a thorough and holistic one, attempting to address the issue from a number of relevant and equally important angles.

(Source: Pacific Island Monthly, January 1996)





**DID YOU
KNOW ?**

Tagged tuna keep their place in the sun

Tuna sunbathe—at least those in the Great Australian Bight do. Southern bluefin tuna (*Thunnus macoyii*) roll over and over to soak up the sun as they skim along at or near the surface of the water, often for hours on end. The reason for this behaviour, which fishermen call 'shining', is not known. But research by marine biologists suggests the 'warm-blooded' fish expose their bodies to the sun to warm them and maximise growth.

Learning about the tuna's behaviour has become an urgent task. The fishery for southern bluefin tuna is worth about A\$ 1 billion a year, but their numbers are falling fast. According to Tom Polacheck of the fisheries division of CSIRO, Australia's national research organisation, the breeding stock of this species is at an all-time low—perhaps only 6 per cent of that in 1965.

The 'sunbathing' finding was an early result of a study to identify migration and breeding patterns. The first results of the work were presented at a

meeting of the International Council for the Exploration of the Seas, held in Newfoundland in October. Researchers from CSIRO Fisheries implanted electronic tags in 180 southern bluefin tuna in the Great Australian Bight last January. The tags, developed by CSIRO and Zelcon Technic, a small electronics company in Hobart, record measurements of temperature, depth and location for five years and store them for twenty. Archival tags, which measure about 5 by 2.5 cm, were placed in the abdominal cavities of the fish, along with a dose of antibiotic. They contain a highly accurate clock and sensors to measure depth and body temperature. Sensors to measure the water temperature and light intensity are carried on a wire protruding from the fish.

Only two fish were retrieved—one was caught by fishermen only two weeks later, the other was caught in August. The temperature of the latter was found to have increased by up to 4°C above the temperature of the water while it twisted and turned at the surface for about ten hours at a time.

'We believe the fish was doing this for metabolic gain', says John Gunn from the fisheries division of CSIRO. 'It appears that during the summer, tuna feed intensely for several days and then sunbathe for a couple of days. As growth is highest in summer, this behaviour may be part of a strategy for maximising growth'.

Both tuna had other unusual and so far unexplained behaviour. Every day for three months, they dived to depths of up to 230 m just before sunset and just after sunrise for up to 15 minutes at a time. According to Gunn, the timing could be related to feeding. When the sun is shining at an acute angle to the water, the fish and other prey are more likely to be silhouetted in the water and easier to spot. Both fish stayed near the surface during the day and often spent the night at depth.

Another 220 fish will be implanted with the device next January and a similar number in 1996. 'We expect over five years to get about five per cent of the tags back', says Gunn. 'Because we are accumulating new information, even this low rate of recovery is important. We can learn a lot from just one fish'.

Eventually, the scientists hope to understand the migration patterns of the fish, which range across the globe from about 30° to 50° South. Only one spawning location is known—south of Java—and scientists know very little about breeding patterns.

Conventional methods of monitoring the movement of tuna—catching a fish, attaching a tag, releasing the fish and capturing it again—have given no information about what it does and where it goes in between.

The next step in CSIRO's research is to avoid the need for the tags to be retrieved and returned by fishermen. Gunn hopes that within three years the data will be beamed straight to laboratories via satellite.

(Source: New Scientist, 7 January 1995)



Ocean plundered in the name of medicine

In a frantic race to find new and potentially lucrative drugs, 'bio-prospectors' working for pharmaceutical companies are taking too many organisms from the oceans without any idea of the consequences, an Australian marine biochemist claimed in November 1995.

'We cannot simply remove large volumes of an organism from the ocean—however useful—unless we know for sure that we are not wiping it out', warned Mary Garson of the University of Queensland. 'We have no idea at the moment whether many of the organisms are rare or common.'

Garson, who was speaking in Sydney at a forum for ecologists and the science media, said that ways must be found to grow marine organisms in the laboratory and by aquaculture to prevent prospectors from plundering the seas.

Drug companies are interested in toxic chemicals present in tiny quantities in some marine species. Compounds isolated from two sea squirts, a sponge, a sea moss, a mollusc and an alga are already undergoing

either clinical or pre-clinical trials in the US and Canada. Any product brought to the market can be expected to net more than US\$ 10 million a year.

But, said Garson, 98 per cent of the samples collected are discarded even before any detailed chemical and pharmacological analysis.

A bio-prospecting group from the US recently collected 450 kg of the acorn worm *Cephalodiscus gilchristi*, to isolate 1 mg of an anti-cancer compound. This is the equivalent of sifting through a large freezer full of dried rice to find two grains of salt, said Garson.

The same group collected 1,600 kg of the sea hare *Dolabella auricularia* to obtain 10 mg of a peptide called dolastatin 13, which has some activity against melanoma.

In other cases, 2,400 kg of sponges from the Indo-Pacific were needed to yield just one milligram of an anti-cancer chemical, and 847 kg of moray eel liver were used to isolate 0.35 mg of ciguatoxin for chemical study. 'Just imagine how many moray eels were collected.'

Garson criticised bio-prospectors for rarely giving any indication of the abundance of the organisms they were after, making it difficult to know what impact they were having.

They assumed that larvae drifted long distances and so removing the adults would not harm the species. But little was known about the reproductive and larval stages of many organisms, she said.

As a first step towards regulating the bio-prospecting industry, a meeting of signatories to the Convention on Biological Diversity decided last week to work with the UN Law of the Sea secretariat to sort out the laws governing the use of the biological resources on the deep seafloor, especially around hot vents where marine life is prolific.

But even if these international conventions are enforced, they will apply primarily to resources in the open sea rather than to those around individual countries.

(Source: New Scientist, 25 November 1995)



■ SCIENCE OF PACIFIC ISLAND PEOPLES: OCEAN AND COASTAL STUDIES

Science of Pacific Island Peoples: Ocean and Coastal Studies, edited by John Morisson, Paul Geraghty & Linda Crowl, is reviewed by Paul Dalzell, SPC Inshore Fisheries Scientist.

In July 1992 the Institute of Pacific Studies at the University of the South Pacific convened the first international conference on the Science of Pacific Islands Peoples. This four day meeting was inspired by the need to preserve the unique traditional base of scientific and technical knowledge accumulated by the peoples of the region, and now in danger of being lost as island people move increasingly from a traditional rural existence to urban lifestyles.

The output of the meeting was four volumes of papers that were tabled for discussion during the conference. These are as follows:

- Volume 1, Ocean and Coastal Studies;
- Volume 2, Land Use and Agriculture;
- Volume 3, Food and Medicine and
- Volume 4, Education Language, Patterns and Policy.

The volume on Ocean and Coastal Studies contains 11 papers by authors from a range of professions, who have covered a diverse range of subjects associated with the marine environment.

Over the past 10–15 years there has been a growth in interest in the coastal fisheries in the South Pacific by fisheries and marine biologists, and fisheries administrators. Until then, most countries with fisheries departments were mostly pre-occupied with oceanic tunas and the revenues

that these stocks would generate through licensing foreign fishing fleets and the development of domestic fisheries.

Literature on the subject of coastal fisheries has generally been the preserve of disciplines such as anthropology and the social sciences.

However, the increasing population growth in many Pacific Islands and the signs that coastal stocks can be seriously depleted have led to a re-appraisal of the importance of studies on coastal fisheries. This is also true for the broader issue of activities in the coastal zone and the issues of planning and development, which are also discussed by a number of authors in this volume.

Fishing tends to be the dominant theme of most of the articles and descriptions of traditional coastal fisheries practices in Vanuatu, Yap, Kiribati and the Solomon Islands are included in this volume.

In each of these papers descriptions are given of fishing techniques employed for catching fish and other organisms, the species captured, customary marine tenure systems and traditional ecological knowledge related to fishing.

Bob Johannes expands on the theme of traditional ecological knowledge by discussing the accumulated corporate experiences of fishermen in the Pacific and the value of this information to fisheries scientists and marine ecologists. As an example of the usefulness of this in-

formation, Johannes notes that by the 1970s, about 20 animals world-wide had been shown by marine biologists to have lunar spawning cycles.

However, Palauan fishermen had through centuries of accumulated experience noted the regular lunar spawning periodicity for over 50 species of reef fish.

On other related topics, Paul Geraghty presents an interesting paper that investigates the links between different islands in the Pacific through nautical terminology employed in Kiribati and in the Polynesian Islands to the east. In the introductory passages in the paper, Geraghty illustrates the use of language in reconstructing Pacific prehistory, which is particularly important in cultures where history is an oral rather than a written tradition.

Continuing on a nautical theme, David Turnbull discusses Pacific navigational systems, which, rather than being based on mathematical concepts (as is the case with contemporary navigation systems), integrate experience with respect to physical characteristics of the immediate environment (currents, wave action, wind direction, cloud patterns) with knowledge of the movement of stars.

Turnbull notes that simple comparisons between contemporary western systems of navigation and those of the Pacific Islands are superfluous, and that one should recognise that there are workable alternatives to the conventional approach to

technical problems such as navigation. Further, these traditional systems are in danger of being eliminated by modern technology in the guise of progress.

Bob Johannes has also elaborated on this theme here and

elsewhere with respect to traditional knowledge and conservation in the Pacific.

Given that this book deals with contemporary issues familiar to most Pacific Islanders and that it is cheap, costing only six Fijian dollars, it is a worthwhile

acquisition for any fisheries department library. It can be obtained from the Institute of Pacific Studies of the University of the South Pacific in Suva.



■ ON THE SEX OF FISH AND THE GENDER OF SCIENTISTS

On the sex of fish and the gender of scientists, by Daniel Pauly, is reviewed by Paul Dalzell, SPC Inshore Fisheries Scientist.

Since 1990, Chapman & Hall have been publishing a series of volumes on fisheries biology. It includes original works and new editions and reprints of previously published texts.

The objectives of the series are to present authoritative and timely reviews which focus on important aspects of the biology, ecology, taxonomy, behaviour and management of fish and fisheries. The latest volume in the series, by Daniel Pauly, is something of a departure from the general character of the series, being a collection of essays on the nature of fisheries science and on the process of science as a whole.

These 27 essays cover topics as diverse as fisheries management in South-east Asia, growth performance of fishes, myths and resource conservation, the influence of gender on the conclusions reached by scientists, and cost versus performance of diving regulators. This last essay is itself an illustration of how to get the most out of a data set, in terms of both illustration and conclusions.

The general theme, however, is primarily to explore how science works and to suggest ways in which the work of fisheries scientists can be more effective.

Fisheries scientists in the Pacific Islands region are likely to be familiar with the work of Daniel Pauly, particularly since the advent during the 1980s of the ELEFAN suite of computer programs for analysing length-frequency data, and also the empirical estimation of natural mortality rates for fish stocks from growth and temperature data.

These, however, are only two examples of the work of a fisheries scientist who has generated a large body of literature concerned principally with tropical fisheries science, and who has also taken a deep interest in the nature and processes of science.

The foreword by Ray Hillborn, another notable and prolific fisheries scientist, remarks that Daniel Pauly has become the most widely-cited fisheries scientist of his generation.

Hillborn's favourite essay in the collection is 'Fisheries scientists must write', which outlines why documenting fisheries (and other scientific) research is essential and not simply an academic exercise designed to pad out a CV. This essay alone should be required reading in the South Pacific Islands, where the bulk of fisheries research is poorly documented and much

important information is either unavailable or, more worryingly, is lost.

Other essays important to scientists in this region include 'On Malthusian overfishing' and 'On using other people's data'. The first of these describes how severe the overfishing problem can be where there is severe poverty and unchecked population growth, as in the Philippines, where traditional gears have overfished the resource and fishermen must now rely increasingly on illegal methods such as dynamite and poisons to obtain a decent catch. The second echoes the essay on the need for scientists to write and to document their data so that these can be available for use by colleagues and other fisheries scientists.

The 'down-side' of this highly informative and entertaining book is the price, £44 (US\$68) for the book and airmail postage to the Pacific from England (it may possibly be less expensive from the United States). Given the limited budgets of many fisheries departments in the South Pacific, this book may be something of luxury. However, it contains many valuable lessons, so I certainly recommend it as an addition to any fisheries department library.



THE FISHERIES AND MARINE RESOURCES SECTOR OF PAPUA NEW GUINEA

Overview of the fisheries and marine resources sector

Papua New Guinea has a coastline approximately 17,000 km long. Deltaic flood plains and barrier lagoon complexes extend for 4,250 km, whereas the islands and atolls account for 4,180 km. The total shelf area, to a depth of 200 m, is approximately 7.4 million hectares.

Currently, it is estimated there are 1,762 verified fish species in Papua New Guinean waters and 80 more that are noted but have not been verified. The majority of these species are marine.

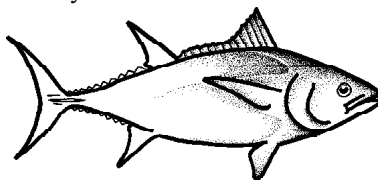
Sedentary marine resources are an important part of the subsistence and artisanal fisheries of Papua New Guinea. Some of these species, such as beche-de-mer, trochus and oysters, are increasingly being exploited for commercial purposes.

The pelagic fisheries in Papua New Guinea waters are relatively diverse and productive. A number of shrimp and lobster species are also important elements of the artisanal and commercial fisheries. Due to the small coastal population and the low level of industrialisation in the coastal zone, marine pollution problems in Papua New Guinea are not a real concern at this time.

by **Tatek Buraik**¹,
NFA, Papua New Guinea
and
Henry Bomai Yule²,
SPC, New Caledonia

The coastal and offshore waters of Papua New Guinea contain a large variety of fishery resources. These resources support a number of fishing activities, including a large-scale distant-water tuna fishery and smaller domestic operations for prawn, barramundi, lobsters, pelagics and sedentary resources. Inland waters are generally much less productive and support relatively small fisheries, primarily for tilapia, carp and freshwater prawns.

There is no domestic tuna fishery in Papua New Guinea at present but investment proposals are with the Government for consideration. Most of the tuna caught in Papua New Guinea is taken by distant-water fleets from the United States of America, South Korea, Taiwan and the Philippines, using purse-seine boats. The South Pacific Commission estimates that approximately 300,000 t of tuna is caught in PNG waters each year.



Fisheries administration and functions

The creation of the Department of Fisheries and Marine Resources (DFMR) [now National Fisheries Authority (NFA)] and the National Forest Authority out of the former Department of Primary Industry was in line with the Government policy to promote economic development, in particular the renewable resource sector.

This could not be achieved under the former Department of Primary Industry, as it was difficult for fisheries and forestry to be given priority in terms of policy development and implementation, as well as the allocation of funding for programmes, due to the size of the agriculture sector. Their creation was a move by the Government to give more recognition and priority to the renewable resource sector.

The Gazetted Notice of 31 December 1986 which formally established the Department of Fisheries and Marine Resources listed a range of functions for the Department, covering legislation, development, research, resource management and liaison requirements.

There are provincial fisheries divisions within the provincial governments and their programmes are concurrent with these of DFMR.

DFMR interacts with the provinces only in policy and programme implementation. While there is a need for policies and programme implementation to be compatible,

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prioritisation and allocation of annual budgets lies within the responsibility of provincial governments.

DFMR has assisted by establishing Research, Coastal Management and Surveillance Stations to enhance relevant activities at the provincial level. The only formal link with provinces is through the annual meeting of the National Fisheries Council. Various types of assistance have been requested of DFMR through the Council, but a formal request needs to be made by the Provincial Government concerned before DFMR can provide assistance.

The Department of Fisheries and Marine Resources is currently made up of three Divisions and nine Branches. It is headed by a Secretary who is appointed by the National Executive Council (NEC). Responsible to him is a Deputy Secretary who is appointed through the normal Public Service selection process, and who is directly responsible for the general administration of the Division and Branches.

Medium term objective

In the medium term, beyond 1996 the fisheries sector will aim at optimising the economic development of Papua New Guinea through the exploitation of its fisheries resources; strengthening the administration of the sector; and ensuring that fisheries management is carried out in accordance with the principles of sustainable development.

The strategies and programmes of the Department are based on development priorities and recommendations identified by past studies on the fisheries sector; the major policy, legal and

administrative reforms adopted as a result of the creation of the National Fisheries Authority and its approved functions; production of a set of revised policy statements; the approval of the Fisheries Act 1994 and the Fisheries Regulations 1995; and new policies for domesticating the tuna industry in PNG.

The key programmes which to be undertaken include developing a local tuna industry; enabling artisanal fisheries development (especially small enterprise development; augmenting the production capacity of inland river systems through stocking; maximising the rent from the distant-water tuna fisheries; and strengthening the institutional capacity of the Department of Fisheries and Marine Resources to make it more client-supportive.

Programmes and implementation

1. Major policy initiatives and institutional capacity building

The Department of Fisheries and Marine Resources has undertaken major, legal, and administrative reforms to establish future directions for the fisheries sector. The policy initiatives include the production of a new set of Fisheries Policies for the fisheries sector, the revision of the Fisheries Act and Fisheries Regulations and approval by Government to establish the National Fisheries Authority.

1.1 Establishment of National Fisheries Authority

In November 1993, the Government approved the establishment of the National Fisheries Authority, which will take over the existing functions of the

Department of Fisheries and Marine Resources. The decision to establish the National Fisheries Authority was a political one, taken in line with the Government's privatisation policy and the present trend in other renewable resources sectors.

The Fisheries Act 1994 formally establishes the National Fisheries Authority, defines its objectives and functions, and also specifies a set of fisheries management principles which the Minister and the Authority are required to take into account. It also deals with other basic legal matters, as well as detailing the nature of the relationships between the Authority, the Minister and NEC.

The Authority will be a non-commercial statutory organisation and will still be subject to normal Government regulation and supervision. Its existence should enhance consultation, co-operation and responsibility-sharing between national- and local-level government and between government, industry, resource-owners and special interest groups.

The establishment of the Fisheries Authority will concerns about the effectiveness of DFMR and the need to make the body more efficient, accountable and directly responsive to the needs of the provinces and the fishing industry.



The Authority will maximise Papua New Guinean participation in the fishing industry by facilitating commercial investment by national companies and citizens and promoting the wise use and development of fisheries resources as a renewable assets.

1.2 Administrative functions of the National Fisheries Authority (NFA)

The Authority, the Authority will give advice to the Minister on policy, licences and other matters relating to fishing. The Authority is also required to give effect to any policy directive by the Minister and NEC on the development, management and use of Fisheries and marine resources.

The Authority will oversee the administration and enforcement of the Fisheries Act and any other legislation pertaining to fisheries matters, and of any fisheries policy approved by NEC. These duties were previously carried out by the Department of Fisheries and Marine Resources.

The Authority is responsible for drawing up relevant policy documents, such as fishery plans, for specific fisheries, and fisheries policy and strategy for the long-term development of the fisheries sector. These fisheries development plans are submitted to the Minister for approval.

Based on these, the Minister, in consultation with the Authority, then draws up Licensing Guidelines for endorsement by the NEC. The Licensing Guidelines comprise the primary statement of government policy regarding the licensing of fishing and related activities under the Act.

1.3 Fisheries policies and plans

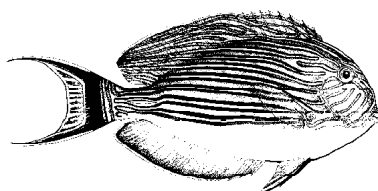
The new fisheries policy includes new Government initiatives on industrial fisheries domestication, as well as new regional initiatives to better manage and develop the fisheries resources.

The major emphasis of the policy is an industrial and commercial fisheries development, with the view that industrial and commercial fisheries provide the infrastructure for small- and medium-scale fisheries development.

The policy also reflects the concept of sustainability and resource management as the key element for exploitation of fisheries resources. During the preparation of the policy, extensive discussions were held at the National Fisheries Council level and with the private sector and NGOs.

The Department is currently preparing a Five-Year Corporate Plan which will set the basis for priority programmes for implementation. In addition, an annual programme document, which will provide annual work programme and budgetary allocations, will be produced annually.

Fishery resource plans for the harvesting of specific fisheries will also be prepared to ensure that there is long-term sustainability of the resources. All this will be undertaken in the medium term to assist in effectively monitoring the progress of the programmes undertaken by the Department.



1.4 Fisheries Act and Fisheries Regulation

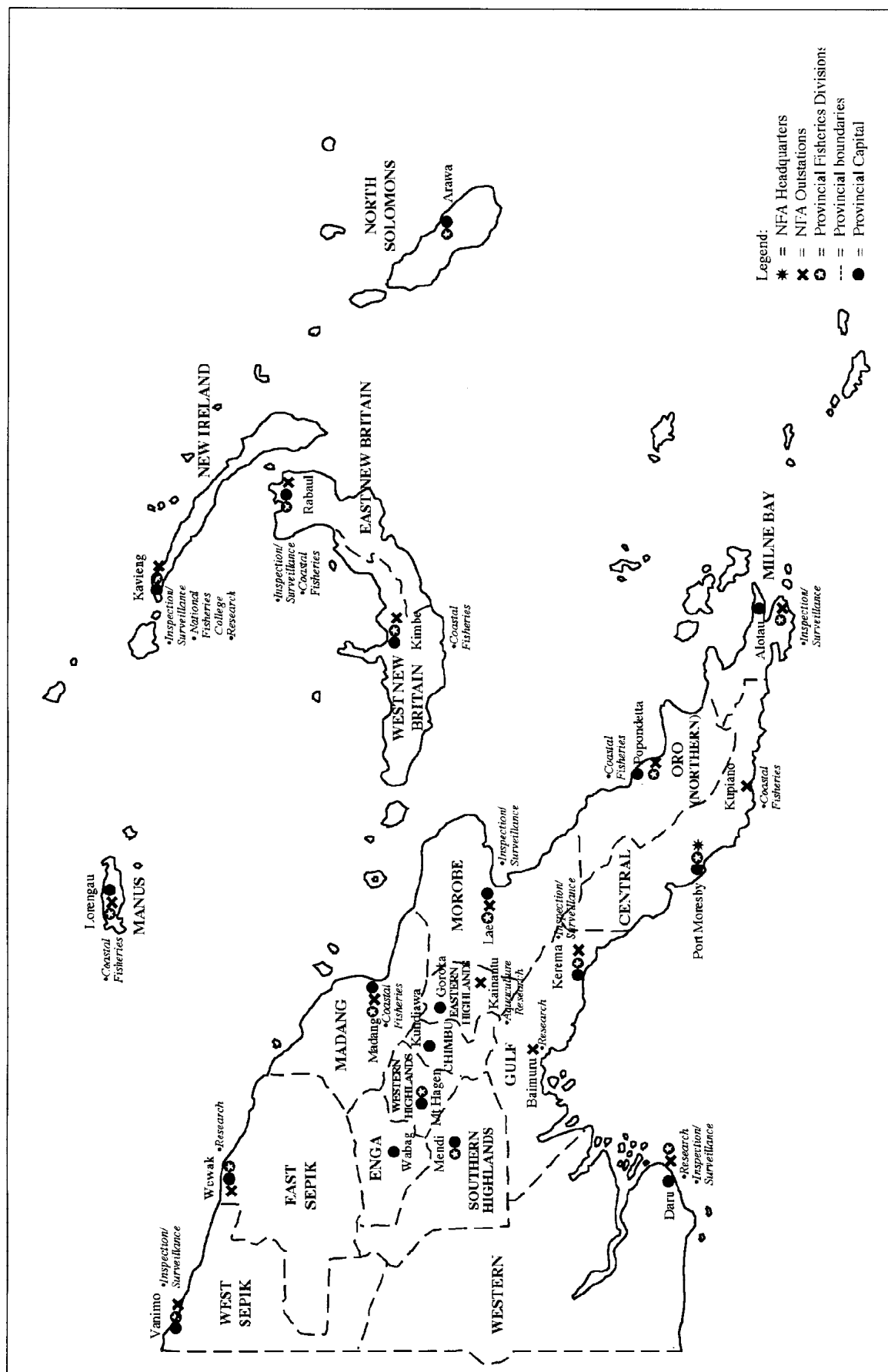
The 1994 Fisheries Act takes into account new developments in the management of modern-day fishing activities; new technology; economics and marketing trends; and a whole wave of new international and regional conventions. The Act establishes the administrative structure for the Authority and deals with the important aspects of regulating fishing activities, mainly commercial fishing activities in Papua New Guinea.

The Fisheries Regulations which provides the details of a comprehensive licensing management system, also specifies new increases in licence fees for various types of fishing, as well as penalties under the Act. Manuals of surveillance and inspection procedures are being drawn up to assist officers in monitoring and enforcing the provisions of the Fisheries Act and Regulations

1.5 ADB Technical Assistance Support

A major institutional strengthening exercise has recently been completed by the Asian Development Bank (ADB) through a Technical Assistance (TA) grant. The major thrust of this TA has been in the area of counterpart training in project identification and preparation.

The outcome of this study is a number of investment projects prepared to appraisal stage pending formalisation for submission to ADB as components of the project loan. A project preparation TA (PPTA) is now being prepared. In achieving its broad objective, the scope of the PPTA encompasses activities very much consistent with institutional strengthening, with



Map of Papua New Guinea showing locations of the different administrations related to fisheries

emphasis on developing processes relevant to achieving the goals of NFA.

2. Fisheries research and resource management

In line with the Government policy to promote sustainable development in the fisheries sector, the Department will ensure that fisheries resources are exploited within the limits of sustainable yields so that they can provide a long-term source of edible protein for local consumption; income and employment opportunities for Papua New Guineans, and much-needed foreign exchange for the Government.

The Department will devise management regimes through scientific research in the areas of biology and ecology, stock assessment, fisheries management plans, fisheries interactions and the impact of fishing activities on the environment.

3. Coastal fisheries programme

The Coastal Fisheries Programme is aimed at providing support to small-scale fisheries projects and fishermen in order to encourage increased participation in the exploitation, utilisation and distribution of fish and fish products which will contribute to income generation and create employment at the village level.

In 1993, 1994 and 1995, the programme included a privatisation programme for existing coastal fisheries stations, post-harvest and women-in-fisheries activities, small-scale credit facilities, and an extension and gear development programme.

4. Training and staff development

This programme is on-going and is aimed at developing the skills and knowledge of staff so that they provide effective professional services to the Department. The programme consists of overseas training, in-country training, attachments and development of a three-year training plan.

During the period, nine officers are undertaking long academic (post-graduate) courses, mainly in Australia and funded by AusAid. There have been few in-country courses, as priority for funding was given to the long-term overseas courses.

A number of attachments have been undertaken which provided practical training to staff. They were funded by the South Pacific Commission, the Forum Fisheries Agency, the Japan International Cooperation Agency and the Food and Agricultural Organization.

5. Fisheries surveillance

The statutory requirement to provide the necessary control, management and conservation of PNG's fisheries resources requirement has been strengthened through the new legislation, which provides the legal instruments for better management and control of commercial fishing practices and related activities, and for the protection of the country's national fisheries resources.

The Government is currently investigating the establishment of an integrated surveillance system which will be cost-effective and sustainable in the long term. This approach was recommended by a feasibility study conducted in 1994.

6. National Fisheries College

The Department's only Fisheries College, which provides education and training in fisheries technology at Certificate level, has been in existence for 18 years. Until recently there had been no major development or upgrading of its training facilities and curriculum.

However, work was done recently on upgrading the student accommodations, training facilities, staff housing and the main administration office. These developments cost the Government nearly K1 million.

In addition a complete review was undertaken of the College syllabus in line with concerns identified by past sector studies, such as the FAO Sector Review and the ADB Technical Assistant Support, including concern over the fact that private sector training requirements were not being met.

The new syllabus was produced with technical assistance from JICA. As a result of the new syllabus additional training aids and facilities were established, including a new training vessel and new training classrooms. Additional academic staff were recruited.

In line with the Office of Higher Education National Training Plan, the National Fisheries College was among a number of colleges to be administered by a Governing Council which comprised representatives from relevant Government Departments and the Private Sector. The Governing Council is responsible for major policy decisions on the administration of the College.

7. *Tuna fishery*

Tuna is the single most valuable fishery resource in Papua New Guinea. The major activities in tuna fishing are still carried out by distant-water fishing nations through fishing access arrangements. Fishing access agreements are in place with fishing companies from Taiwan and the Philippines. Fishing access for South Korean fishing fleets was ended in June 1995.

Access agreements with DWFNs will continue to be granted until PNG is able to fully domesticate its tuna fishing industry. The Government has now established shore-based industrial fisheries facilities. This had led to the construction of a fish cannery in Madang by ZZZ Fishing Company. In addition, a Taiwanese company (New Guinea Fisheries) has established its base in Port Moresby, with a fleet of two purse-seine vessels.

Considerable potential also exists to develop the sashimi tuna industry, employing long-line fishing methods and targeting the high-value yellowfin tuna. Due to the level of investment in this fishery, the Government has restricted tuna longlining exclusively to national investors. Already two such operations are fully owned by Papua New Guineans; they are based in Rabaul and Port Moresby.

8. *Liaison with the private sector*

Current emphasis by the Government on the private sector has resulted in favourable policies being developed to provide incentives this sector. The Department and the Private Sector, Fisheries Industry Association (FIA) have been co-operating in reviewing existing disin-

centives which have been affecting the fishing industry in PNG. There has been some progress in the relationship between FIA and the Department in the last few years. As a result, there has been increased participation by the FIA in the development of existing fisheries policies and programmes.

The FIA has also participated in a number of influential committees, such as the National Fisheries Board, the Governing Council of the National Fisheries College, and the National Fisheries Council, and has been involved in the proposed establishment of a National Training Council to cater for private sector interest under the new fisheries legislation.

9. *Regional and international liaison*

Papua New Guinea is a member of regional organisations. In particular, liaison has been maintained with the Forum Fisheries Agency (FFA) and the South Pacific Commission (SPC) in promoting regional cooperation in fisheries, particularly those concerned with tuna and international high seas fisheries.

The main focus of fisheries work with the SPC has been in the area of scientific research under the Tuna and Billfish Assessment Programme (now the Oceanic Fisheries Programme), with access to the central database and logsheet records on tuna vessels licensed in the region. Other technical assistance and funding have also been received.

Major responsibilities undertaken in consultation with the FFA include, the administration of the Multilateral Treaty with the United States, the operation

of the Regional Register of fishing vessels and the coordination of the regional Surveillance Programme and the Niue Treaty on Regional Surveillance.

A sub-group of Forum Fisheries Committee (FFC) is formed by the Parties to the Nauru Agreement (PNA), which co-operate in an agreed set of harmonised Minimum Terms and conditions (MTC) for access to the Western Pacific tuna fishery. They also co-operate in management of the Western Pacific purse-seine fishery through the Palau Arrangement, which places a ceiling on the number of purse-seine vessels in the region. Other technical assistance and funding.

Papua New Guinea has actively participated in the above regional organisations in a number of areas. Through SPC Papua New Guinea received assistance for the Women-in-Fisheries Programme, with research information on tuna and billfish, and provision of the masterfisherman to assist with FAD construction and the East New Britain tuna longline project, and help from PIMRIS (Pacific Islands Marine Resource Information System) with the library and information technology systems.

Through the FFA regional arrangements, PNG has been assisted in the areas of co-ordinating regional surveillance flights, technical advice on tuna industry domestication policy, improved institutional capability in the exchange of information technology, prosecution procedures and co-ordination of matters relating to high seas fisheries enforcement and management.

Most recently PNG hosted the 14th PNA and FFC 26th Meet-

ing in Port Moresby which provided the opportunity for annual discussions on programme implementation by FFA.


In the international arena, major fisheries initiatives have been undertaken in consultation with the Food and Agriculture Organization (FAO), the Asian Development Bank (ADB), Japanese International Co-operation Agency (JICA), United States Aid Agency (USAID) and the International Centre for Ocean Development (ICOD).

Under the FAO co-operation was developed through Con-

ferences on Straddling Fish Stocks and Highly Migratory Fish Stocks, negotiations on the FAO Code of Conduct for Responsible Fishing, and the United Nations Law of the Sea Convention which came into force in November 1994.

The ADB is currently assisting the Department to improve its institutional capabilities in the area of project identification, preparation and documentation. In light of the new policy initiatives, the ADB will recommend medium- to long-term institutional support to ensure that the Department is strengthened to adequately fulfil its functions and requirements.

During the period JICA assisted PNG in ongoing training in fisheries. It also provided technical assistance in support of the review of the National Fisheries College syllabus and funding for the Inland Fisheries Research Programme at Aiyura, Eastern Highlands Province.

The USAID assisted PNG in the review of the fisheries sector as well as assistance and gave assistance for the private sector (FIA), while the ICOD assisted by funding of the Women-In-Fisheries Programme in consultation with SPC. 



Women processing prawn in Port Moresby, Papua New Guinea

DEVELOPMENT OF A SMALL GILLNET FISHERY FOR ROUNDSCADS IN PAPUA NEW GUINEA

Introduction

Little is known about most subsistence coastal fisheries in Papua New Guinea despite their importance as a source of animal protein for much of the population that lives near the sea. This article describes a small-scale gillnet fishery for roundscads on Bali or Unea Island, one of the Vitu Islands which lie to the north of West New Britain Province (Figure 1). Besides its importance as a subsistence food source, the roundscad fishery may also be a source of bait for longline tuna fishing which is being developed in neighbouring East New Britain.

Bali is the second largest island of the Vitu Group, with a population of about 3,400 people. Virtually all men, women and children around the coast are actively involved in fishing activities. The roundscad fishery is known locally as the 'tin-pis' fishery due to the fish's similarity in size and appearance to the canned mackerel that are a staple protein for many Pacific Islanders.

What makes this fishery interesting is that until recently roundscads were not a traditional target species for subsistence fishers on Bali. The fishery developed following observations by fishermen on the schooling behaviour of roundscads above the barrier reefs around the island, and without reference to similar fisheries elsewhere or the assistance of government fisheries extension officers.

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During this survey the main objectives were to identify the species of roundscad caught in the fishery, describe the fishing operations, record local knowledge and observations about the fishery and the target species, and comment on the potential for further development of roundscad fishing at Bali Island.

Bali Island

The nearshore marine environment of Bali is diverse. There are extensive inshore seagrass beds in waters of less than 2 m, and shallow fringing reefs surround most of the island. These inshore waters are quite turbid, especially in times of high rainfall due to run-off from the clay-like soil which typifies the area. Between one and two kilometres offshore are a series of submerged steep-sided barrier reefs, and it is on these reefs that roundscads are caught.

The roundscad or 'Tin Pis' fishery

During 1984 two local fishermen were diving on the barrier reefs at dusk and saw the roundscads schooling above the reefs. These two men, from the villages of Kumburi and

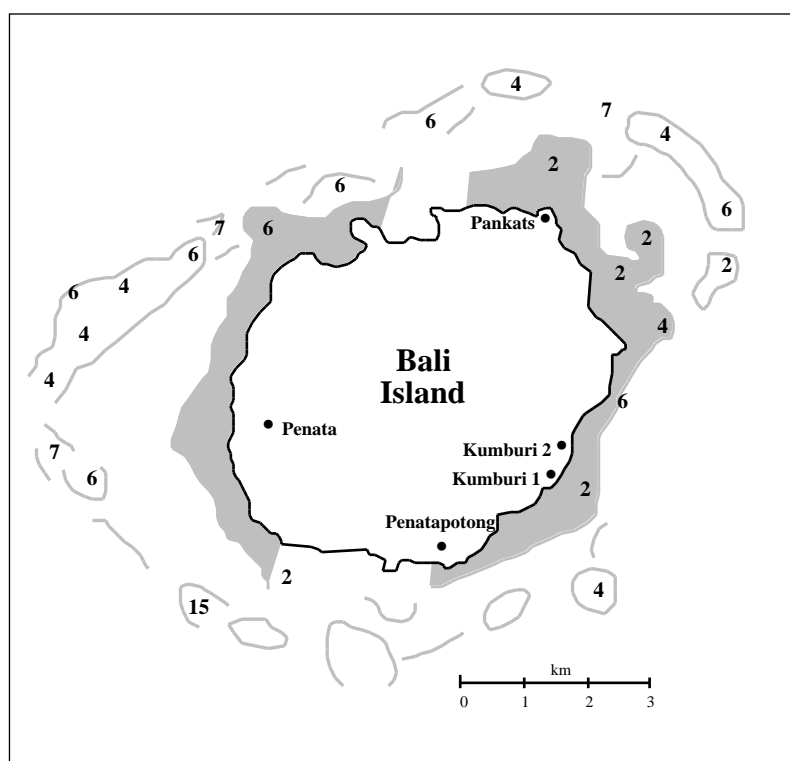


Figure 1: Map of Bali Island, showing locations of major fishing villages and reefs (approximate depths shown in metres)

Penata, set out to develop a technique to catch the fish, eventually refining a gillnetting method that has been catching small but consistent numbers of the fish for at least ten years. The fish are sold locally for food at a cost of 10 toea (US\$0.08) for three fish. They are also sometimes used for bait for handline fishing and fishers report that good catches are guaranteed when using roundscad bait is used.

Currently, fishing groups from four villages are exploiting the roundscad resource. These are: Kumburi with four active fishing groups, Penata and Penata Potong with two groups each, and Pankats with only one group.

There are up to 15 men or older boys in a fishing group. This number of fishermen is necessary to set the nets and later drive the fish into them. Not all villages have customary fishing rights on the barrier reefs where roundscads are caught, and this has led to disputes between fishing groups without traditional tenure on the reefs and the traditional reef owners.

Roundscads are caught by setting 2 in (stretched mesh) gillnets at dusk and dawn on top of the barrier reefs. Varying-sized nets were observed locally, mostly 50 m long by 1.5–2 m deep. When more than one net is used to fish, they are combined in various ways, including stringing them together lengthwise (2 x 1) or joining another two nets on top of these (2 x 2) to increase the depth of water fished.

If the tide or current is strong, the nets are set in line with the water flow, so that the water does not flatten the net. With no current, the nets are set in any

direction. The lead line (bolt) of the net is in contact with the seabed, tied around corals to keep it in place. Some groups attach extra floats to the top, so that a large catch will not sink the net.

There are variations in methods between local fishing groups which depend partly on the availability of gear. In general, the fishermen are not well equipped and the nets are in poor condition, particularly as nets must be imported from Lae or Port Moresby and are expensive compared with the average income of the Bali Islanders. Most other fishing gears used on the island are home-made (spearguns), or are cheaper gears such as handlines.

The tops or crests of the barrier reefs around Bali lie in depths varying between 5 and 15 m. The nets are set at any time from 17.30 hours and left for at least half an hour. The fish come on top of the reef at around 18.00 hours.

The fishers use a variety of methods to drive the fish into the nets, including splashing the water surface, shining torches to frighten the fish, bringing the net in a semi-circle to enclose the fish or some combination of these. All this may be done as soon as they see the fish or after some unspecified period of time.

Large single-hull canoes (known in Papua New Guinea as mons) or motorised dinghies are used to travel to the fishing grounds. Usually the former are used, as there are few outboard motors on Bali. Factors affecting the catch rate include the state of the moon and the prevailing current. Fewer roundscads are caught at the full moon and when there is little current.

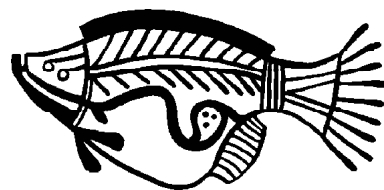
Survey results

During this survey, fishing was carried out in conjunction with two local fishing groups using three gillnets (100 m x 2 m: 2 in mesh). One of the Kumburi village fishing groups was encountered on the night of the survey and their catch was also sampled.

All catches were weighed on the night of capture and each species was identified, counted and weighed separately. A sample of 120 roundscads was purchased from the Kumburi fishing group to determine sexual maturity and to conduct some investigations into feeding behaviour of the roundscads.

The fishing groups employed very different fishing methods. The Kumburi fishers fished most of the water column above a 5 m deep reef by placing the nets in a 2 x 2 design and used torches to startle fish into the net, then closing the net around the catch.

The Penata group fished the lower 2 m of the water column above the reef on a deeper reef and did not use torches, but splashed the water surface to frighten fish into the net and simply pulled the nets into the boat after a catch was made. Both fished between 17.30 and 19.00 hours. The Penata Potong group set nets before dusk on reefs unsuitable for 'tin pis'.



The roundscad species known locally as 'tin pis' was identified as *Decapterus macarellus* [Fam: *Carangidae*] (Figure 2). This particular species of *Decapterus* is distinguished from others in the genus by its yellowish tail, narrow body shape and distinct white lining (emphysial membrane) on the inside of its upper lip.

D. macarellus is a circumtropical species found in most tropical waters (Allen & Swainston, 1993). As this species is a recently discovered resource, there are no local (Tokples) names for it, unlike the other commonly caught fish in the area. A similar species caught in the Duke of York Islands, East New Britain, is known locally as 'salmon'.

A summary of the catch data from the observations conducted on Bali during the survey is contained in Table 1.

Catch per unit of effort (CPUE) for gillnet fisheries is conventionally expressed as the catch divided by the product of the net length and the time period the net is deployed. In this case the selection of an appropriate unit of CPUE is complicated by the fact that no standard nets were used. In addition, the fish are caught at a particular time of night when nets are left in the water for a short period. It is

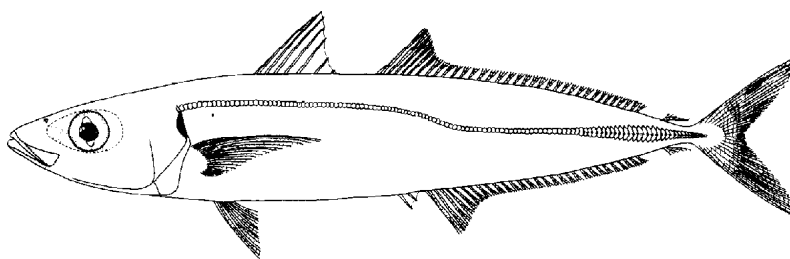


Figure 2: Illustration of *Decapterus macarellus*, tin pis

unknown whether increasing the time left in the water would increase the catch, so the use of time as a measure of effort may be irrelevant. Catch per set for a unit length of net may be a more appropriate estimate of CPUE.

Two of the fishing groups, Kumburi and Penata, caught roundscads, but they used very different methods. Attempts to estimate catch rates would be inaccurate and misleading, comparisons difficult and would only tell us the obvious: that the Kumburi fishers made the largest catch overall and comprising only the target species, while the Penata group caught a few roundscads but mostly other reef species.

Differences in catch volume and composition may be due to fishing methods, skill, and other factors, such as location. It is not possible to comment further following these limited observations.

It is, however, important to determine an appropriate estimate of fishing effort and CPUE if this fishery is to be properly assessed. The by-catch of the roundscad fishery on this occasion was mostly fusiliers (family Lutjanidae), a common species caught by gillnets on reefs in other parts of the Pacific (e.g. Philippines; see Dalzell, 1993). These are also a good food fish, and are popular on Bali.

Other by-catch species included reef fish such as goatfish and surgeonfish. The large reef fish catch made by the Penata Potong group is not considered as by-catch as the nets had been set too early in the afternoon to target roundscads.

A summary of the length and weight data for roundscads is given in Table 2. There was very little variation in length between the sexes, however, female fish were about 10 g greater in average weight than male fish.

Table 1. Summary of gillnet fishing for roundscads on Bali Island during 1995

Village	No. of nets	Net dimensions (m)	Net configuration	Species composition	No. of fish	Weight of fish (kg)
Kumburi	4	100 x 3	2 x 2	<i>Decapterus macarellus</i>	146	19
Penatapotong	1	100 x 2.5	1	Reef species	91	N/A
Penata	2	200 x 2.5	1 x 2	<i>Caesio caerulaurea</i>	68	9
Penata	2	200 x 2.5	1 x 2	Reef species	16	4.5
Penata	2	200 x 2.5	1 x 2	<i>Decapterus macarellus</i>	6	0.8

Table 2. Summary of the length and weight data for *D. macarellus* from Bali Island

Sex	Average length (± SE) (n) (mm)	Average weight (± SE) (n) (g)
Female	214.5 ± (3.2) (70)	131.7 ± (4.4) (67)
Male	216.3 ± (3.5) (38)	121.9 ± (4.1) (37)
Both sexes	215.1 ± (1.8) (108)	128.2 ± (3.2) (104)

The length-weight equation for *D. macarellus* at Bali Island was as follows:

$$Wt = 4.245LnL - 17.940$$

where L is length in millimeters and W is weight in grams.

Most of the fish caught ranged in size between 188 and 238 mm (Figure 3), with a mode at 215 mm and a mean length of 213 mm.

Two larger specimens, with lengths of 330 and 338 mm, were also caught and are probably representative of an older year class, possibly between 3 and 4 years of age (Dalzell, 1993).

Male and female roundscads are identical in external appearance, and can only be separated on the basis of gonad examination. The majority of the sample consisted of female fish, which were twice as abundant than males (females=70: males=38).

Most of the fish examined (80%) were in a pre-spawning condition as indicated by the presence of large ovaries with well developed eggs in the females and white maturing testes in the males.

The stomach contents of 15 roundscads were examined and found to contain plankton (tiny crustaceans, fish eggs and larvae, etc.). Most of the stom-

achs were not very full, but this may reflect capture shortly after the onset of feeding behaviour. The fish school above the barrier reef to feed at dawn and dusk, when there is increased plankton abundance on top of the reef, and possibly to escape predation.

Concluding remarks

Decapterus macarellus is found in all tropical waters and is harvested by gillnets, handlines, purse seines and trawls.

Roundscads are classed as small pelagic fishes, species which occupy the upper surface layers of the water column and feed mostly on plankton (Dalzell, 1993). As roundscads increase in size they tend to move towards a more demersal habitat where they are vulnerable to trawling.

In the Pacific Islands roundscad gillnet fisheries are small-scale operations, similar to the Bali Island fishery. In some locations such as Niue and the Cook Islands, specialised handline fisheries have developed to catch roundscads by chumming them near to the surface with coconut pulp where they will also take a hook baited with coconut.

In Hawaii, a handline and hoopnet fishery for *Decapterus macarellus* captures 122 t per annum and Hawaiian hoopnet fishing was proven to be effective for roundscad stocks in Niue and Tonga (Gillett, 1987, 1989).

The roundscad fishery of Bali Island is the product of an enthusiastic and committed fishing community. Two fishermen took the initiative to harvest a new resource, and developed fishing methods with no out-

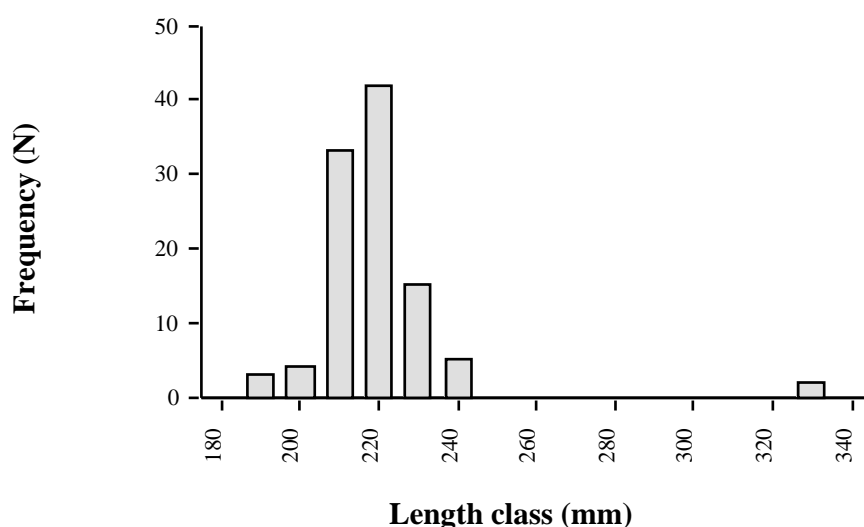


Figure 3: Length frequency of *D. macarellus* from gillnet catches at Bali Island

side help or knowledge of similar fisheries and without the assistance of extension officers.

Other interesting features of the fishery are the precision of the schooling behaviour of the fish above the barrier reefs, and the use of torches to frighten the fish into nets, where, in many other fisheries, submerged lights are left in the water to attract baitfish.

Roundscads are reported to be abundant around the entire Vitu Islands group, although some areas remain inaccessible to fishermen without outboard motors. Local people reported that most inshore reef stocks in the area are already heavily exploited.

Underwater observations conducted during this survey revealed an absence of large fish on the reefs, while most of the fisheries production from Bali comprises a diverse range of small fish from shallow waters around the island. There is a need, therefore, to diversify fishing and to target more abundant pelagic species such as roundscads.

It is difficult to comment on the state of the roundscad resource on the basis of these limited observations. Current exploitation of roundscad stocks appears quite low and can only be classed as a mainly subsistence fishery, with part of the catch sold to Bali residents.

As such, roundscads are an important item to the members of the community not involved in fishing, and it is encouraging to see that this product is pre-

ferred to the tinned fish bought from trade stores.

Further development would depend upon many factors, one of which is the ability of the fishing communities to increase the catches so that there is an excess over subsistence requirements. Fishing would need to become more efficient, perhaps with new reefs exploited so that the same reefs are not constantly fished and exhausted.

Before encouraging any serious increases in fishing effort or efficiency, however, there is a need to develop a method to calculate fishing effort and CPUE, and to begin monitoring the fishery.

Given the remote location of Bali Island, the collection of data might be conducted by the local fishers with occasional assistance by Fisheries Officers from West New Britain.

A proposed data collection sheet would gather information on the time and conditions where fishing (tide, moon, sea, etc), gear used, total catch, weight of roundscad and by-catch, number of fish, etc. The Bali Islanders claim to have been taking consistent catches of round scads for ten years.

If catch rates are steady or increasing and stocks are plentiful, development is a viable option. Potential markets for roundscad as a bait species include the East New Britain Longlining Project, based at Kokopo, which currently imports saury from Japan.

Fishing trials could be carried out using roundscad to establish its suitability for longlining. While fish were being collected for the trials, more information could be gathered on the distri-

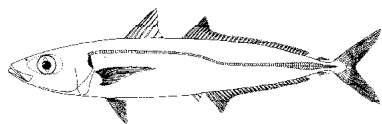
bution and abundance of the species. Local game fishers in Kimbe might also provide a market for small amounts of roundscad, as would Bali locals residing in Kimbe, who are accustomed to eating roundscad.

If the stock of roundscad is small, further development would be inadvisable. Some management measures might be introduced to preserve the stock, including; a closed season for spawning (which may occur around late September – October judging by the condition of female fish during this survey), or restriction of the number of nets per group, and so on.

There are substantial obstacles in the way of large-scale development at the moment. The catches observed during this survey were low and, although local fishermen claim to catch up to 500 fish per night (about 65 kg), it is not known how many nets were used and whether this is an accurate estimate. Few fishermen seem to fish consistently, and their gear is in poor repair. Further, there are disputes about reef tenure and fishing rights that require arbitration.

With respect to roundscads for longline bait, a pre-requisite for longline fishing is that bait supplies be consistent and reliable.

Given that this cannot be guaranteed by the Bali Island fishery, a more suitable strategy might be to aim at augmenting imported bait supplies for domestic longline fishing operations, rather than to try to provide total bait requirements. This would also assist in continuing the subsistence supply of roundscad to the island as well as reducing the costs of longline fishing operations



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