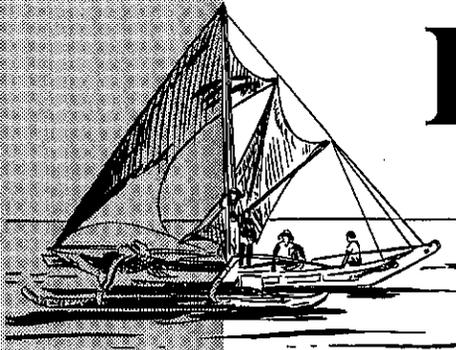


FISHERIES

Newsletter



NUMBER 71
OCTOBER — DECEMBER 1994

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The Fisheries Training Section is now involved with
a major safety-at-sea awareness programme



South Pacific Commission
Prepared by the Fisheries Programme Information Section
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SPC ACTIVITIES

■ INFORMATION SECTION

Seventh PIMRIS Steering Committee Meeting held in Suva

The Seventh Pacific Islands Marine Resources Information System (PIMRIS) Steering Committee Meeting was held at the University of the South Pacific in Suva, Fiji, from 1 to 2 December 1994. This meeting usually takes place before the SPC Regional Technical Meeting on Fisheries (RTMF). Due to financial constraints, the RTMF is now held every two years and, subsequently, the PIMRIS Steering Committee Meeting had to be rescheduled.

This year's meeting was attended by participants from Kiribati, Tuvalu and Western Samoa. Participating agencies (FFA, SOPAC, SPC, USP, and, for the first time, SPREP) were also represented, as well as a representative from the Cana-

dian Ocean Resources Associates Inc. (CORA), executive agency for the Canadian International Development Agency (CIDA).

Speaking at the opening of the meeting, USP Pro Vice-Chancellor, Dr Vijay Naidu, stressed that it was important for the University to make a major commitment towards PIMRIS as it was an essential source of information for effective planning and management of marine resources. He also highlighted the importance of sharing the information in the region.

The second address was delivered by the University Librarian, Ms Carol Mills. She emphasised the need for the MOANA database to be maintained.

MOANA is now an active part of PIMRIS regional activities with regards to marine and fisheries-related fields.

Once again one of the major concerns to participants was the continuation of the PIMRIS Coordination Unit. The funding agency CIDA, through its executing body, CORA, has extended the period of operation of PIMRIS using unspent funds. These funds will expire in August 1995. The meeting's general feeling was that the needs of PIMRIS should be defined in detail, that a more pro-active attitude should be taken towards the need for funding, and that this should include as many different strategies as possible for approaching potential donors, including:



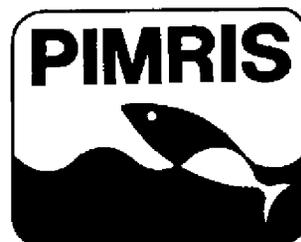
Make no mistake! The SPC Fisheries Information Adviser Jean-Paul Gaudechoux is not sleeping. He is just gathering his thoughts before delivering his speech.

- ☛ Linking PIMRIS formally with the Canadian South Pacific Ocean Development Programme (phase II) funding proposal;
- ☛ Absorption of the Coordination Unit by the USP Library (reservations, however, were expressed regarding the lack of resources and funding in the library);
- ☛ Turning PIMRIS into an Aquatic Sciences and Fisheries Abstracts (ASFA) input centre, which could generate some funds; and

☛ An approach for 'marketing' the various activities of PIMRIS to facilitate possible cost-sharing amongst donor agencies.

Another issue discussed during the meeting was the venue of a probable PIMRIS workshop in 1995. The aim of the workshop is to train people in basic information management skills. The training will include an introduction to computers and CDS-ISIS. The venue of the workshop will be USP, Suva, subject to availability of funds.

The venue for the next PIMRIS Steering Committee Meeting was decided: Suva (November–December 1995). The meeting asked the Coordination Unit to make efforts to get more Pacific Islands fisheries officers to attend.



Participants at the Seventh PIMRIS Steering Committee Meeting

PNG DFMR Librarian attached to the Section

Following an official approach from the Government of Papua New Guinea, Henry Yule, Librarian of the Department of Fisheries and Marine Resources (DFMR), was attached to the Section from 24 October to 18 November 1994.

The purpose of the attachment was to initiate the publication by DFMR of a fisheries newsletter, and to train Henry in information searching, collection techniques and arrangements in the SPC Library, in order to enhance the DFMR library.

The Fisheries Information Adviser provided practical training in information gathering and compilation of newsletters, distribution techniques (e.g. mailing list) and gave Henry an introduction to desktop publishing software, as well as re-

fresher training in word-processing techniques. Henry was then able to participate in the production of the *SPC Fisheries Newsletter*.

The library provided training in library administration. Henry searched for information in the library collection and in stand-

alone networks of other libraries and information centres, using the CDS/ISIS software.

Overall this attachment was very successful. Henry has widened his abilities and acquired the knowledge necessary to publish a fisheries newsletter within his Department. One of

the main objectives of the Information Section is to coordinate and oversee the training of fisheries officers in the region in all aspects of information gathering and dissemination through attachments to SPC.



■ RESOURCE ASSESSMENT SECTION

Forthcoming Regional Workshop on Coastal Fisheries Management

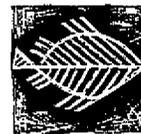
The South Pacific Commission and the Forum Fisheries Agency will convene a Workshop on Coastal Fisheries Management in the South Pacific later this year. The venue will be the Forum Secretariat conference centre in Suva, and the meeting will be held over two weeks, between 26 June and 7 July.

It is hoped that fisheries officers and scientists from all the Commission's member countries will be able to attend the workshop. Other speakers who have experience of coastal fisheries management in the region

or expertise relating to tropical fisheries management will also be invited to participate.

This workshop is intended to set priorities and highlight those countries in the region where fisheries management is required. This will assist the recently established Integrated Coastal Fisheries Management Project (ICFMP) in setting objectives for the future, which includes assisting member countries to formulate management strategies for coastal fisheries resources.

The workshop will also give participants a chance to exchange views and share experiences of managing coastal marine resources in their respective countries. The report of the meeting will include the record of discussions and recommendations arising therefrom, and the various papers presented at the meeting will be edited and published in the ICFMP technical paper series.



■ CAPTURE SECTION

Second SPC Sub-regional FAD Skills Workshop held in Palau

Some Micronesian chief fisheries officers are likely to be besieged with purchase requests for deep-water echo-sounders and GPS navigation units, along with FAD material orders, following the Second SPC Sub-regional FAD Skills Workshop held in Palau in late October.

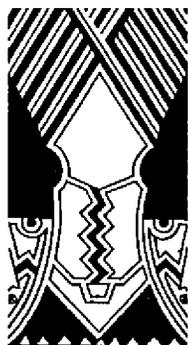
Twelve fisheries officers responsible for domestic FAD programmes, from the Federated States of Micronesia (Yap, Pohnpei and Kosrae), Guam, Kiribati, Nauru, the Northern Mariana Islands, Palau and

Tuvalu gathered in Koror over two weeks to participate in the workshop, the second of its kind organised under SPC's UNDP-funded Offshore Fisheries Development Project. The FAD officers participated in theoretical and practical training, both on shore and at sea, in all the physical skills required for successful FAD deployment. The training covered: site survey by echo-sounding and the use of GPS navigation equipment; site selection; mooring design; mooring and raft rigging and construction; and deployment techniques.

Like the first FAD workshop held in American Samoa, this workshop was arranged to coincide with a local FAD deployment programme for which the SPC Fisheries Capture Section's technical assistance had been sought. In this way the Section was able to provide training under actual field conditions and simultaneously answer Palau's need for FAD assistance. Palau's Marine Resources Division hosted the workshop and provided the survey and deployment vessel and FAD materials.

The workshop was supervised by SPC Masterfisherman Peter Watt, assisted by Sifa Fukofuka on attachment to SPC from the Cook Islands Ministry of Marine Resources, consultant Masterfisherman Steve Beverly, and SPC's newly-appointed Fisheries Development Officer, Satalaka Petaia.

Assessment of the workshop's impact by way of a set of practical exercises at its conclusion



indicated that, while all participants had acquired new skills and understanding of FAD processes, there was likely to be need for follow-up support for those officers with less experience.

By the participants' own rating, the workshop's main achievement was that it made them aware of the need to conduct FAD site surveys prior to mooring calculation and deployment and gave them practical training in the use of GPS navigation units and deep-water echosounders. There was general agreement that the use of this equipment made bottom survey work both easy and accurate, and that the cost of such equipment was a good investment when compared to the cost of even one FAD lost through inaccurate survey.

Through these two workshops the Capture Section has now provided practical FAD training for 26 officers from 16 countries. Indications are that the workshops have played a useful role in raising awareness of sound FAD technology and practice and that, combined with the wide adoption of technical advances in FAD moorings and rafts developed by SPC, and some ongoing support, regional FAD use is likely to enjoy increasing success.

As it is unlikely that a third FAD Skills Workshop can be convened it is hoped that the needs of the few countries which have not been able to participate in this training programme can be assisted by attachment training or, in some cases, the assignment of SPC technicians.



Palau prepares its new fishing vessel for longlining trials

Immediately following the conclusion of the Koror FAD Skills Workshop, SPC consultant Masterfisherman Steve Beverly, an experienced commercial tuna longline fisherman, stayed on for two weeks at Palau's request to assist the Marine Resources Division (MRD) in fitting out and establishing a tuna longline fishing system on its new fishing vessel, F/V *Elechil*.

The *Elechil* (Palauan for 'baby whale') was donated by the Government of Japan and since its arrival in early 1994 has been used in a small-scale coastal fisheries development programme sponsored by Japan's Overseas Fishery Cooperation Foundation. SPC Masterfisherman Peter Watt had previously assisted MRD in specifying gear and deck machinery for the vessel to ensure that it could be used successfully in a range

of training and research applications.

Elechil is a Yamaha, fibre-reinforced-plastic, forward-house design with a large covered afterdeck. Principal characteristics include the following: length overall, 14.8 m; breadth overall, 3.4 m; depth overall, 1.9 m; gross tonnage, 17.0; propulsion, 165 hp 2000 rpm, 4-cycle Yanmar diesel; speed, 10 knots; complement, 5 crew; ice hold, 1.2 m³; insulated fish holds, 2.5 m³; fuel oil, 2500 l; and fresh water, 500 l. *Elechil* has a large, flat afterdeck with flush hatches, and an ample seawater pump with a deck wash-down hose.

Wheelhouse electronics provided with the vessel include Furuno radar, SSB radio, VHF radio, colour video sounder, GPS navigator, radio direction-

finder, and digital water-temperature gauge.

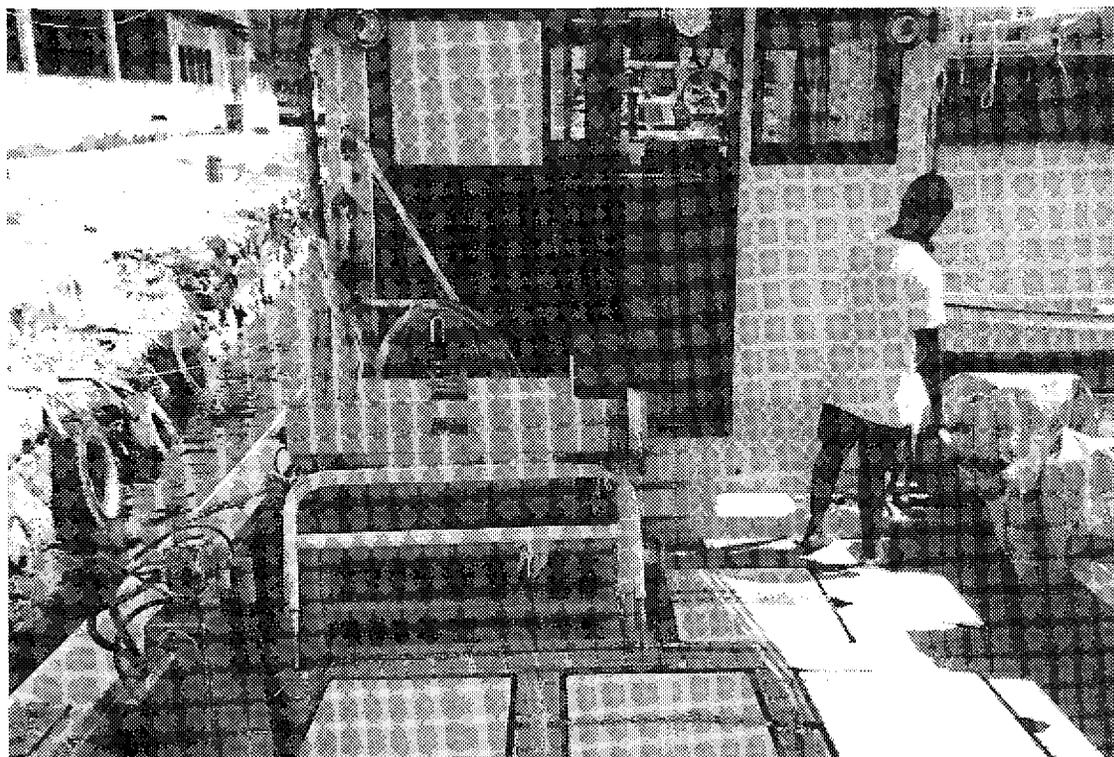
The main engine is equipped with a power take-off (PTO) that operates an anchor capstan, a vertical longline hauler and a Lindgren-Pitman 27 in x 30 in (68.6 cm x 76.2 cm) mono-filament longline drum. The reel is mounted just aft of the wheelhouse on the port side athwartships. It is loaded with 5 miles of 3.3 mm monofilament. Two aluminum blocks for hauling and setting the longline were supplied with the reel.

Additional fishing gear on board includes five electric deep-bottom fishing reels and two fibreglass trolling poles. The deep-bottom reels are powered by 24 volt direct current and can be dismantled.

After inspection of the vessel, deck machinery and fishing gear stocks, Steve Beverly was able to work with *Elechil*'s crew

to establish setting and hauling systems for the longline and to provide MRD with recommendations relating to gear require-

ments and operational aspects of longline fishing. MRD now intends to commence tuna longlining trials early in 1995.



Elechil, Palau's new fishing vessel, showing the nylon monofilament longline hauling drum and the flush deck which were specified for tuna fishing trials

■ POST-HARVEST SECTION

Bêche-de-mer poster and handbook now available

Following a request made some years ago by the Papua New Guinea Department of Fisheries and Marine Resources, the South Pacific Commission has produced a poster on sea cucumbers and beche-de-mer species.

Although compiled in response to a request from PNG, this poster is likely to be of interest to fisheries officers, traders and those involved in marine resource education in all Pacific Islands countries, especially those with large sea cucumber fisheries.

The poster is principally aimed at fisheries inspectors and other fisheries officers, and is intended to help them identify sea cucumbers correctly down to species level, in order to improve export statistics on this group of animals. Very often there is much mixing and most beche-de-mer exports are not classified by species. This makes it difficult for fisheries research staff, who are expected to provide advice to the government on management of the fishery, to understand how heavily the various different sea cucumber species are being exploited.

Because inspection of beche-de-mer happens after processing, the poster features photographs of finished products, as well as pictures of the live animal, for each species.

The South Pacific Commission's Post-Harvest Section has also just released a revised edition of *Beche-de-mer of the tropical Pacific*, entitled *Sea cucumbers and beche-de-mer of the tropical Pacific — a handbook for fishers*.



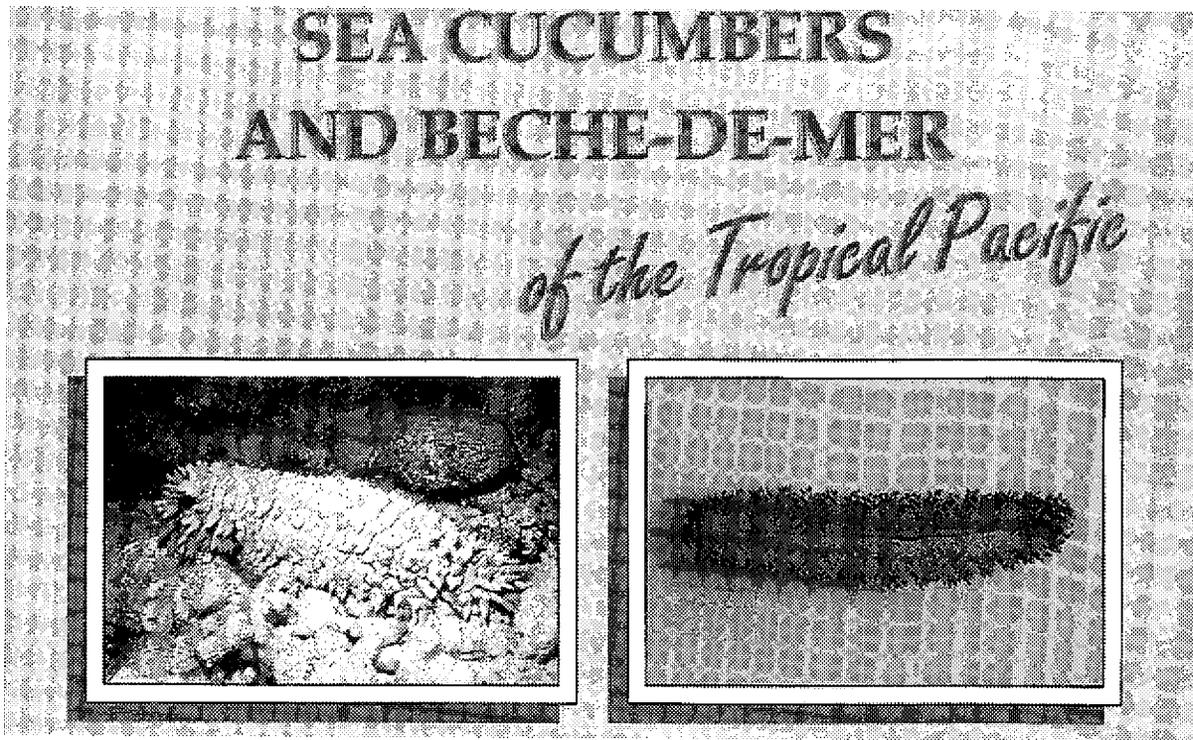
This edition was prepared by Dr Chantal Conand, now of the Université de la Réunion (Dr Conand is also the technical coordinator of the Beche-de-mer Special Interest Group). Recent data on the biology of these species and their commercial value, acquired in the course of a study carried out by ORSTOM (Noumea Centre), enabled the text to be updated. Further improvements to the processing, packaging and mar-

keting sections were made by the SPC Post-Harvest Fisheries Adviser.

In this edition one species of no commercial value has been replaced by a low-value species, and an estimate of the average density of each species in its marine habitat included. The processing method for sandfish, which has become one of the most valued products and is now exported from a number

of Pacific Island countries, is set out in detail. The section on marketing has been rewritten and the list of beche-de-mer buyers updated. Lastly a short bibliography has been added for readers wishing to explore the subject further.

For more details on the poster and handbook, please contact the SPC Post-Harvest Fisheries Adviser.



■ TRAINING SECTION

Video on sashimi-quality tuna shot in New Caledonia

At 11 p.m. on Monday 12 December, the *Dar Mad* sailed out of Noumea for a one-day drift longlining trip. On board this ship, which is run by the New Caledonian Maritime Affairs Service, was a team of six single-minded people anxious to catch at least one living yellowfin or bigeye tuna so as to be able to shoot a training video about the various stages of onboard processing of sashimi-quality tuna.

The longline was set between 3 and 5 a.m. the following morning 10 miles offshore from the Dumbea pass in dull weather and heavy seas. Two hundred hooks baited with squid or big sardines were connected to the kuralon Japanese main line. Despite the limited number of hooks set, Aymeric Desurmont and Philip Simoni, the New Caledonian masterfishermen, did not lose faith.

They knew this area like the back of their hand and had already brought home some fine catches with their longline. Jeff Huglo, the Imagin Video Production Company's cameraman, was a little less optimistic because of the unfavourable sea conditions and rainy weather which promised to make shooting difficult.

After an interlude for the sampling of fresh pasta accompanied by smoked fish, garlic and fresh cream (good seasickness recipe!) Steve Beverly, the SPC consultant, got ready the equipment which is essential for dealing with sashimi-quality tuna: a foam mat to lay the fish on, cotton gloves to handle it, a cosh, a pointed instrument to kill it, a bleeding knife, a gutting knife, a hard brush to clean out the gill cavity and some elasticated cloth sleeves used to protect the fish while stored on board.

The longline was paid out around 1 p.m., a little earlier than usual, in order to increase our prospects of reeling in live fish. There was no mistaking our delight when after 10 minutes or so a beautiful bigeye tuna weighing about 30 kg was hauled up from the deep! The gaffing was faultless and the fish was stunned with a blow to

the top of the head and then killed cleanly and efficiently, all this under the whirring lens of the camera.

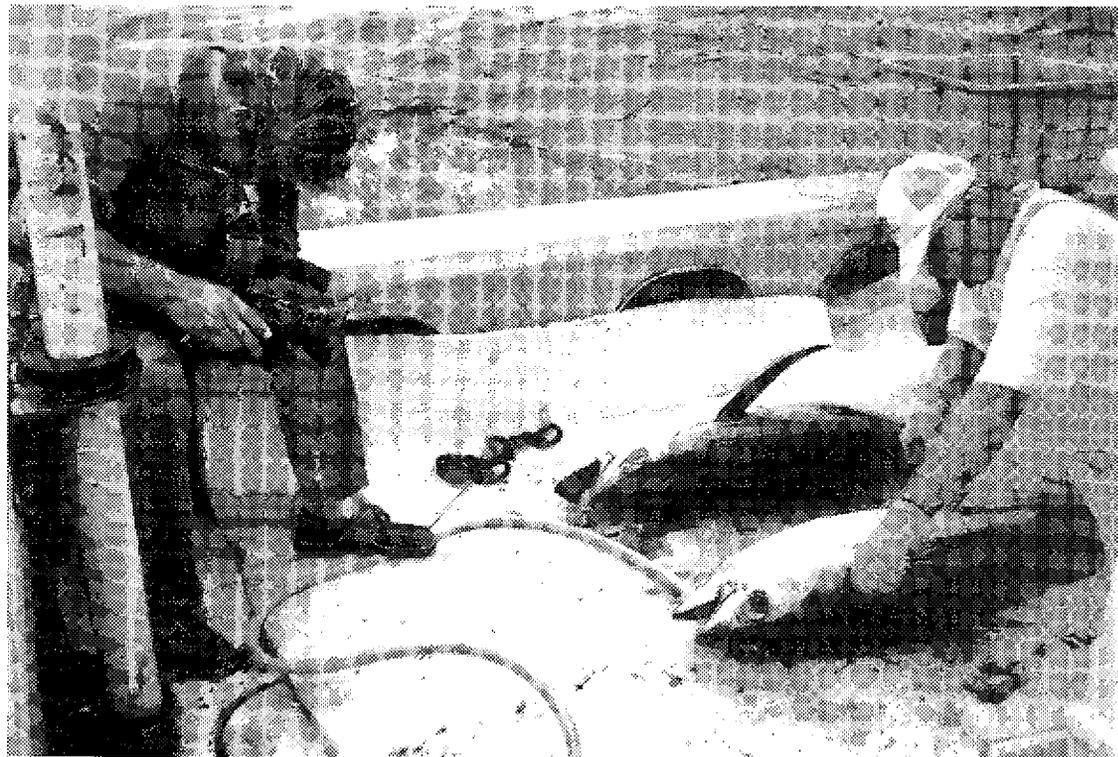
The rest was nothing more than a mere formality for Steve, who was just a wee bit distracted from his work by the arrival on the deck of a second bigeye tuna slightly smaller than the first. Despite this and the unstable deck of the *Dar Mad*, Jeff captured on film the final stages of treatment which Steve was giving to our star, involving the Tanaguchi method of gutting, cleaning and onboard storage. The mission was accomplished in a little under half an hour from the start of the set.

The rest of the afternoon was sheer pleasure, with 23 albacore brought in, weighing 500 kg; a 100 kg of mahi mahi; and 2 small yellowfin – 680 kg of market-worthy tuna in all. In other words, we had a record

CPUE of 3.4 kg per hook – a figure to make green with envy the captains of most of the longliners working in the region.

The catch was given away to the staff of the New Caledonia Maritime Affairs Division, the SPC and an old people's home in Noumea.

The video cassette on onboard treatment for sashimi quality tuna will be available from the end of January 1995 in French and English. A second film dealing with shore processing and export formalities for tuna heading for the Japanese sashimi market will be shot in Fiji in February 1995. These two cassettes will be widely distributed throughout the region, in particular to fishery training sectors and fishing companies using longliners.



Steve Beverly and Jeff Huglo grapple with two good-sized bigeye tuna.

Safety-at-sea public awareness project underway

In 1991, following requests from several Pacific Island countries, the FAO/UNDP Regional Fisheries Support Programme commissioned a report on 'Safety at Sea Issues in Pacific Island Artisanal Fisheries'. The consultant's report estimated that in the 16 countries surveyed, over a two-year period there had been between 612 and 667 distress incidents involving small craft, resulting in a loss of life of possibly 113 persons.

While there can be no measure of the distress and grief these incidents and fatalities give to the families involved, the consultant did give some estimations of the monetary costs by stating :

... general conclusions can be drawn from either the actual costs incurred or extrapolation from the usual costs (but not necessarily from charges) of vessels and aircraft employed in search and rescue operations. On this rough basis, including estimated levels of external assistance (mainly aircraft flight-time) and internal budgeting, it can be estimated that in the past few years in the region as a whole, US\$750,000 to US\$1,000,000 is expended each year on search and rescue efforts.

The report considered that the cause of the problems contributing to distress were in three categories: mechanical, weather and misjudgment/poor seamanship. Many of the persons involved did not have a great deal of experience and had received no training. The 'It can't happen to me' attitude was prevalent.

In presenting suggestions for improving safety the report commented:

... a majority of those queried were of the opinion that only education and a campaign of public awareness over time would bring meaningful results. This was particularly true for those who were closest to artisanal fishing and the sea, i.e. members of extension services in fisheries departments, professional mariners, some outboard dealers and the like.

and

... In planning even modest (safety) programmes it must be realised that safety at sea is something which must be taught and continually reinforced. It is recognised that heightened awareness of safety in industrialised societies is due to constant reinforcement. In Island countries, it is the almost total lack of exposure to safety awareness on a recurrent basis that results in it being ignored. Programmes should thus emphasise the necessity for their continued, long-term existence.

The development of a more in-depth, long-term, approach to safety issues is necessary to address the problem. During 1993, the South Pacific Commission received five requests from fisheries administrations to provide assistance in the development of safety-at-sea awareness programmes for both fishermen and the general public.

In response, the Commission has initiated a Safety-at-Sea Public Awareness Project and has approached FAO, in cooperation with FAO member countries, to assist in its development.

The safety programme developed by the Commission so far aims to provide useful resource materials to assist interested fisheries administrations, train-

ing institutions and NGOs to promote better awareness of the basic elements of small-boat safety at sea. Included in the package under development will be a safety logo, a poster series, a checklist card, T-shirts, a video, audio tapes and a tutor's workshop guide.

The main message of the SPC project is that attention to basic safety is not necessarily expensive or time-consuming and can easily be incorporated into the operation of small fishing vessels.

Following a great effort from SPC's Graphic Artist, Jipé Lebars, the Commission has been able to complete and distribute the first of these materials, including logo stickers, a poster and the checklist card (as a large A4 sticker, a laminated waterproof card, and a T-shirt — See pages 10-11).

Video production and three more posters are planned for early 1995 and, with the addition of the tutor's guide and audio tapes, the complete resource pack should be available by mid-1995.

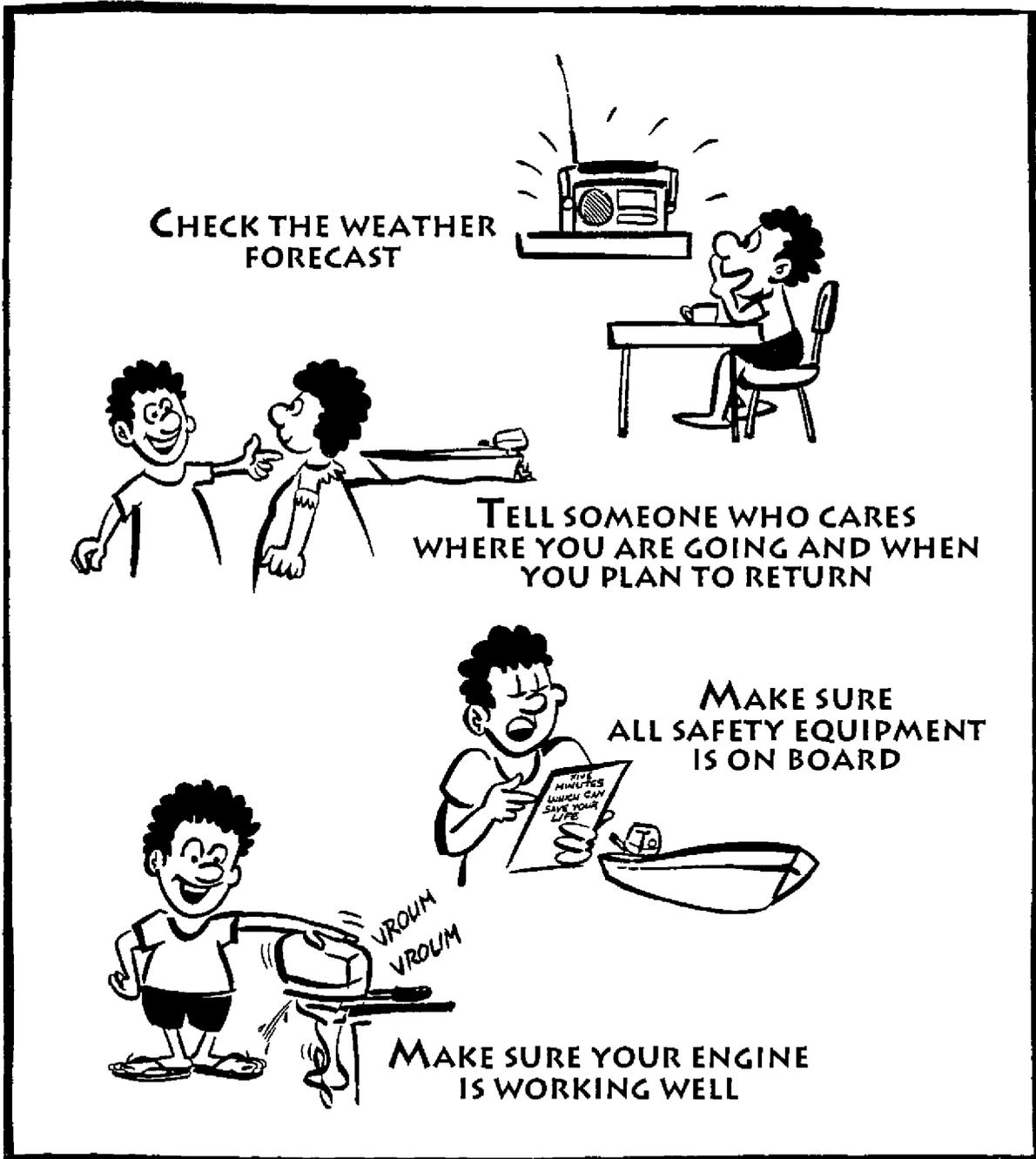
The Commission hopes that this project will gain additional support from FAO, in which case it should be possible to produce the resource kit in national languages and give support to in-country workshop programmes.

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

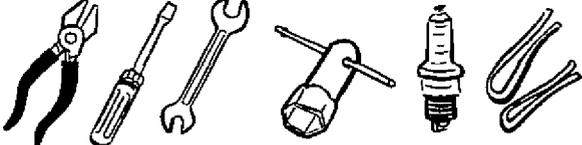
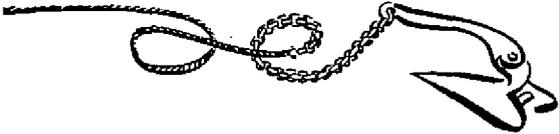


FIVE MINUTES WHICH CAN SAVE YOUR LIFE

BEFORE GOING OUT TO SEA:



SMALL BOAT SAFETY CHECKLIST

 <p>SPARE FUEL</p>	 <p>ENGINE TOOLS AND SPARES</p>
 <p>ANCHOR AND ROPE</p>	 <p>SEA ANCHOR</p>
 <p>ALTERNATIVE PROPULSION</p>	 <p>COMPASS</p>
 <p>FLARES SIGNALLING DEVICE MIRROR</p>	 <p>FLOTATION DEVICE</p>
 <p>WATER IN CONTAINER</p>	 <p>FOOD</p>
 <p>FIRST AID KIT</p>	 <p>KNIFE</p>
 <p>BAILING DEVICE</p>	 <p>SHADE</p>

■ OCEANIC FISHERIES PROGRAMME

Multilateral High-Level Conference on South Pacific Tuna Fisheries

The Multilateral High-Level Conference on South Pacific Tuna Fisheries was held from 5 to 9 December 1994 in Honiara, Solomon Islands. The Conference was attended by representatives of 21 countries and territories: Australia, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Japan, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Papua New Guinea, People's Republic of China, Philippines, Republic of Korea, Solomon Islands, Tonga, Tuvalu, United States of America, Vanuatu and Western Samoa.

Observers attended from the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), the Food and Agriculture Organization of the United Nations (FAO), the Inter-American Tropical Tuna Commission (IATTC), the South Pacific Commission (SPC), the South Pacific Forum, and the Western Pacific Fisheries Consultative Committee (WPFCC). The meeting was hosted by the Forum Fisheries Agency (FFA).

Following the opening statements by the delegations, the meeting considered first the status of the stocks, and then the collection and exchange of catch data.

Papers for these two agenda items were prepared by SPC in collaboration with members of the Standing Committee on Tuna and Billfish. Dr John Hampton, SPC Principal Fisheries Scientist, presented the paper on the status of the stocks, while Dr Antony Lewis, SPC Oceanic Fisheries Coordinator, presented the paper on the collection and

exchange of catch data. Also considered at the Conference were transshipment, transponder technology, enforcement, gear conflicts, and other issues.

The discussion concerning the status of the stocks and the collection and exchange of catch data was dominated by the concerns of distant-water fishing nations (DWFNs) that current deficiencies in these areas have been caused by the lack of a formal arrangement between SPC and DWFNs for their participation in decisions concerning research and data collection.

In this regard, Japan proposed that a working group be established to study the organisational and financial aspects of establishing a framework for the collection and dissemination of data, and stock assessment with the participation of scientists from all states with an interest in the stocks.

In response to the proposal by Japan, the Conference agreed that a technical consultation should be convened to consider options for improved provision of complete catch-and-effort data, and the formulation of criteria for data management and security.

In addition, the consultation should consider options under which scientists from all parties involved in the fishery can more fully participate in the stock assessment process and the tuna research programmes. It was agreed that the technical consultation will meet for one week immediately preceding the Eighth Meeting of the Standing Committee on Tuna and Billfish, which is tentatively

scheduled for August 1995 at a venue to be decided.

Concerning transshipment, the Conference agreed that transshipment in port has provided increased economic benefits to FFA member countries, as well as improved data coverage; a ban on transshipment at sea was implemented as a condition of licensing by members of the South Pacific Forum in June 1993. It was agreed that compliance with coastal state regulations was generally good, but that there were problems on both sides.

Noting the assurances that had been provided by DWFNs with respect to the concerns expressed by FFA member countries regarding employment, pollution, dumping of discards and by-catch on local markets, the Conference agreed that further consultation, on a bilateral basis, would be desirable to overcome remaining difficulties. All states represented in the Conference confirmed that vessels flying their flag are not transshipping at sea.

Concerning transponder technology, the Conference agreed that the discussion had been positive. In principle, all states represented at the Conference supported the use of vessel monitoring systems (VMS) technology as an effective tool for enforcement, but it was recognised that the nature of the region posed great challenges.

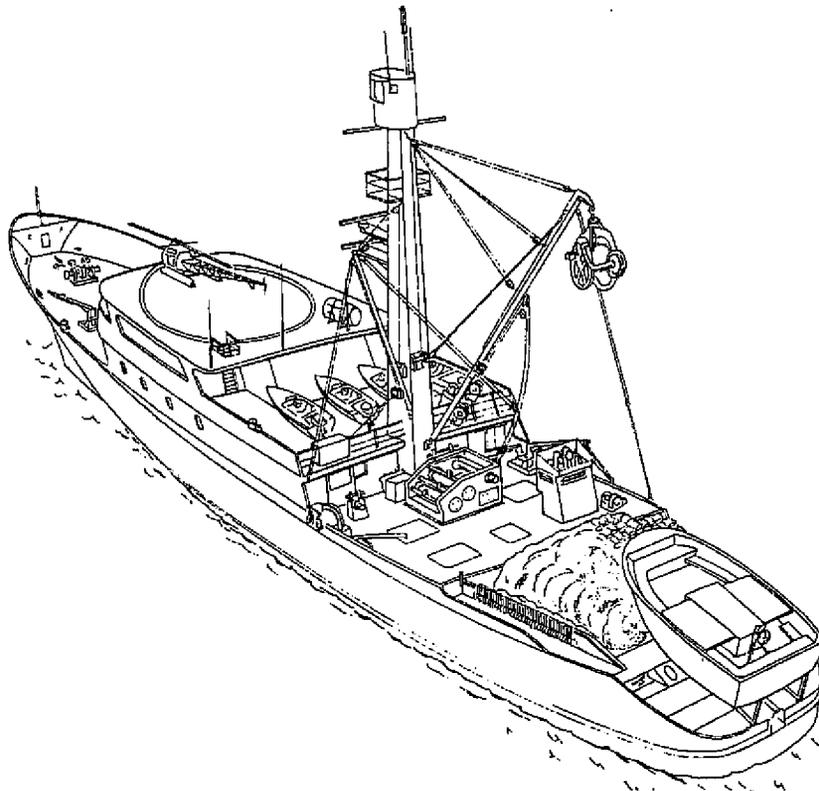
Conference participants agreed to continue to explore how such systems could be utilised in the most beneficial way for both coastal states and DWFNs. It was recognised that FFA mem-

ber countries had no intention of acting unilaterally in this regard, and it was hoped that a continuing dialogue would help to resolve the difficulties identified by Japan and other DWFNs concerning technical and legal aspects. The Conference noted with appreciation the offer by Japan to host a technical consultation on VMS in 1995.

Concerning enforcement, it was recognised by all participants in

the Conference that effective enforcement is essential for conservation and management. While FFA member countries are concerned at the poor level of compliance by some vessels, they also recognised the concerns expressed by some countries regarding the use of excessive enforcement measures. In this regard, the Conference agreed on the need for greater cooperation between coastal states and DWFNs.

Concerning gear conflicts, the Conference endorsed a proposal by Japan that flag states give strong guidance and instructions to longline vessels to make best efforts to set longline gear with a spacing of at least two nautical miles from other longline gear, and, in cases where the longline gear has to be cut, to make best efforts to retie the gear firmly at the points of the cut.



■ SECOND MACKEREL CANNERY PLANNED FOR PNG

Plans are well advanced for a second mackerel cannery in Papua New Guinea (PNG). Work is already under way on the country's first, being built by Malaysia's Kumpala Fima and located at Lae on the northern New Guinea coast.

The second project is a joint venture between Vo-ko Industries of Fiji and a PNG company, Nepulrager, to trade as Pacific Fish Cannery. The nine million kina (US\$ 9.72 million) project is likely to be located near the capital, Port Moresby.

The cannery will have a capacity to produce 480,000 cartons of

canned mackerel per year from fish caught in PNG waters, with the company planning to import additional frozen mackerel from New Zealand, the United States and Peru for canning to meet domestic demand.

Papua New Guinea, which has recently devalued the kina, now imports K 30 million (US\$ 32.4 million) worth of canned mackerel each year and the devaluation means prices of the product will rise. To help meet that demand from local sources, cannery projects are given substantial tax holidays and import duty exemptions. Companies investing in land-based facilities

will also be given preference for fishing licences for the PNG EEZ.

Meanwhile, PNG and the Federated States of Micronesia have signed an agreement to cooperate in exploiting their vast fisheries resource (see *SPC Fisheries Newsletter* #70, p. 15-16).

The countries share a long border between their respective EEZs and they will work together to monitor and conserve tuna stocks.

(Source: *World Fishing*)



■ GOLDEN FUTURE FOR SOUTH PACIFIC FISHERIES

In the next five to 10 years, investment in the South Pacific fishing industry may total between K 200 million (about US\$ 170.2 million) and K 300 million, PNG Fisheries and Marine Resources Department Secretary, Mr Joseph Gabut, told an audience at the 11th South Pacific training course in coastal fisheries development held in Port Moresby.

Mr Gabut said the proposals for investment concentrated on tuna fishing and canning. He

said that up to 1.2 million tonnes of tuna alone could be harvested in the region and sold at an average of about K 10 (about US\$ 8.50) per kilogram for raw catches, while processed tuna would fetch 10 times that amount. Other resources, including mackerel, reef fish, beche-de-mer, sea-shells and pearls, would fetch twice the amount paid for processed tuna.

The training course, lasting 11 weeks, was sponsored by the

Japan International Co-operation Agency aided by the Fisheries and Marine Resources Development Assistance, Office of International Development Assistance of the University of Papua New Guinea. People attending the course were from Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Tonga and Western Samoa.

(Source: *The South Sea Digest*)



■ IOI OFFERS ITS FIRST COURSE

The International Ocean Institute Operational Centre at the University of the South Pacific (IOI-South Pacific) and the USP's Marine Studies Programme course, Management and Development of Coastal Fisheries, were officially opened by the Vice-Chancellor Esekia Solofa at the lower campus.

The five-week course, from 24 October to 25 November 1994,

was the first full course to be offered by IOI-South Pacific.

Suggesting an integrated approach to the management of the coastal fisheries, Mr Solofa said that it was important for proper training to be provided to people managing marine resources. He said that marine resources were important to the people of the Pacific Islands and that there was an urgent need

to develop proper strategies for resources and fisheries management.

Sustainable Development Advisor, United Nations Development Programme, Dr Suresh Raj said that in the Pacific, the sharp conflict between the need for immediate consumption or use of coastal and marine resources, and the need to ensure the sustainable supply of re-

sources was reaching a critical stage. The need for integrated Coastal Zone Management Plans and their implementation was now paramount.

Dr Raj outlined some of the serious issues. These included the rapid growth of urbanisation, resulting in pollution of coasts adjacent to urban centres; lack of trained human resources which limited the environmental management capabilities of the Pacific Island countries (PICs); solid and hazardous waste accumulation, resulting in public health and pollution problems; pollution of coastal waters, especially in the vicinity of urban areas; destruction of coral reefs through dynamiting, for causeway and boat channel construction; and over-exploiting renewable resources, including coastal fisheries, in the face of rapidly increasing populations.

He said that in response to such problems, it was recognised that systems for integrated coastal zone management must be designed and implemented in the PICs. In this regard, UNDP, with technical input from IOI South Pacific, was in

the process of approving US\$ 350,000 for a project aimed at establishing a Coastal Zone Management Plan in the Republic of Marshall Islands. He invited participants from other Pacific Island countries to approach UNDP for similar assistance.

In a welcoming address, Professor Robin South, Director of IOI-South Pacific, stressed the importance of coastal fisheries to the Pacific Islands nations. He said while they were the most important resource for the region, coastal fisheries were not well documented or understood, and posed a major management problem for Government.

Professor South said the International Ocean Institute had been heavily involved in coastal management strategies and issues, and had also been at the forefront of the development of training programmes and courses targeting coastal managers and senior government decision makers in the ocean sector. Starting in 1984, a project was developed between the USP and the Forum Fisheries Agency for the delivery of a

regional training programme and courses on Ocean Resources Management. In 1992 the University assumed responsibility for the Ocean Resources Management Programme (ORMP), and was moving towards the development of a degree programme at the bachelor's level, majoring in Ocean Resources Management.

The course was attended by 23 participants from the Cook Islands, Fiji, Federated States of Micronesia, Kiribati, Palau, Papua New Guinea, Philippines, Solomon Islands, Tonga and Western Samoa. The Course Coordinator was Joeli Veitayaki, Coordinator of USP's Ocean Resources Management Programme, who delivers two of the five modules. The other course developers and lecturers were Dr D.W. Keats, visiting IOI Scholar from the University of Western Cape, South Africa, and Ms Vina Ram-Bidesi, lecturer in ORMP. Funding for participants was provided by IOI South Pacific, under the Global Environmental Facility/United Nations Development Program Project.

(Source: USP)



■ THREAT TO MARINE BIODIVERSITY UNDER-ESTIMATED

At the Marine Coastal Biodiversity Conference held during the first two weeks of November 1994, biologists, ecologists and scientists stressed the importance of a taxonomic database for living species and the conservation of biodiversity.

The two-session conference was held at the East-West Center at the University of Hawaii. The first session took place from 2 to 4 November and covered species systematics and information management priorities. Speakers came from around the

world to contribute their knowledge and expertise about software and geographical information systems.

The second session took place from 6 to 9 November and covered topics about population, development and conservation priorities.

The term biological diversity has more than one interpretation. The U.S. Congressional Office of Technology Assessment has defined biological diversity to include: species diver-

sity (the variety of species in an ecosystem), ecological diversity (the variety of biological communities) and genetic diversity (the genetic variation that occurs among members of the same species).

The variety of species, ecosystems and habitat influence the productivity and services provided by ecosystems. As the variety of species in an ecosystem changes, the ecosystem's ability to provide other invaluable services changes too.

One of the main themes of the biodiversity conference was the need to enable countries to sustainably manage their own renewable resources. Efficient biodiversity data management is a crucial component of this process. What is a taxonomic database and why is it so important?

The World Conservation Monitoring Center (WCMC), which handles global diversity data, is one agency that disseminates information on biological resources, their conservation and sustainable use at the global level. Its information service is used by governments, development agencies, non-governmental organisations and multinational corporations, as well as individual scientists, journalists and conservationists.

Mark Spalding from WCMC said 'It is essential to consider both the user community and the wide array of existing global, regional and national databases'.

Spalding said putting together a database includes: gathering information on species, habitats and sites through an extensive network of contacts; managing and disseminating this information, and promoting the information networks to improve the flow and exchange of data.

Also discussed at the conference was the status of marine biodiversity. It is becoming more apparent that the diversity of species in the ocean has been under-estimated, especially in remote environments such as the deep-ocean floor, and that the environmental threats from pollution are increasing more rapidly and spreading faster than is assumed by marine policy-makers and regulators.

As technology and international trade become intensified, the impact of environmental threats is extended to the oceans. The World Resource Institute said 'Even in Antarctica, penguins far from any agriculture contain DDT, shorelines have been fouled by oil spills, and blue whales are critically endangered. The species and ecosystems suffering the most, however, are in the coastal waters closest to humankind'.

In the last 20 years, marine conservation has become a global concern. Even though fisheries conventions and international agreements concerning seals and whales have existed for some time, only recently have regional sea conventions, conventions to prevent marine pollution, and the UN Convention on the Law of the Sea begun to impose a framework of international ocean law.

Some of the main reasons for the loss of marine biodiversity are: habitat loss, introduced species, over-exploitation of species, pollution, global climate change and industrial agriculture and forestry. The underlying problem can be traced to the increase in pollution. Jenny Bryant from the Department of Geography at the University of the South Pa-

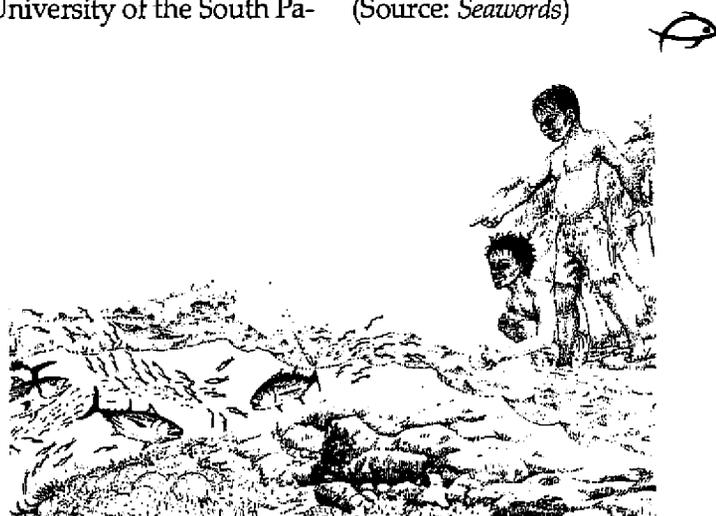
cific, Fiji, said that the population of coastal areas is now equal to the entire population in the 1950s. Bryant gave further insight on status and changes in human settlements in the tropical Pacific Islands.

'The term human settlements has a broad range of meanings', she said. It refers to the development of cities, land use and tenure, population densities and numbers, employment and health-related issues, sanitation, and other economic and political factors.

According to Bryant, urban construction has often created damage out of proportion to coastal ecosystems. For example, deforestation has led to severe erosion in the Cook Islands, French Polynesia and Hawaii. Sea turtles, whales, sharks, giant clams and black coral are endangered or extinct in some areas of the Pacific due to over-exploitation.

Coastal areas are becoming over-exploited because of tourism, especially in the tropical islands because of their beaches, coral reefs and sea life, lush vegetation, scenic beauty, sunny climates and culturally diverse and friendly resident populations.

(Source: *Seawords*)



■ TUNA NEXT FOR TONGA FLEET

Fishing has been an important activity in Tonga since ancient times. However, it was just 20 years ago that the seamount-based commercial snapper fishery began; it is now Tonga's most important fishery. The past year (1994) has seen a large increase in tuna fishing with monofilament longlines and the outlook for tuna development is optimistic.

Tonga has developed a US\$ 1 million plus snapper export industry and present catches are well within sustainable limits, according to stock research. Now, Tongan fishermen are looking to tuna as the next big fishery to exploit.

The Kingdom of Tonga is a country consisting of about 150 islands, which are a considerable distance from the equatorial tuna purse-seine fishing grounds and slightly to the north of the area where Korean and Taiwanese vessels achieve high albacore catch rates using conventional Asian longline gear. The Tonga zone is, however, endowed with underwater topography such as seamounts, underwater volcanoes, and trenches which are conducive to good snapper fishing.

Little was known about the snappers and other bottomfish which inhabit the deep waters of the reef slope and seamounts of Tonga before the 1970s. Exploratory fishing in the 1970s by the Food and Agriculture Organization (FAO) and the South Pacific Commission (SPC) showed that catches of several snapper species could be made in waters up to 400 m deep.

It was demonstrated that these fish were present in substantial quantities and a comprehensive fisheries development programme was, therefore, carried out by the Tonga Government with FAO and SPC assistance. This was not easy. The programme included designing boats appropriate for Tonga's fishermen, teaching boatbuilding

skills, training fishermen in snapper fishing techniques, and starting a biological research programme to ensure conservation of the stocks.

To date, 41 FAO-designed vessels have been constructed by the Ministry of Fisheries specifically for snapper fishing. A typical trip starts early on Monday morning when the crew load ice, food and fuel on to their 9 m wooden vessel. They sail perhaps 75 nautical miles from the main port of Nuku'alofa.

Although the ocean surrounding the islands of Tonga is several thousand metres deep, there are over 100 seamounts which rise up relatively close to the surface. These seamounts are where the snappers are found. A snapper boat anchors on a seamount and the crew use four large hand-operated fishing reels to lower their lines. To each line are attached three to eight hooks (size 3 to 6 Mustad tuna circle hooks) baited with either saury, skipjack or squid.

Fishing seamounts is hard work. At a depth of 300 m, it takes a crewman about eight minutes to crank up the hooks, even with snapper fishermen who do not have delicate arms! During a good fishing day, four hours can be spent grinding on the large reels and fine-weather trips mean from two to three days being spent on the grounds, followed by a day motoring back to port.

Most vessels arrive in Nuku'alofa late on Friday night and fish are unloaded the next morning at

the market. Prime individuals are selected for export. Two species, the longtailed red snapper (*Etelis coruscans*) and the pink snapper (*Pristipomoides filamentosus*), are especially valuable. Export fish are carefully weighed, repacked in ice and stored in a chillroom ready for the weekly flight to Hawaii.

These fish are painstakingly packed in special fish export boxes. Air cargo space on the Hawaii-bound flight is quite limited and the available space is not known until just before departure, so fish exporters do not relax until their fish has been loaded on. Quality is extremely important in the snapper business. How the fish is handled from the time it comes on board the boat to when it reaches the consumer makes a huge difference in price. Badly-handled fish does not even earn enough to pay air-freight costs. Good fishermen have a large bag of tricks to make their fish look 'fresher than fresh' when it arrives at the final destination.

These include: touching the fish only with gloves; handling the fish by the gills and never by the tail; not letting fish touch the deck; placing fish in an ice/salt-water slush for a few hours on capture for rapid cooling before packing in ice; using ice with no sharp edges; and having 4 kg of ice on board for every kilogram of fish. A well-handled fish will have clear eyes, red gills, scales intact, a brilliant coloration and an absence of even minor bruises when being examined by a wholesale buyer in Honolulu or Tokyo.

Snapper is the country's most important commercial fishery, producing over US\$1 million of export revenue and employing over 200 people in fishing, marketing and other services. Tonga's snapper resource is not infinite, however. The Ministry of Fisheries has conducted a

comprehensive biological research programme for the past five years and this has shown that present exploitation is within biologically sustainable limits. Net sustainable economic benefit, however, would probably increase if there were somewhat fewer fishermen.

So the future challenge for the Ministry of Fisheries will be to determine the most appropriate approach to maximise the fishery's economic return.

(Source: Bob Gillett — *Fishing News International*)



Mono-lining takes off

Four species of tuna are found in commercial quantities in Tonga: albacore, yellowfin, bigeye and skipjack. In the late 1970s, research was carried out on these fish in which thousands were captured, tagged and released. This work showed that tuna tagged in the Tonga 200-mile zone and adjacent areas moved to Papua New Guinea, Tahiti, New Zealand and Micronesia. Although over a million tonnes of tuna is caught annually in the area to and from which Tonga's tuna migrate, the amount caught in the waters of Tonga is a tiny 300 t.

Tonga's inshore and reef fisheries are mostly heavily exploited, so interest in tuna is easy to understand. Tuna are caught by a variety of methods in the Kingdom. There were many traditional Tongan techniques, including the use of pearl-shell lures for catching small tuna on the surface.

Commercial-scale tuna fishing in the tropical Pacific is done by longlining, a method used in Tonga by both Asian and Tongan vessels since the early 1950s, when the target species was mainly albacore for the Starkist and Van Camp canneries in American Samoa.

The newer method of longlining uses smaller vessels (35 to 80 ft. — 10,7 to 24 m) and 1200 lb. (545 kg) monofilament longline from which 1,000 to 3,000 hooks are set. Tuna caught with this gear are landed in prime condition, handled extremely carefully and rushed to overseas markets. Monofilament gear is targeting fish for the fresh sashimi trade and so the market price may be 20 times greater than that for canning-grade tuna caught using older Asian gear.

For example, a single fish caught by a Tongan-owned and operated monofilament longline vessel recently sold for TS 3,000 (T\$ 37/kg) in Japan. It is fortunate that many handling techniques and marketing channels developed for snapper are transferable to tuna.

Tuna fishing with monofilament gear has been under way for less than a year in Tonga, but it has been very successful in neighbouring countries. One Fiji fisherman, who started with a single vessel a decade ago, has acquired 18 monofilament longline boats and exports US\$ 20 million worth of high-grade tuna.

Because of certain oceanographic features in Tonga, he has stated that the potential in Tonga should be at least as great as for Fiji. Both the tuna resource situation and potential business profitability have contributed to the recent tuna excitement in Tonga.

Another factor has been Government policies. In mid-1993, the Ministry of Fisheries decided that the promotion of tuna fishing should be a priority. Subsequently, a cabinet-level decision was made that allows all Tongans access to the Kingdom's tuna resources.

The Ministry's vessel Ektaki is now being fitted with commercial monofilament gear and it is the intention that, after a period of trial fishing under an American-sponsored project, the vessel will train private sector fishermen in monofilament longlining.

Ministry support to tuna fishing has not been limited to large commercial operations. Placing fish aggregation devices (FADs) — buoys anchored in the open sea — has enabled small troll fishermen to catch more tuna, for instance.

Although there is cause for optimism about tuna fishing in Tonga, problems must still be overcome. High-quality tuna must be air-freighted overseas, so the industry is at the mercy of airlines. A major constraint is that each productive tuna vessel requires three tonnes of air cargo space a week. In addition, a shortage of repair facilities and skilled fishing captains could slow growth.

However, the resource is there, business potential has been demonstrated and the Government is providing support. Now, the challenge is to put all the pieces together.

■ SEAFOOD CONSUMPTION AND HEALTH

One often hears people say that 'fish is good for the brains'. In fact its composition makes it a healthy food for the whole body.

In general, the nutrient composition in 100 g of fish is as follows: protein, 17–22 g; lipids, 1–6 g; carbohydrates, 0.8–1 g; water, 80 g (see *SPC Fisheries Newsletter* #64).

A laboratory finding of Norwegian scientists is that fish fat also fights cancer. In their tests, the reproductive ability of leukemia cells was impaired by treatment with Omega-3 fatty acid similar to that found in fish oil. Concentrated fish fat had a healing effect on skin disorders such as eczema.

Researchers in Spain have concluded that regular consumption of fish can help prevent asthma. Studies are being undertaken by the Spanish Medical Society, SEPAR, on various



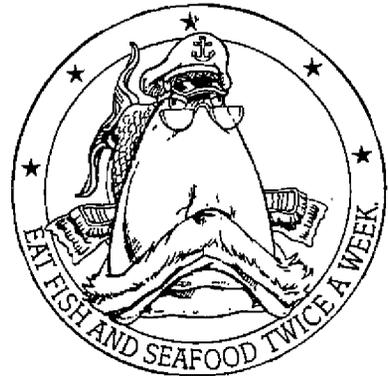
groups which suffer from the disease. Similar research is also being carried out in Australia.

The Japanese say that eating fish, raw or processed, 'improves the brain', but whether this accounts for their economic success remains to be ascertained.

A Japanese tuna processor, however, has come up with a product 'that can effectively improve mental activities by increasing learning functions, memory retention and recall, and also generally improve physical health by suppressing allergies and reducing cholesterol'.

The renowned U.K. medical journal, *The Lancet*, in a recent issue, ran an article that raised the possibility that eating more fish could 'calm us down'. It particularly mentions consumption of such species as herring, mackerel, salmon, sardines and sprats.

A study which the articles cites suggests that people with a high level of a certain type of fat called triglyceride in their blood tend to be more aggressive. Oil found in fish lowers these levels. This is due to the action of a special type of polyunsaturate, Omega-3. Dr Ray Rice of the British Fish Foundation says that a reduction in aggression 'may be one more of the factors contributing to the explanation of how eating more oil-rich fish reduces the risk of heart disease'.



Still in the United Kingdom, research into seaweed has shown that through an advanced form of chromatography using a seaweed-based material called agarose, the cost of a new generation of drugs can be reduced a thousand times. The technique using seaweed is now being used to manufacture anti-cancer drugs.

From Malaysia's University of Science has come the news that a species of sea cucumber (*Holothuria atra*) may be used in the treatment of ringworm (a fungal infection) and serve as an antiseptic.

From an extract of the sea cucumber, researchers have isolated four toxins, two which were found to retard ringworm growth. The extract was also found effective in healing cuts.

(Source: *SEAFDEC Newsletter*)



■ BALLAST-WATER UPDATE

The New Zealand Ministry of Agriculture and Fisheries (MAF), in consultation with other government departments and related agencies, is considering the following measures relating to cleaning of vessels, and is

particularly concerned about the ballast-water issue.

Targetting high risk vessels

Although the discharge of any ballast water will carry the at-

tendant risk that exotic organisms could be discharged, it is assumed that certain discharges pose more of a risk than others, depending on factors such as type of vessel, cargo stowage, origin of the ballast, structure of

ballast tanks, length of voyage and quantity of discharge.

Although no sampling and analysis of ballast water are undertaken, indications are that certain ballast water discharges should be restricted.

For example, the Pacific seastar (*Asterias amurensis*), a voracious shellfish predator, has been introduced into Tasmania (presumably in ballast), where it has bred prolifically. MAF has received scientific advice that it would be prudent to ban the discharge of ballast water originating in Tasmania between July and January of each year when the larva of the seastar is present in the water.

MAF intends to follow the advice given and is consulting with shipping interests. This policy reflects a departure from the current voluntary code of practice (COP) used for ballast discharge which requests mas-

ters either not to discharge ballast water in New Zealand or, if that is not possible, to exchange ballast water at sea prior to arrival. The policy change is unlikely to prove too arduous for shipping interests as the amount of Tasmanian ballast discharges in New Zealand is minuscule.

Ban on hull scraping

To reduce drag on a ship as it moves through the water and for maintenance, marine flora and fauna must be removed from a vessel's hull. This usually takes place in a dry dock but sometimes while the vessel is berthed. Marine flora and fauna growing on the hull are scraped off and introduced into the marine environment. MAF intends to restrict this practice after consultation with shipping interests and companies that offer this service.

Research

There is ample evidence that a risk is present from the discharge of ballast water, but the risk has not been quantified. If 90 per cent of vessels comply with the COP and it is accepted that the provisions of the COP are efficacious, then the risk to New Zealand may be minimal. However, there is insufficient evidence at present to establish this. The COP has reduced the risk but the amount of reduction is unknown. Research that pertains specifically to New Zealand is needed.

Over the next three months a ballast water sampling/analysis programme (including costing and who should pay) will be developed to ascertain the extent of the risk. Further research will be decided depending on the results of the sampling and analysis programme.

(Source: *Sentinell*)



Ballast-water discharge

The need for introducing regulations to control ballast water discharge by visiting ships is being considered by Nelson local authorities.

There are fears that giant sea worms (Sabella sp.) which have infested some South Australian waters could also arrive in New Zealand and threaten its multi-million dollar shellfish industry.

MAF Fisheries scientist Barbara Hayden says the worms, which grow up to 50 cm in length, could be brought over in ballast water or on the hulls of ships. Each worm constructs its own dense outer covering as it grows, into which it can withdraw itself for protection from predators. The worms form dense colonies, crowding out other marine organisms.

Barbara Hayden says that if the worms, originally from the Mediterranean Sea, are able to thrive in Australian water, there is a good chance for their being able to survive around New Zealand. They could adversely affect the shellfish industry.

(Source: Professional Fisherman)

BOTTLE-TOP FISH SCALER

A simple and effective fish-scaler has been developed by the FAO/DANIDA Training Project on Fish Technology. Serrated bottle caps (i.e. beer- or mineral-water-type) are loosely

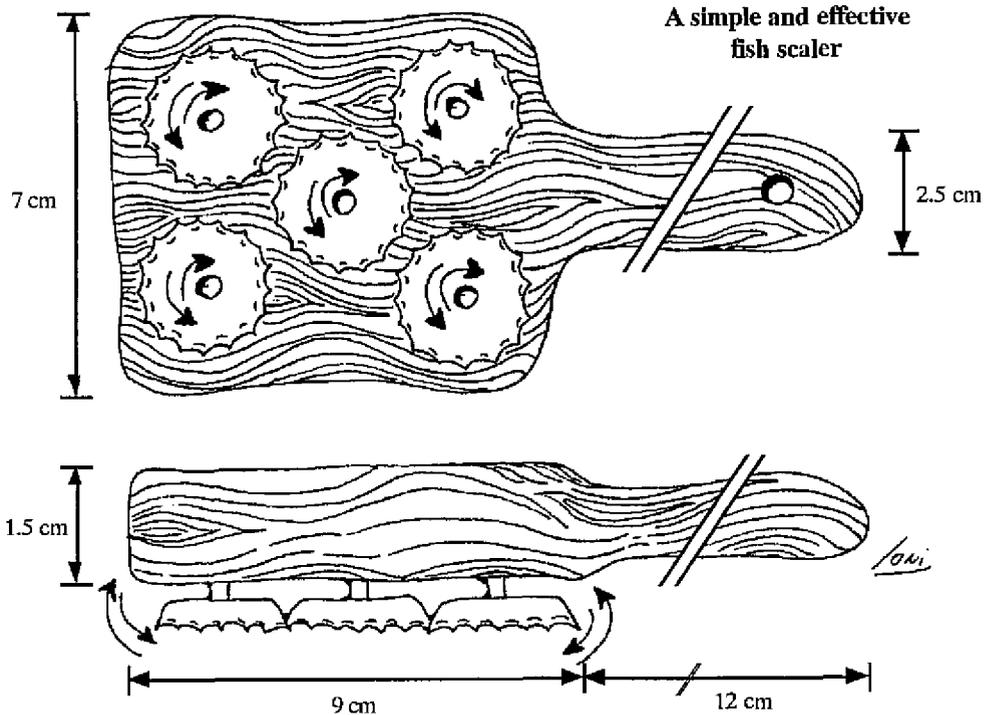
nailed to allow rotation on a piece of wood shaped like a square bat.

The wooden base is made from clean hardwood, coated with

either food-grade plastic resin or with a paint that is safe to be in contact with food. The bottle caps are stripped of any paper, plastic or rubber seal and glue.

Usually fish-scaling is carried out using the back of a knife, but the cap scaler has been found to cause less damage to the skin of the fish. The fish is held firmly by the tail and the scaler is moved from the tail to the head of the fish, firmly but gently. Because of the greater area covered by the scaler compared to knife, the scaling process is quicker to carry out. The configuration of the caps can be varied in order to adapt the scaler to different types of fish.

The scaler has other useful applications such as removing small feathers from poultry.



However, a scaler used on poultry should not then be used on fish as this could cause cross-contamination by bacteria such as *Salmonella*. All scalers should be thoroughly cleaned after use

with a brush in chlorinated or soapy water, or with other appropriate cleaning agents.

(Source: *SPORE*)



THE INTERNATIONAL WORKSHOP ON SEAFLOOR MAPPING IN THE WEST AND SOUTHWEST PACIFIC

Scheduled more than a year ago, the International Workshop on Seafloor Mapping in the West and Southwest Pacific, organised by the South Pacific Applied Geoscience Commission (SOPAC), a regional organisation based in Fiji, was held from 4 to 8 November 1994 at ORSTOM's headquarters in Noumea, New Caledonia.

This workshop brought together more than 100 high-level scientists from 22 different countries and territories: Australia, Belgium, Canada, the Cook Islands, Spain, Fiji, France, Great Britain, Japan, Kiribati, Niue, Norway, New Caledonia, New Zealand, Papua New Guinea, French Polynesia, the

Solomon Islands, Tonga, Tuvalu, the United States of America, Vanuatu and Western Samoa.

One after the other, representatives from SOPAC's member countries mounted the podium to report on a full decade of work in seafloor mapping, an area, like many others, in which there have been many changes.

Besides exchanges of information and a display of a large number of posters and other large-scale materials, the workshop also allowed different working groups to come up with recommendations on the various areas of specialisation.

One working group in particular studied the effects of seafloor mapping on the assessment of reef and lagoon resources and on the development of fishing activities on the reef slopes and seamounts.

The reef slopes and seamounts assume a very great economic importance for the region's countries and territories. The distribution of target species and the fishing techniques used are closely related to the topography and nature of the seafloors. However, depth contour surveys should not be disregarded.

In New Caledonia, several fishing experiments are scheduled and will act as a follow-up to seafloor mapping surveys. The 'HALICAL' surveys will use a bottom longline at depths of between 500 and 800 m in the area mapped by the Zonoco 2 mission (North of the main island and the Loyalty Island Province; see *Fisheries Newsletter* #70) and a deep-bottom

trawl at depths of between 800 and 1500 m in the area mapped by Zonoco 1 (West of New Caledonia).

Similar mapping surveys in New Zealand and Australia have allowed identification of areas of potential interest to fishermen. The recent developments in New Caledonia, New Zealand and Australia suggest that a

greater effort should be made on the depth-contour surveys at depths between 500 and 2000 m. The alfoncin (*Beryx splendens*) and related species live on the seamount plateaus in the region and the emperors (*Hoplostethus atlanticus* – orange roughy) live on the sharp seamounts.

(Source: ORSTOM)



■ LAST QUARTER'S CLIMATE

July 1994

Mixed climatic conditions continued during July, and it is not at all clear whether the 1991–1994 ENSO episode can be considered to have finished. The narrow tongue of below-average sea-surface temperatures (SST) seen recently along the Equator in the eastern Pacific, which is usually a sign of an emerging La Niña episode, has extended westward and deepened a little.

However, there are strong ENSO features, particularly the extensive and growing areas of SST anomalies in the central and north Pacific (up to +1.5°C) and in the south Pacific around the dateline (down to -1.5°C), and the systematic anomalies in pressure patterns leading to a continuing negative Southern Oscillation Index (SOI) (-1.7), 0.8 below that of June. Equatorial easterly winds also show a dual character, being stronger than usual (typical of La Niña) over the cold eastern seas, and weaker than usual (ENSO) over the warm central Pacific pool.

The Pacific Islands rainfall data show that the South Pacific Convergence Zone (SPCZ) continued to be more active in eastern areas from Samoa and Tonga across to Cook Islands and especially French Polynesia.

There was also an area of above-average rainfall along the Equator between Papua New Guinea and western Kiribati.

Rainfall was 150 per cent to 200 per cent of average in these areas.

Record July rainfalls occurred in the southern Cook Islands, with five times average at Mauke (363 mm) and almost four times average at Mangaia (421 mm).

Extremely dry conditions continued over Australia (its Bureau of Meteorology has just issued a drought press release), and a belt of low rainfall (30 to 50% of average) extended across the north Tasman Sea, affecting New Caledonia and Norfolk and Kermadec Islands. Western Kiribati and most of Fiji were drier than average. Labasa, Fiji measured rainfall of just 1 mm, equal to the previous lowest since records began in 1956.

Air temperatures, like SSTs, continued to be above average in the east and below average in the west. TOGA Sea Level Center readings for the previous month (June) showed sea levels were generally above average in most north and south Pacific islands regions by about 5 – 10 cm.

August 1994

Climatic conditions during August indicate a continuation of the current 1991–1994 ENSO episode. The narrow tongue of below-average SST contracted eastwards and deepened a little.

However, there are strong ENSO features, particularly the extensive and growing areas of SST anomalies in the central and north Pacific (up to +1.5°C) and in the south Pacific around the dateline (down to -1°C), and the systematic anomalies in pressure patterns leading to a continuing negative Southern Oscillation Index (SOI) (-1.9), 0.2 below that of July. Furthermore, equatorial easterly winds are weaker than usual over the warm pools of the central and western Pacific Ocean.

The Pacific Islands rainfall regime was similar to that of July, in that the SPCZ continued to be more active in eastern areas from Samoa across to the northern Cook Islands and especially French Polynesia. There was also an area of above-average rainfall along the Equator between Papua New Guinea, Vanuatu, western and central Kiribati. Rainfall was mostly 150 per cent to 300 per cent of average in these areas. Record high August rainfalls occurred at Canton Island, central Kiribati

(315 mm, just over six times average), and in Vanuatu and French Polynesia, with over three times average at Pekoa (418 mm), Hereheretue (216 mm) and Tahiti-Faaa (169 mm).

Extremely dry conditions continued over Australia, with no rainfall at numerous sites (the Bureau of Meteorology has issued another drought press release), and a broad belt of low

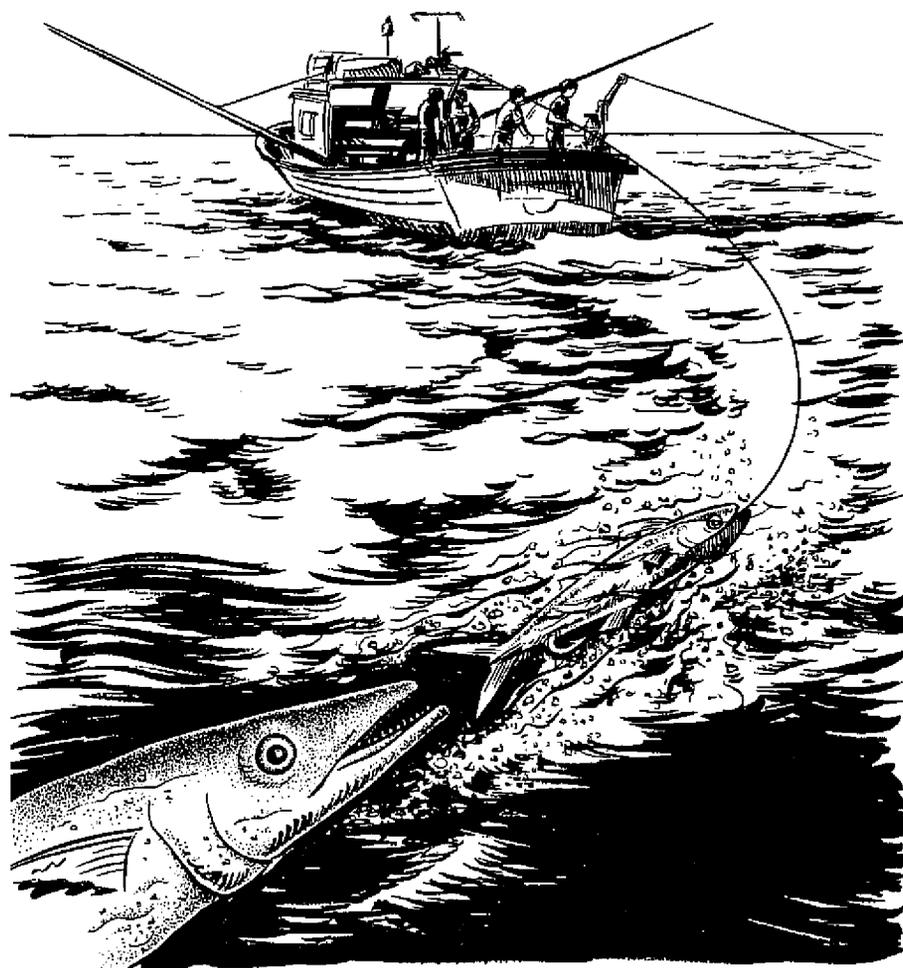
rainfall (10 to 50% of average) extended south along the date-line from Fiji to New Zealand. Drought now prevails over much of western Viti Levu, Fiji, with Nadi and Lautoka having received no rainfall at all in August. Record low rainfall was measured at Vava'u, Tonga (6 mm) and Raoul Island (9 mm). Air temperatures were below average by about 0.5°C in Fiji, Tonga and the Cook Islands,

and above average by up to 1°C in eastern Kiribati. TOGA Sea Level Center readings for the previous month (July) showed sea levels were generally above average in most north and south Pacific islands regions by about 5–10 cm.

(Source: *South Pacific Climate Monitor*)



Note from the Editor: As you may have noticed, only two months' climate were reported in this issue. Unfortunately the Editor of the South Pacific Climate Monitor has informed us he had to terminate the production of this bulletin, due to lack of financial support. Every month for nearly three years, the South Pacific Climate Monitor has been providing a high-quality appraisal of the month's climate in the South Pacific Islands region and a climate outlook for the coming months. Several salvage options have been considered, including continuing to seek long-term funding, developing the Monitor to make it financially self-sufficient, and developing a project to transfer the Monitor operations to a Pacific Island country.



■ PROCEEDINGS OF AN INTERNATIONAL WORKSHOP ON TRADITIONAL MARINE TENURE AND SUSTAINABLE MANAGEMENT OF MARINE RESOURCES IN ASIA AND THE PACIFIC, SUVA 4 – 8 JULY 1994

The last issue of the *Newsletter* mentioned that an international workshop on traditional marine tenure and management had been convened in Suva during July by the International Ocean Institute. The meeting was held at the University of the South Pacific and was supported by the Western Pacific Fisheries Consultative Committee and the Government of France.

The objective of the meeting was to promote the exchange of information on customary marine tenure (CMT) and management between researchers and fisheries managers in South-east Asia and the South Pacific. For this reason, the meeting was attended by participants from the Philippines, Indonesia, Thailand and Vietnam.

The proceedings of the meeting were published in November 1994 and contain all the papers addressed at the meeting plus summaries of the various discussions that took place following each presentation. Marine tenure systems were described for a number of countries, including the Federated States of Micronesia, Fiji, Solomon Islands, Kiribati, New Caledonia, Palau, Papua New Guinea, Tonga and Vanuatu.

It was clear from these presentations and subsequent discussions that there were few similarities between the traditions of marine tenure in the South Pacific and South-east Asia. Ownership of marine resources is not as strongly perceived in South-east Asia and hence coastal fisheries are open to all in most locations.

However, Maria Mangahas, from the University of the Philippines, documented a number of cases from South-east Asia where forms of marine tenure systems existed or used to exist. In pre-colonial Philippines, fishing rights to sections of rivers were established and could be traded in the same manner as land or crops. This system fell apart under Spanish rule and the eradication of the traditional Philippine communities known as *barrangays*.

Mangahas mentions similar historical traditions of tenure of swamp lands and reef areas in Indonesia. In present-day Indonesia, the Sasi system operates in parts of Sulawesi and East Timor. This system is designed to ensure equality of access to community fishing rights and equity of opportunity to derive both subsistence and economic incomes from coastal resources.

Local people have the right to fish for most fishes in Sasi areas, however, for certain schooling species there may be special rules that are invoked by a headman depending on his interpretation of the fishes' behaviour. Mangahas concluded her presentation by noting that marine tenure systems had been inadequately documented in South-east Asia. This may be because they are not immediately obvious to fisheries biologists whose training and background do not sensitise them to local institutions.

An excellent example of this from the South Pacific was provided by James Turner from the East-West Centre in Hawaii. Turner examined the problems

associated with a small seasonal tuna baitfish fishery at Arawe on the south-west coast of New Britain in Papua New Guinea (PNG). The now-defunct domestic pole-and-line tuna fleets used to obtain bait by fishing coastal waters in PNG and paying a compensation payment based on 2.5 per cent of the FOB price of tuna.

The demarcation of various bait grounds in PNG was carried out by fisheries officers using natural features on maps to define boundaries. In the case of the Arawe bait ground, the defined boundaries cut across three distinct kinship groups with conflicting claims to the surrounding marine areas. Conflict between these groups over the bait royalty payments was therefore inevitable, but might have been ameliorated with better appreciation of the social structures in the area concerned.

Further details of these presentations and the discussions they generated are contained in the Proceedings, which run to a hefty 312 pages. Even those fisheries personnel with little interest in CMT are likely to find something of interest in this volume. I would recommend in particular the workshop overview by Professor Ron Crocombe of the Institute of Pacific Studies. Professor Crocombe outlined succinctly the role of CMT in the past and how it is likely to develop in the future. He suggested that most work in the region on CMT was concerned mainly with the past, when the region was dominated and influenced by Europe.

However, North-east and South-east Asia will soon exert a greater influence on the region and on institutions and resources such as CMT and fisheries.

Prof Crocombe concluded that this presents both exciting prospects and great problems but that a key to dealing with them is for Pacific Islanders to have as much understanding as pos-

sible of the marine technology, experiences and institutions of the people and cultures who will bring a new set of influences to bear upon them.



■ BIBLIOGRAPHY ON MARINE POLLUTION PROBLEMS IN THE PACIFIC ISLANDS

Morrison R. J. & G. Rao (1994). *Bibliography on marine pollution problems in the Pacific Islands*. Pacific Islands Marine Resources Information System (PIMRIS), The University of the South Pacific Library. 48 p.

The bibliography focuses on documents covering issues relating to pollution, including water quality, contamination, protection of water resources, ocean and atmospheric processes, sources of pollution, analytical methods, surveys, reports and studies.

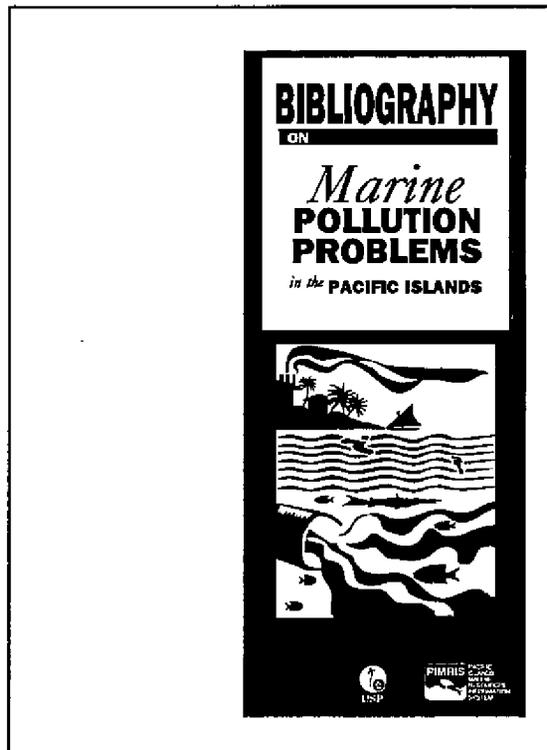
The bibliography predominantly concerns Pacific Island countries, however, a number of references on Australia and New Zealand are also included in view of their relevance to Island countries.

This compilation is a result of a progressive exercise over a period of time. It mainly lists literature generated during the past 15 years. This bibliography provides separate listings by author, categorised under country names.

However, it commences with a 'Pacific - General Information' category. The publication also includes author and subject indexes.

The bibliography is a revised, edited and updated version of an unpublished draft 'Coastal and inland water quality in the South Pacific' by R.J. Morrison, which was prepared for the Fifth SPREP Consultative Meeting in Suva in June 1990.

For more detail on this bibliography, contact the Pacific Islands Marine Resources Information System (PIMRIS) Coordination Unit at the University of the South Pacific Library, P.O. Box 1168, Suva, Fiji [Fax: (679) 300830].



WESTERN PACIFIC TUNA STOCKS — A STATUS REPORT

Introduction

The tuna stocks of the area commonly described as the western Pacific – the tropical and sub-tropical waters of the SPC area, extending to the longitude of Hawaii in the east, and including eastern Indonesia and the Philippines to the west – now support annual catches of between 1.2 and 1.4 million tonnes per year. About one million tonnes of are taken within the SPC area, mostly within the EEZs of Pacific Island states.

The western Pacific catch now represents half the global catch of primary market species of tunas; the 1993 catch within the SPC area was valued at US\$ 1.5 billion. Although most of this catch continues to be taken by foreign licensed vessels (locally-owned or joint-venture vessels account for only five per cent of the value of the catch), the resource still represents for Pacific Island countries the most valuable living marine resource and the one most likely to yield significant economic benefit.

This report provides a brief overview of the current pattern and levels of exploitation, arrangements for monitoring of the resource, and the current status of the stocks, at least in biological terms.

The resource

Tunas occur throughout the vast ocean area of the western Pacific, and are individually capable of considerable long-distance movement. The tropical tunas – skipjack, yellowfin and bigeye – comprise most of the resource in the western Pa-

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cific, accounting for over 90 per cent of the catch. (Albacore tuna occur in more temperate waters, as well as sub-tropical waters, and the valuable southern bluefin tuna occurs, for all intents and purposes, south of the SPC area).

Skipjack, the smallest of the tunas, makes up 70 per cent of the catch by volume, and occurs in the surface layers at all stages of its life history. The catch is mostly canned or made into speciality products.

Yellowfin and bigeye tuna, both of which can attain close to 200 kg and are valued as sashimi (Japanese raw fish) species, occur at the surface as juveniles, often in schools with skipjack. Yellowfin are taken as adults in surface schools, and also by longline well below the surface; bigeye, the most valuable species, swim deeper as adults, and nearly all the adult catch is taken by longline.

Surface fish are caught by sophisticated purse-seine vessels, which encircle entire schools, and pole-and-line vessels which use live bait to attract feeding tunas; longlines and vertical handlines are used to take adult yellowfin and bigeye.

A variety of other species may be taken during tuna fishery operations, including various billfish (marlin, swordfish, sailfish), sharks and other species. This is specially true of longlines, and purse-seine sets on floating logs.

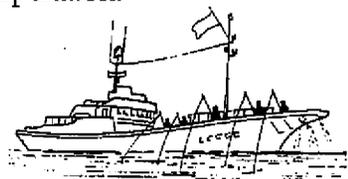
The fishery

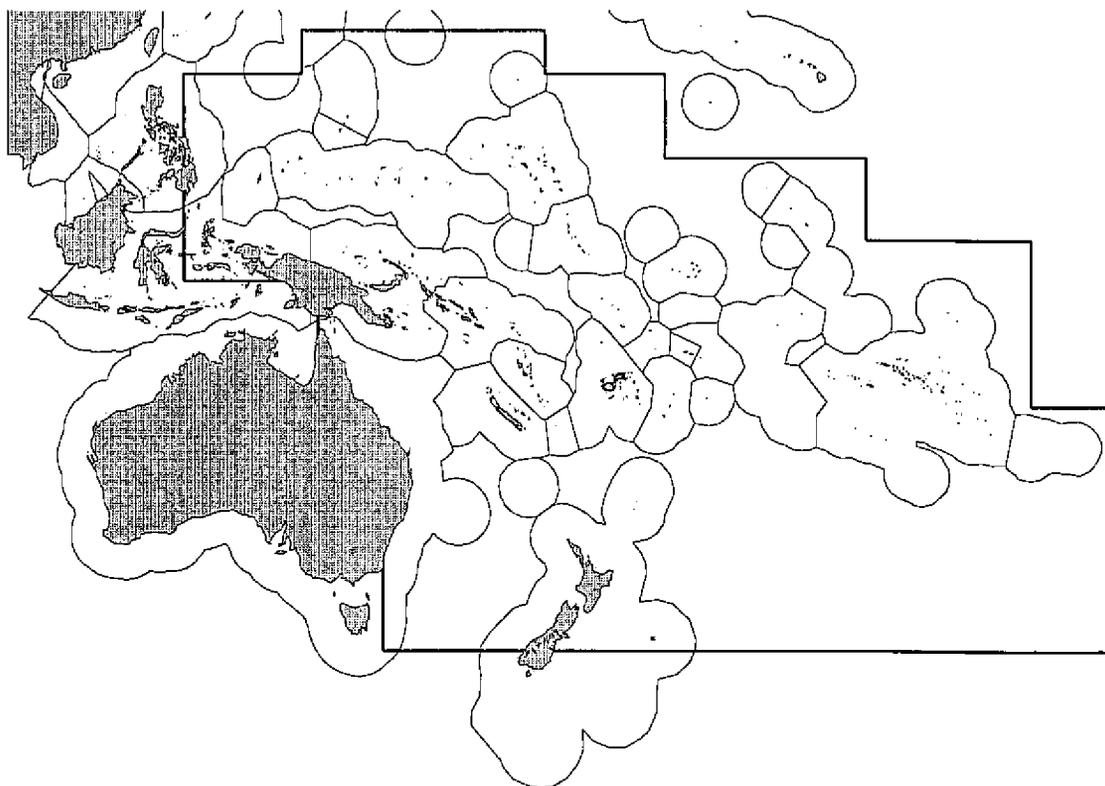
The total catch during 1993 in the SPC area was 930,000 t, a doubling over the past 10 years. Of this, 80 per cent of the catch by volume was taken by purse-seine vessels, which have accounted for most of the catch increase over the past decade. Longline vessels took only 13 per cent of the catch, but this accounted for 45 per cent of the landed value (US\$ 660 million – FFA figures), equal to the value of the much larger purse-seine catch. Pole-and-line fisheries accounted for the remaining 7 per cent by volume and 9 per cent by value.

The purse-seine catch is concentrated in equatorial areas (between 10°N and 10°S), mostly within the EEZs of members of the Nauru Group of countries. The longline catch is more widely distributed.

The total catch in the western Pacific peaked during 1991, and has declined slightly since then, partly due to bans on high-seas transshipment, enforced by Nauru Group countries.

In 1993, Japan remained the largest producer (238,000 t), followed by Taiwan (208,000 t), the USA (195,000 t) and Korea (178,000 t). Locally-owned or joint-venture fleets account for only 5 per cent of the total landed value of the catch, although this is slowly improving as domestic longline ventures become established, and purse-seine vessels are acquired by local ventures. High-seas tuna fishing remains, for the most part, a capital-intensive, high-risk operation.





SPC statistical area map

Monitoring and fishery research

With most of the catch taken by foreign fleets, detailed information on catches (how, when, where) should be made available by these fleets on daily catch-and-effort logsheets, as required by the conditions of access to fish Pacific Island nations' EEZ waters. These data, plus the more complete information from domestic fleets, are maintained on a Regional Tuna Fisheries Database (RTFD) by SPC, on behalf of the countries of the region.

Although this has generally worked well for Japanese vessels and of course US vessels under the terms of the multilateral treaty since June 1988, in practice the data coverage has been seriously incomplete. High-seas data have not been required and are not supplied

in daily logsheet form (for some fishing gears, these catches are significant). For some fleets, catches have been not reported or deliberately under-reported, notably in the past by Korean and Taiwanese purse-seine vessels. For 1993, the RTFD contains daily logsheet data on probably 70 per cent of the total catch; this compares with probably 40 per cent or less prior to the US Treaty.

Since the requirement for purse-seine vessels, at least, to transship their catch in designated ports, catches are now able to be more closely monitored and sampled. The SPC's Oceanic Fisheries Programme (OFP) has gradually been increasing efforts to cross-check landings and collect information on size composition of the catch. With the benefit of EC funding, continuous scientific monitoring of the fishery

should become a possibility for the first time in the near future.

With this generally poor coverage (until recently) of detailed catch information, combined with gaps in our knowledge of some key biological features of the tunas themselves (e.g. age, growth rate, reproduction, migration, stock structure), it has generally not been possible to apply conventional fishery science approaches to examining the condition of stocks exploited by the fishery and estimating potential yields.

This approach generally requires good statistical coverage of catches, for a long time series; good understanding of the size or age structure of the catch by the various component gears and fleets; and good understanding of the biology/ecology of the species.

Much of the current information on the status of the tuna stocks in the Western Pacific therefore comes from results of tagging experiments, combined with some information on trends in catch rates. Tagging experiments attempt to mark a representative proportion of the much larger population, which would be impossible to study in its entirety, then look at the subsequent pattern of recaptured fish in time and space to make inferences about the entire population. Recent experiments carried out by SPC's OFP saw 150,000 tunas released throughout the Western Pacific fishery, with 16,000 or 11 per cent of these eventually recaptured. Information from this work forms the basis of much of our current understanding of condition of the tuna stocks in the western Pacific.

Status of stocks

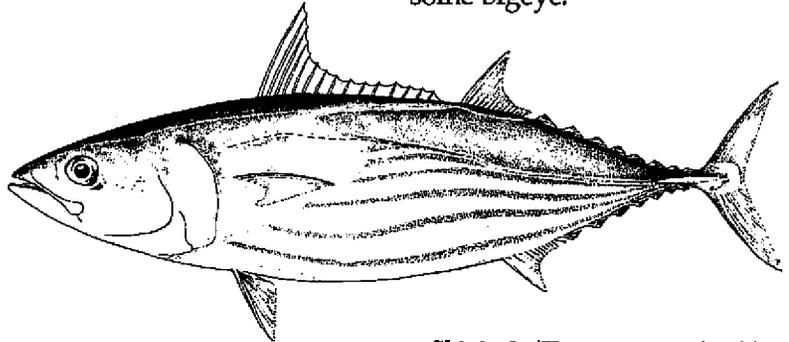
Skipjack

Although skipjack catches have tripled since 1980, catch rates by purse-seine and pole-and-line fleets have generally continued to increase as well. Results of an earlier extensive SPC tagging programme, completed in 1981, suggested that the skipjack resource was very large indeed and only lightly exploited at that time. A potential yield of up to two million tonnes, distributed over the entire SPC area, was suggested.

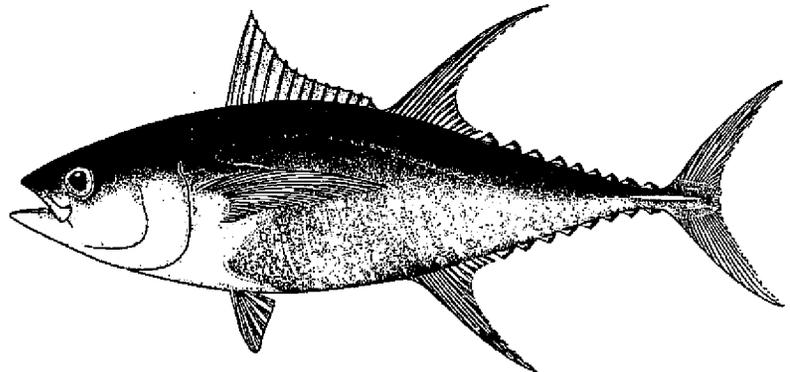
The recent SPC assessment, based on the release of nearly 100,000 skipjack with over 12,000 returns, has confirmed the results of the earlier work and indicates that the current level of exploitation is still low, but has increased in direct proportion to the catch increase. It is predicted with considerable confidence that the record 1991

catch of 1 million tonnes could be increased by 30 per cent and still represent a conservative safe harvest.

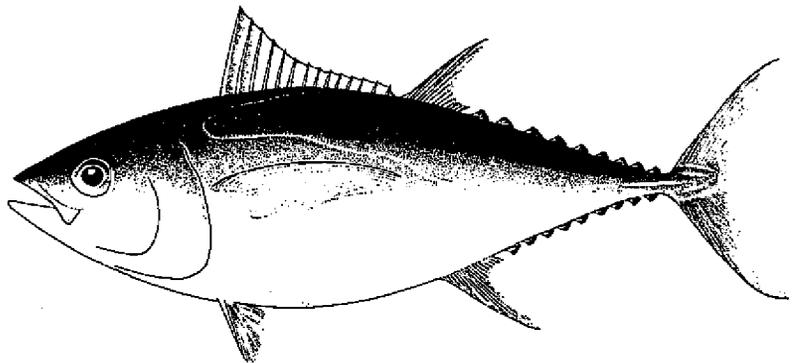
It should be noted that, although the pole-and-line fishery takes overwhelmingly skipjack (>90%), the purse-seine fishery takes significant proportions of yellowfin (25–30%) and some bigeye.



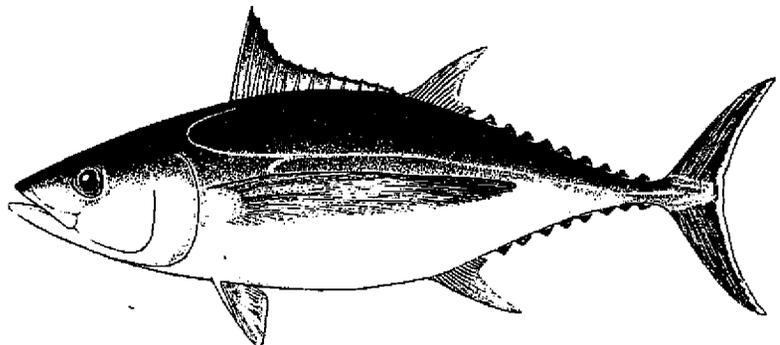
Skipjack (*Katsuwonus pelamis*)



Yellowfin (*Thunnus albacares*)



Bigeye (*Thunnus obesus*)



Albacore (*Thunnus alalunga*)

Yellowfin

The status of yellowfin stocks has attracted more concern, given the steadily increasing catches overall but by purse seiners in particular, and also given the greater value of the catch taken by longline vessels. In 1993, the total yellowfin catch exceeded 400,000 t, with a record purse seine catch of 292,000 t.

Purse-seine catch rates for yellowfin remain variable but stable, but longline catch rates have been declining for some time. Although this is a source of concern, it is, however, still not possible to attribute this decline directly to the effects of fishing.

The recent tagging data again provide the best picture of the average stock condition across the equatorial area where most of the catch originates. These data suggest that current exploitation rates are still low to moderate, and that present catches could probably be increased further, possibly to as much as 600,000 t from the present 400,000 t. Some unanswered questions remain about the effect of the increased purse-seine catch on the more valu-

able (and much smaller) longline catch, but, at least on a regional scale, it has been difficult thus far to detect any negative impacts.

Bigeye

Although the bigeye catch in the SPC area is only a fraction of that of yellowfin (15%), and usually less than 150,000 t (by longline) in the entire Pacific, its high value commands attention. It is, however, the least well understood of the main tuna species.

Catch rates show no clear trends in the SPC area, although there has been Japanese concern recently about declining catches in the eastern Pacific. At face value, the relatively low tag-return rates suggest that exploitation rates of juvenile bigeye are lower than those of yellowfin. Much more work needs to be done on this species.

Albacore

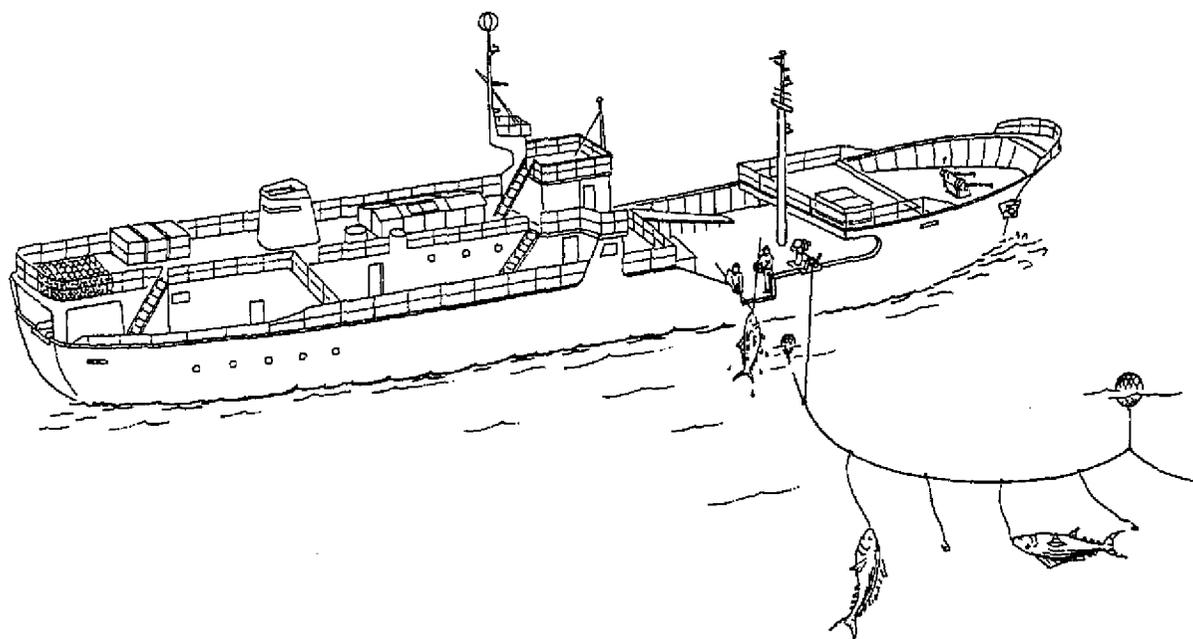
Although now out of the lime-light since various resolutions and restrictions on driftnet activity have been implemented, albacore interestingly show in-

dications of potential overfishing. Recent analyses using age-structured models show a relatively steep decline in stock biomass in recent years, partly as a result of several years of poor recruitment (few young fish entering the fishery). Continuation of fishing, even at present lower levels, may run the risk of overfishing.

Conclusions

Despite sharp increases in the catch of tropical tunas until 1991 and maintenance of similar catches since then, stocks in the western Pacific appear generally to be in sound condition and capable of possibly sustaining further increases in catch. This leaves the Pacific Island countries well placed to extract a better return from this harvest, especially by more direct participation.

The fishery does need to continue to be closely monitored, and the results available, mostly from tagging experiments so far, verified by other approaches. Such activity is planned for the SPC's OFFP, beginning this year.



A STUDY OF THE FISHERY AND BIOLOGY OF *BERYX SPLENDENS* (ALFONSIN) IN NEW CALEDONIA

Introduction

New Caledonia's exclusive economic zone contains many seamounts formed by volcanic activity. Many are concentrated in the south-eastern part of the zone, where they form two characteristic alignments along the eastern border of the Norfolk Ridge and along a southern extension of the Loyalties Ridge (Figure 1). Some have developed into large guyots whose relatively flat tops permit the exploitation of economic demersal species. In other parts of the world, including the northern Pacific, fisheries have developed around such features.

by P. Lehodey and R. Grandperrin
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The early and late 1980s were an extremely important period for the study of the fishery potential of seamounts in the waters of New Caledonia. Three Japanese vessels spent 223 days fishing there. These were the trawler *Kaimon Maru* (26 November to 10 December 1980); the dual-purpose boat *Hokko Maru*, which was bottom longlining and light-fishing for squid (7 February to 5 May 1988); and the longliner *Fukuju Maru* (27 September 1988 to 29

April 1989), which was re-registered under the French flag as the *Humboldt* in 1989. The *Humboldt* fished commercially for a little over two years for Socalpi, a joint-venture company. It began operations on 12 May 1989 and ceased activity on 12 July 1991.

The Territory was anxious to monitor fishery developments in its waters and granted ORSTOM (French Institute of Scientific Research for Development in Cooperation) some funds to carry out research on 'deep-water fisheries in New Caledonia's exclusive economic zone'. A two-year study comprising two segments – commercial fishery monitoring and scientific research cruises – took place between March 1991 and March 1993.

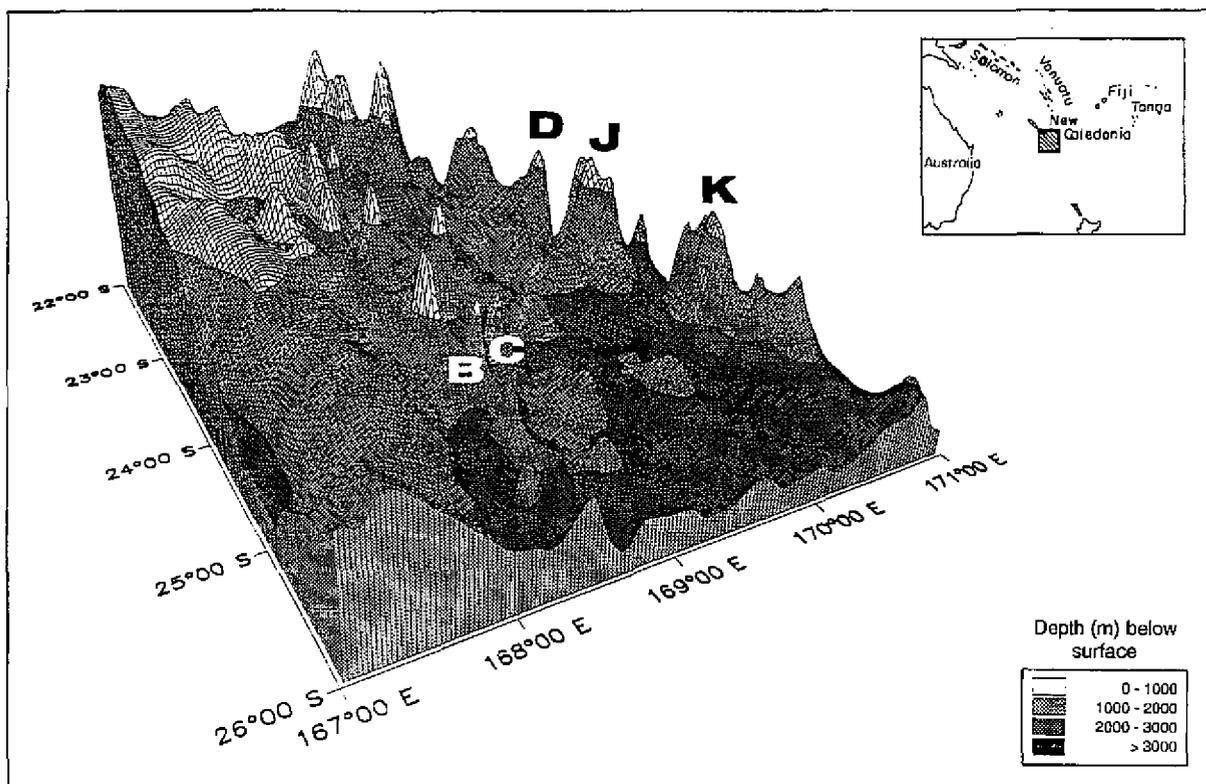


Figure 1: Main seamounts fished for alfonsin, *Beryx splendens*, by bottom longline in New Caledonia [from Lehodey et al., in press]

The commercial *Beryx splendens* fishery

An examination of the fishery's general characteristics revealed that activities (a total of 710 days fishing) were almost entirely concentrated in an area embracing the Norfolk Ridge and a southern extension of the Loyalties Ridge (693 days fishing). Total effort, in all areas and for the whole period concerned, amounted to 4,691,635 hooks (one or two longlines of approximately 4,000 hooks each were usually deployed daily, as portrayed in Figure 2).

Total catches amounted to 1265 t, including 1247 t of commercial species. Catches of the target species, alfonsin (see Figure 3 on page 32), represented 1169 t, accounting for 92.4 per cent of the total catch by weight and 93.8 per cent of the weight of commercial species. The average yield for this species was

24.93 kg for 100 hooks, with the mean individual weight being 1.26 kg.

The other commercial species captured were *Hyperoglyphe antarctica* (Antarctic butterfish) and *Pseudopentaceros richardsoni* (pelagic armourhead), which were only caught over the two ridges, Norfolk and the southern Loyalties (*H. antarctica*: 56.3 t; *P. richardsoni*: 4.6 t). Maximum yields for these two species were recorded in autumn and spring.

Fishing effort (number of days spent fishing and number of hooks deployed) virtually doubled when the fishery moved into its commercial phase. In the Norfolk Ridge-Loyalties Ridge zone (Figure 1), it was concentrated around five seamounts (B, C, D, J, and K). Catch fluctuations roughly reflected effort, although the correlation was less favourable for the last

fishing trips. This fall is, at least partly, the logical consequence of the fact that fishing started on a virgin stock. A detailed analysis shows that the catch per unit of effort (CPUE) recorded seasonal fluctuations, connected with reproduction amongst other factors. When these seasonal fluctuations are eliminated, it may be noted that CPUE stabilised overall during the second phase of exploitation.

The scientific cruises

Eleven scientific cruises (*Beryx* cruises 1 to 11 aboard the *RV Alis*), accounting for 104 days at sea, were carried out, mostly round the three seamounts B, D and K. The following sampling and measurement apparatus was used: similar (but shorter) bottom longline to that used during the commercial cruises, bottom trawl, pelagic trawl, beam trawl, Waren dredge, fish larval net, traps, temperature

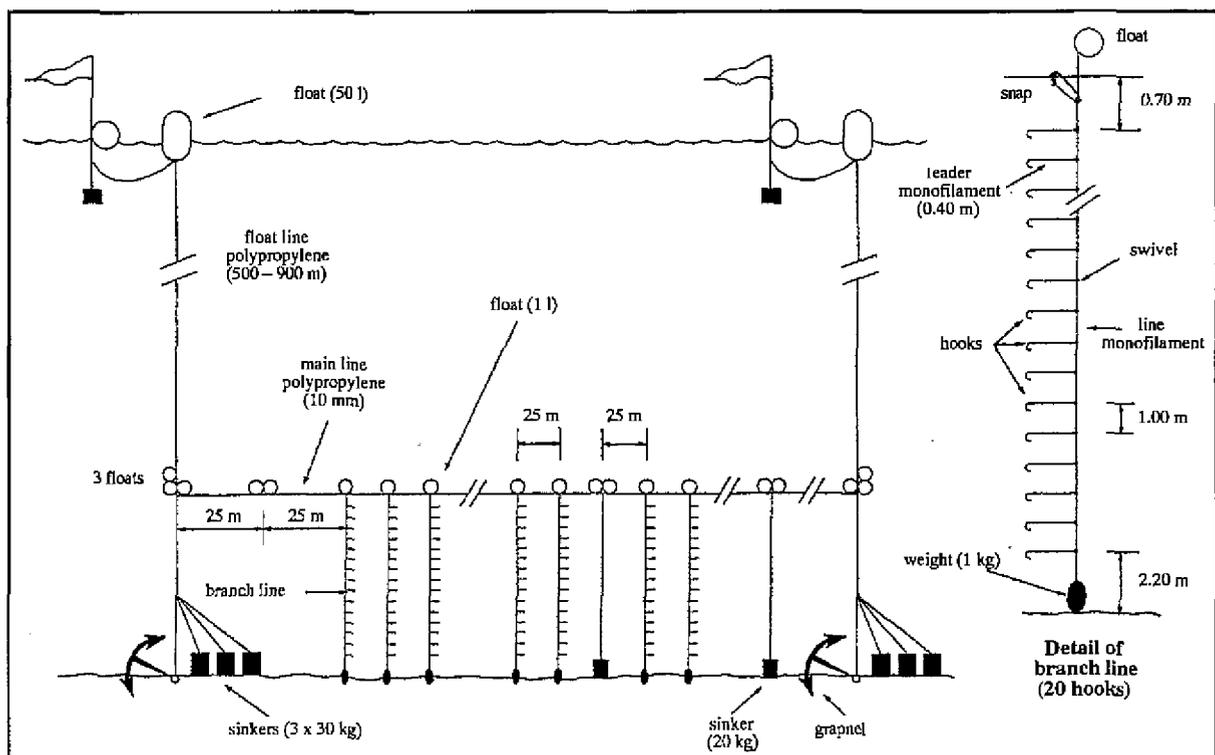


Figure 2: Longline gear used by commercial boats to catch alfonsin, *Beryx splendens*, in New Caledonia [from Lehodey et al., in press]

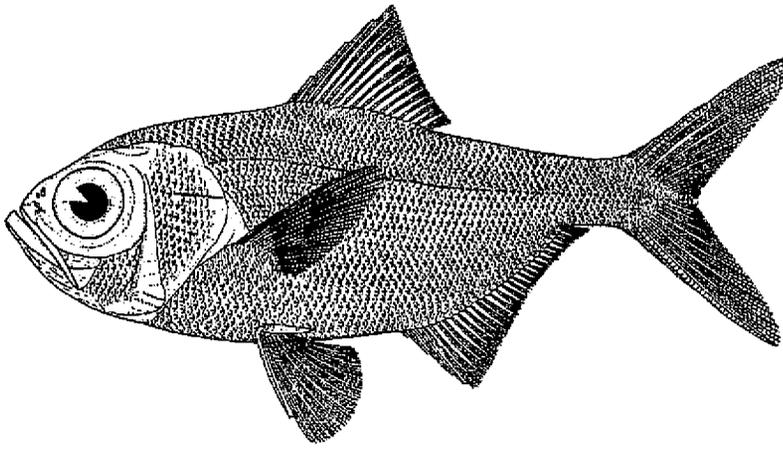


Figure 3: The target species, alfonsin, *Beryx splendens*

and salinity recorder, and a deep echo-sounder coupled to a global positioning system for bathymetric work.

The sea-floor topography was determined by coupling the GPS data with the deep echo-sounder. Seamounts B, D and K emerged as distinctly separate structures from their underlying ridge; they showed a fairly flat summit and an average slope gradient of 20–25 per cent.

The systematic use of a CTD (conductivity, temperature, depth) recorder revealed that the isotherms occasionally rose towards the surface. The hydrological sections drawn from 108 sampling stations enabled us to determine the temperatures of the water layers favoured by *Beryx*; the deepest catches of adults (840 m) were recorded in water at a temperature of 6°C, while the shallowest (500 m) were in a layer at 11°C. The youngest specimens (juveniles with a fork length of between 13 and 17 cm) were found at depths of between 390 and 420 m, that is at temperatures of between 16° and 17°C.

During the scientific cruises, a total of 21,713 fish (9,389 of commercial interest), weighing 15.3 t (including 10 t of commercial

interest) and representing 264 species was captured with the various gear types used. Some *Hoplostethus mediterraneus* and *H. gigas* caught with the bottom-trawl prompted legitimate hopes that *H. atlanticus* (orange roughy) might be present, in view of the close relationship which would appear to exist between the marine fauna of New Caledonia (Norfolk Ridge) and that of New Zealand.

However, only exploratory fishing at depths of between 800 and 1500 m, which is not possible with the *RV Alis*, could prove this. Suitable vessels would need to be chartered (possibly New Zealand, Australian or French). Such cruises could also reveal the presence of other resources, Macrouridae in particular, currently exploited in both New Zealand and Australia. Of these 264 species, a large number were recorded for the first time in New Caledonia, and some of them were new to science.

During the scientific cruises, 8,678 fish measurements, 782 individual weighings, 4,785 gonad samplings, 5,038 stomach content samplings and 534 otolith pair examinations were performed. A total of 2,569 fish was frozen whole for subse-

quent laboratory examination. Analysis of these samplings and fishery statistics has made it possible to outline the biology of *Beryx splendens* and the parameters essential for a study of its population dynamics.

Biology of *Beryx splendens*

Beryx splendens is a benthopelagic species. After a phase in which it forages in open waters (the pelagic zone) during the night, it returns to the bottom (the benthic zone) towards the end of the night. It is, therefore, only capturable with the long-line and the bottom-trawl gears at the end of the night and during the day. However, it might be capturable with a pelagic trawl during the night.

Beryx splendens otoliths are large and show clear annuli which can be read to define the growth parameters. To estimate the time taken to form a nucleus, it was necessary to cut thin sections for microscopic examination. The males grow less rapidly than the females. Three-year-old male alfonsins have a fork length of 24.5 cm, while the same measurement for females is 24.9 cm. The difference between the two sexes grows with age (see Figure 4, page 33).

At the age of 10 years, males reach a length of 37.7 cm and females 40.7 cm. Maximum age is thought to be approximately 20 years, with some individual specimens, however, being able to live longer and reach sizes of over 50 cm. These results are not dissimilar to those recorded for the same species in New Zealand.

Analysis of the macroscopic gonad maturation stages, together with the histological observations made on the thin histological sections of gonad,

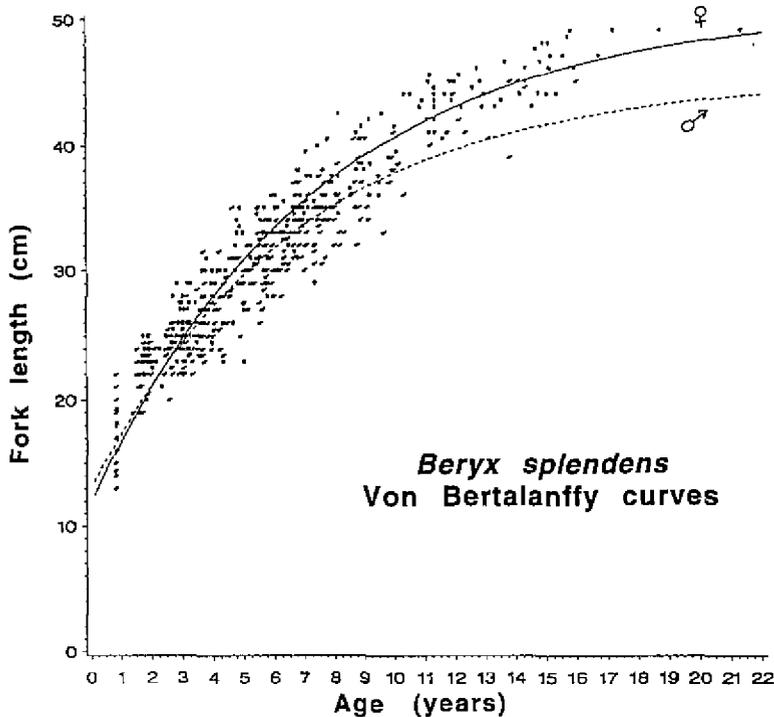


Figure 4: Growth curve of alfonsin, *Beryx splendens* [from Lehodey, 1994]

show that the size at sexual maturity (size L50, at which 50 per cent of specimens are mature for the first time) occurs at 33 and 34 cm respectively for females and males, corresponding to an age of 6 years for females and 7 for males. Spawning takes place during the southern summer, beginning in November with a peak between December and February.

These results are in harmony with observations recorded in the northern hemisphere in the Atlantic Ocean and also in the Pacific, where spawning occurs during the northern summer. On the other hand, they would appear to be contradictory with the results of research carried out in New Zealand, according to which reproduction occurred from July to August, during the southern winter. Fertility is between 270,000 and 700,000 eggs, depending on the size of the specimens; eggs, when spawned, are about one millimetre in di-

ameter. Some larval net sets carried out during the reproduction period harvested many eggs which seemed to be *Beryx* eggs. Attempted *in vitro* fertilisation was a failure.

From 92 larval net sets carried out during and after the reproduction period in the vicinity of the seamounts, none of the great quantities of fish larvae netted could be identified as belonging to the genus including *Beryx*. Their presence would have made it possible to identify larval development areas and an examination of their otoliths could have been used to confirm the duration of nucleus formation.

It may be that the development of juveniles occurs in places other than the habitat of the adults. It is in fact possible to imagine that larvae from eggs laid in the southern part of the zone drift towards the seamount to the north, where their

development until the juvenile stage might be favoured by a winter enrichment of the surface layer.

Examination of 4,806 alfonsin stomach contents revealed the presence of 13,577 types of prey belonging to 205 species or groups of species. Diet varied with time, season, size and depth. Prey was primarily bathypelagic organisms, mostly the many fish which perform nychthemeral (night-day) vertical migration of considerable amplitude. *Beryx* is therefore thought to feed chiefly on migrating marine fauna which draws on the richness of the surface layers during the night, taking it down during the day to the deeper waters. Benthic fauna is not thought to contribute greatly to the trophic chain leading up to the *Beryx*.

It is likely that adult *Beryx* are preyed on by the large benthopelagic predators (deep-water sharks and large Gempylidae) and pelagics (ocean sharks, tunas and associated species, marine mammals). The data available refer to predation on post-larvae and juveniles by tunas and lancet fish (*Alepisaurus ferox*).

Commercial and scientific catches of *Beryx splendens* using bottom longlining provided the source data for length-frequency distributions. Average size increases with depth; these observations can be reliably portrayed by a 'bivariate normal' model which provides CPUE estimates in pure form for any particular seamount. In addition, these data indicate that average size also varies with the depth of the seamount summits, which is taken into account in a 'recursive' model that permits crude CPUE estimates for any given seamount.

Population dynamics of *Beryx splendens*

An analysis of length-frequency distributions suggests that alfonsons migrate between seamounts. The hypothesis according to which each seamount has a separate stock should not therefore be entertained. The exploited area is thought to accommodate a single stock, or possibly two stocks, one corresponding to each ridge (Norfolk and South Loyalties).

The two conventional approaches to population dynam-

ics (production models and 'analytical' models) were used. Under the single-stock hypothesis, the exploitable virgin biomass for the exploited zone would be between 1,793 and 2,254 t; with the two-stock hypothesis, it would be between 2,119 and 3,909 t. According to the various models and applying the natural mortality rates used, annual fishing effort could be estimated at between 1.7 million and 6.7 million hooks.

Without information on stock boundaries, it would be wise policy to base the management of a new fishery on the hypothesis of the existence of a single stock, especially as the observations on the hydrological environment (satellite observations of chlorophyll concentrations, analysis of available hydrological data) have shown the presence of a significant eddy centred between the two ridges, which could favour the drifting of juveniles or the migration of adults from one ridge to another.

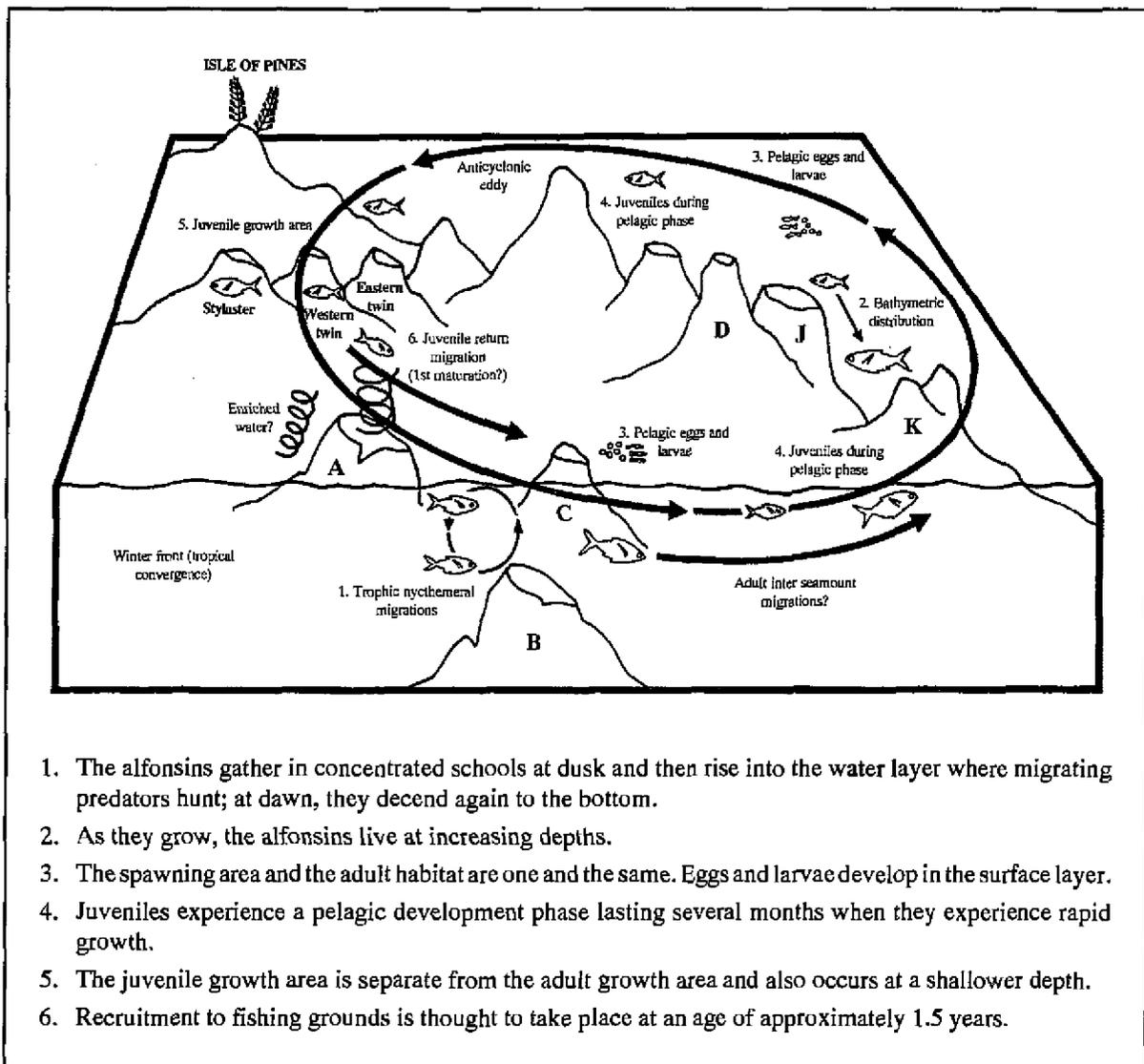


Figure 5: Life history of alfonsin, *Beryx splendens* [from Lehodey, 1994]

If it is not a temporarily isolated event, this eddy would clearly play an essential role in *Beryx splendens*' life cycle (Figure 5). The presence of a specific hydrological circulation event linking the growth areas of juveniles with those of adults could thus prove to be one of the conditions required for this species to thrive. Features of this kind involving the main currents of the overall water circulation pattern have also been described in other areas where the alfonsin is present, in the Atlantic and in the Pacific close to Japan.

During the years when exploitation was at its most intensive, the fishing effort invested in the *Beryx splendens* fishery is estimated to have reached a value close to the optimum effort figure which, applying the overall model, gives a maximum sustainable yield of between 395 and 468 t. Any increase in effort above this level should therefore be monitored very carefully.

The bottom longline was not the only gear type used. If the fishery started afresh using trawling (pelagic or bottom), the results obtained in this study would make it possible to take into account not just fishing effort but also size at first capture (mesh size) for resource management purposes.

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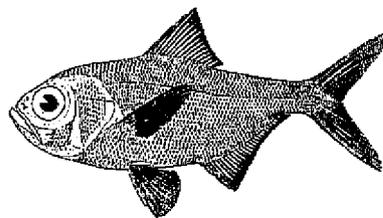
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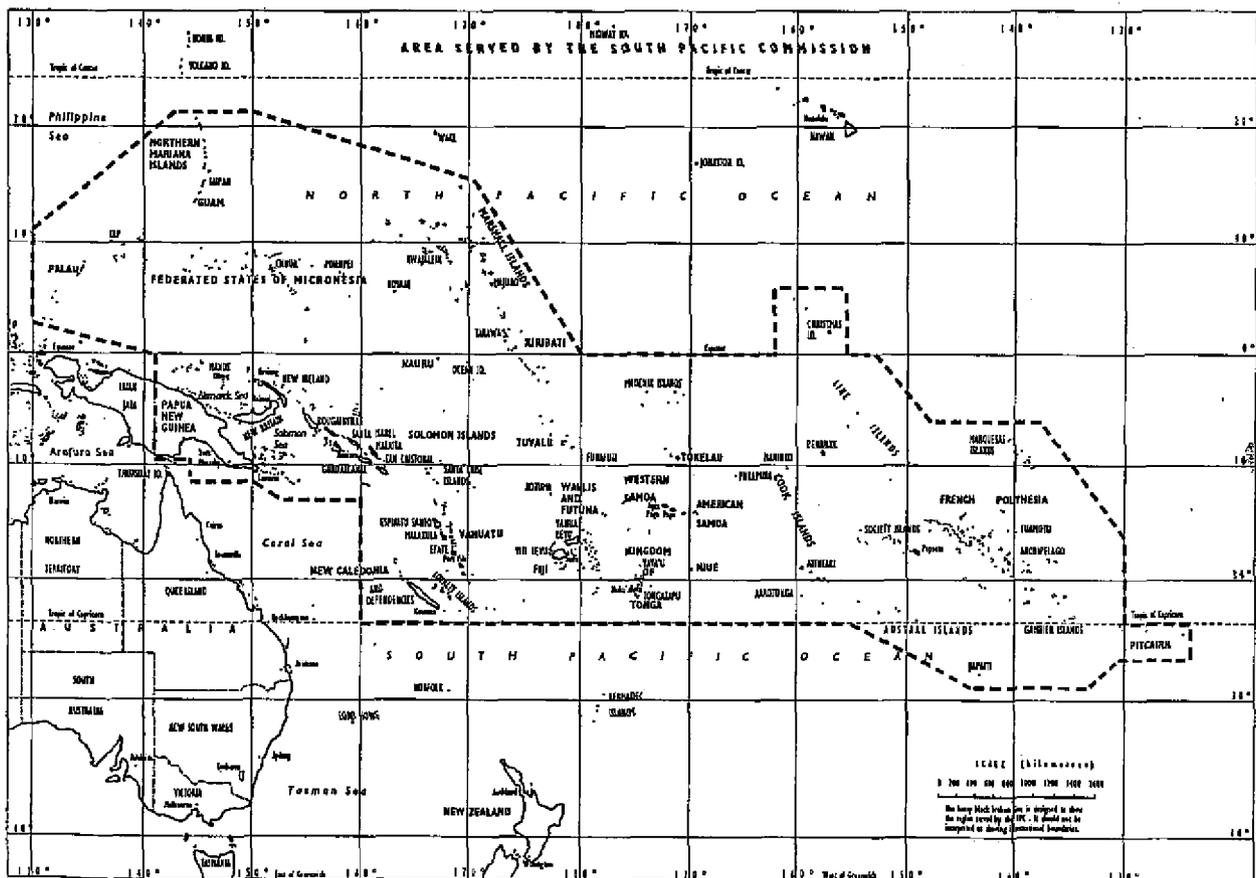
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