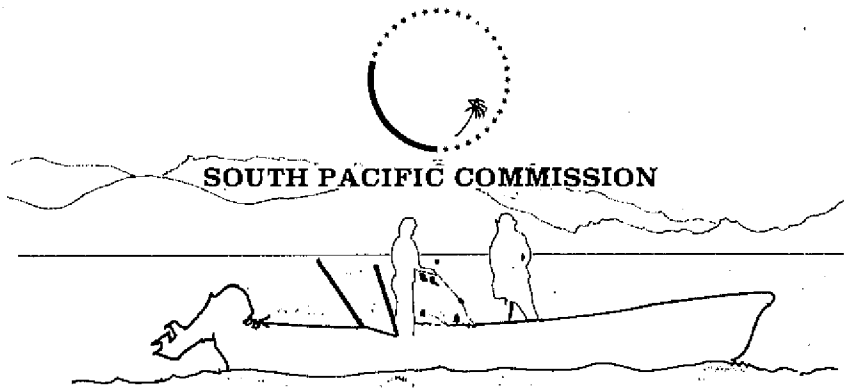

FISHERIES NEWSLETTER

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SPC ACTIVITIES

DEEP SEA FISHERIES DEVELOPMENT PROJECT NOTES

Northern Mariana Islands — Deep-bottom fish survey and stock assessment project (Phase II)

Tourism-driven growth in the market for prime deep-bottom fish species, and a chronic shortfall in production from waters around Saipan, Rota and Tinian, led the Commonwealth of the Northern Mariana Islands' (CNMI) Division of Fish and Wildlife to request the assistance of the Deep Sea Fisheries Development Project (DSFDP) in undertaking a comprehensive assessment of the state of the local deep-bottom resource and fishery, with the aim of determining potential productivity and bringing production to an appropriate level. This involved the surveying of inshore and offshore grounds, and the assessment of stocks and effective exploitation techniques through test fishing with various gear types. An initial survey visit made by SPC Masterfisherman Paxton Wellington in 1988 was severely disrupted by poor weather, causing the survey to be abandoned ahead of schedule.

Being committed to completing this work, the DSFDP, in September 1989, assigned a consultant, Peter Watt (a Canadian with extensive experience in Pacific Islands fisheries development), to continue the programme and, at the request of CNMI, to test-fish with a bottom longline system. Early results indicated that grounds in range of the main population centres held only limited stocks vulnerable to this gear type. However, satisfactorily productive catches were taken by handreel on offshore banks and seamounts. These catches aroused considerable local interest and a training programme for local fishermen is now under way, although very poor weather conditions are presently disrupting the programme. This phase of the project will conclude in February 1990.

TUNA AND BILLFISH ASSESSMENT PROGRAMME

Solomon Islands in-country tuna tagging project

The first cruise of the Solomon Islands tagging project, undertaken jointly by the SPC Tuna and Billfish Assessment Programme and the Fisheries Division of the Ministry of Natural Resources, began on 17 July 1989 (see *Fisheries Newsletter #50*) and ended on 14 August 1989. Tagging took place over 20 days, resulting in 4,034 skipjack and 176 yellowfin tag releases, for a total of 4,210 tunas tagged during the entire cruise.

The second cruise was initially planned to last only two weeks, since the end of fishing season was approaching. The tagging vessel, *Soltai 8*, left port on 31 October, but after four days an engine failure occurred and the vessel was towed back to port. Due to the uncertainty concerning the time needed for repairs, it was decided to terminate the cruise.

Three schools were fished successfully, two from around a drifting raft and one from an anchored raft. Unfortunately, none of the schools were particularly responsive, probably because of the poor quality of the bait carried on board. Thus, a total of only 111 skipjack and 3 yellowfin was tagged.

The third and fourth cruises, utilising a Soltai pole-and-line vessel, are tentatively planned for March/April and June/July 1990.

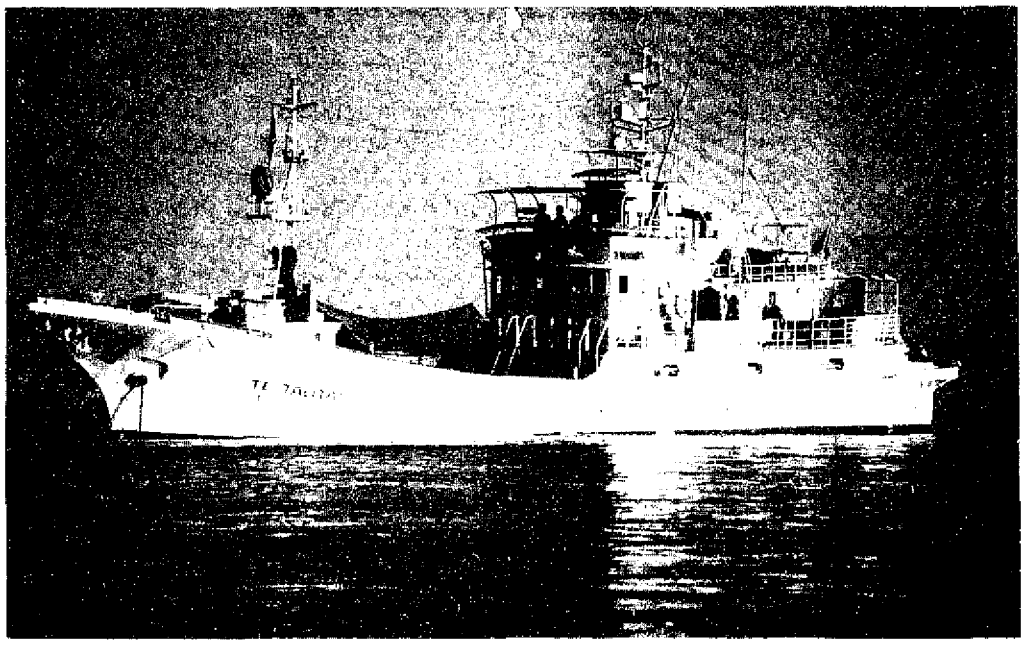
As of November 1989, a total of 357 tags had been recovered, comprising 345 skipjack and 12 yellowfin. All of these recoveries came from fish tagged during the first cruise. The overall return rate stands at 8.3 per cent from a total of 4,324 releases, with a return rate of 8.3 per cent for skipjack and 6.7 per cent for yellowfin. While all tags were released from pole-and-

line vessels, 73 per cent of the recoveries have come from purse seiners, 24 per cent from pole-and-line vessels other than the tagging vessels and 1 per cent from the tagging vessels.

Regional Tuna Tagging Project

Field operations of the SPC Regional Tuna Tagging Project, funded by the European Community, started in Honiara on 21 December 1989. The Tuvalu pole-and-line vessel, *Te Tautai*, was successful in the open international tender for the 20 months of vessel charter. Various modifications were made to the vessel, primarily to meet accommodation and working requirements of SPC scientific staff.

Six days were spent fishing in Solomon Islands, prior to moving to Papua New Guinea waters for January—February. During this shakedown period, 911 fish were tagged and released, including 390 yellowfin, 488 skipjack and 33 bigeye. This early success was made despite the relatively poor availability of fish at the time.



The Tuvalu pole-and-line vessel, *Te Tautai*

INSHORE FISHERIES RESEARCH PROJECT

Management of Inshore Fishery Resources

Harvesting of reef fish in Palau, always traditionally important, has become more extensive and efficient in recent years with the introduction of higher-technology boats and fishing equipment and the development of a local and export marketing infrastructure. The Palau Government's Marine Resources Division (MRD) is concerned at continuing reports of declining catch rates and average sizes of fish and requested the Inshore Fisheries Research Project's advice on a suitable programme of fishery information gathering which would permit the development of a management regime.

A report containing a proposed research and management approach was prepared and its main recommendations, regarding biological data and fishery data collection, a standardised fishing programme and improved communications with State administrations, accepted by MRD. Several tasks were identified that could be achieved by the Palauan University of the South

Pacific students during their vacation time in Palau. Ultimately, the work will be supervised by a professional fishery biologist.

Review of Tonga Inshore Fisheries Assessment Project

This activity was carried out in conjunction with ICLARM (International Center for Living Aquatic Resources Management), which provided the services of a consultant, Dr John Munro, to review the achievements of a three-year programme of data collection and analysis on the inshore fisheries of Tongatapu and Ha'apai and recommend directions for future work. Sample surveys in Tongatapu in 1986/87 and Ha'apai in 1988/89 have provided baseline data on local fisheries. However, routine fishing using a standardised array of gears has not been carried out to the extent planned and there have been problems in analysing the data gathered so far. The project is threatened with discontinuation of funding; hence there is a need to revise the work plan with this contingency in mind and to make arrangements for data analysis to be completed in the near future.

Review of Papua New Guinea baitfish data

The completion of baitfish research projects in Solomon Islands and the Maldives, funded by the Australian Centre for International Agricultural Research, was marked by a workshop on baitfish biology and population dynamics held in Honiara, Solomon Islands. The Inshore Fisheries Scientist attended the workshop as an invited speaker and presented a paper on the population biology of Papua New Guinea baitfish. This included a review and some re-analysis of historical baitfish catch, effort and biological data.

REGIONAL FISHERIES TRAINING PROJECT

Refrigeration Course for Papua New Guinea

Following the successful course conducted at the National Fisheries College (NFC) of Papua New Guinea in 1987, the SPC assisted the Papua New Guinea Department of Fisheries and Marine Resources to organise and conduct a second eighteen-week course in refrigeration maintenance and repair. This course was held at NFC from 22 August to 15 December 1989 and was attended by fourteen trainees from Papua New Guinea and two from Solomon Islands.

The course followed a similar approach to the earlier one, with the eighteen weeks of training broadly divided into two sections. The first nine weeks covered fundamental refrigeration theory and practice, including equipment, components and tools, while the second nine weeks were largely practical, including commercial service calls and supervised workshop experience covering the repair of a variety of equipment in common use by the fishing industries of Pacific Island countries. At the conclusion of the course all remaining refrigeration equipment and tools were donated to the College to augment its on-going capabilities to teach this subject.

All costs associated with the attendance of the Papua New Guinea participants were met by the Government of New Zealand, those of the two Solomon Islanders by the Commonwealth Fund for Technical Co-operation, while all expenses associated with the Senior Lecturer/Course Supervisor were paid by the FAO/UNDP Regional Fishery Support Programme.

NEWS FROM IN AND AROUND THE REGION

FIJI'S TUNA CATCH HAS DROPPED

(Source: *The South Sea Digest*)

Fiji's tuna catch has dropped in 1989 and the Ministry of Primary Industries points the finger at two suspected culprits, bad weather earlier in 1989 or drift-net fishing by Japanese and Taiwanese fleets in latitude 35°—45° S, where young fish are being caught. No statistics were available, according to the spokesman, but the ministry was not ruling out the possible effect of the drift-net.

However, Dr Peter Hunt, director of the government-owned Pacific Fishing Company (PAFCO), who admitted the catch was 'slightly less', said there was no link between drift-net fishing and the drop in the catch. He said it was too early to comment and there was no scientific evidence that albacore tuna stocks were being depleted through drift-net fishing. Dr Hunt added that, compared to the catch four years ago, this year's catch was very good. This year's decline was probably a seasonal fluctuation.

In an interview in Honiara, Forum Fisheries Agency Director, Mr Phillip Muller, said the catching of juvenile albacore tuna 'in nutrient-rich' temperate waters between Australia and New Zealand was bound to have an effect on the adult stock caught around countries like Fiji.

Radio Australia's correspondent in Tokyo has reported that Japan plans to cut its drift-net fishing fleet from about 60 vessels to about 20, and is adopting regulations requiring vessels to give details of catches. It will also conduct research to prove that drift-net fishing is not a threat to tuna stocks.

LAWS TO LIMIT FISHING VESSELS

(Source: *Fiji Times*)

A new fishing licensing system to limit the number of offshore fishing vessels and catch came into force in Fiji from 1 January 1990. Cabinet has approved a proposal to amend the Fisheries Licensing System which allowed fishermen unlimited catches. The new set of laws requires all boats fishing for deep-sea snapper and tuna to obtain a new Offshore Fishing Licence in addition to their normal fishing licences. The Director of Fisheries, Mr Surendra Sewak, said the new licensing system was essential if the government wanted to keep control of the rapidly expanding deep-sea fishery.

The Fisheries Act of 1942 was designed for traditional fishermen operating small boats in lagoons. There was no way of regulating the new industrial-scale fishery. Mr Sewak added that the problem apparently was that the old fisheries licensing laws allowed a fisherman to take as much as he wanted, whenever he wanted. This was acceptable when fishing activity was small-scale, but now a large number of foreign fishermen are wanting to come to Fiji to take large amounts of fish.

The new licensing system includes provisions to limit the number of offshore fishing vessels and the catch of deep-sea snapper by each offshore fishing vessel and thus to safeguard the interests of local fishermen. 'We hope to safeguard local fishermen by requiring a certain amount of local investment before a licence is issued and by preventing large boats (over 12 metres in length) from fishing for deepwater snapper close to reef edges that are used by small boats', Mr Sewak said.

The licensing system also restricts large tuna longliners operating in gamefishing areas, in order to protect the tourist industry. The vessels take a lot of marlin and swordfish as well as tuna. Once the new system comes into effect, fishermen wanting to catch deep-sea snapper or tuna

will have to apply for offshore licences. The Fisheries Division has stopped issuing new licences to large vessels and these will be processed only after the new laws come into force.

The Division estimates that the maximum annual catch of deep-sea snapper from Fiji waters is 1,000 t and that anything over that would endanger the resource. But the Division estimates that the current fishing fleet is capable of taking nearly 2,000 t a year. Mr Sewak said that the Division was worried about the expansion of sashimi tuna fishing because almost all the fish was flown to Japan and, as Fiji had only one flight a week to Japan, competition for air-freight space was intense. The local fishermen were the ones to suffer.

The new laws will enable better control of this fishery, which had expanded from about three boats in 1987 to nearly 40 boats in 1989. But Mr Sewak expressed concern at the number of investors coming into the country to set up fishing businesses without first informing the Fisheries Division. 'Very often, the first we hear about a new fishing vessel is from the Fiji Trade and Investment Board or from the banks; investors seem to take it for granted that we will issue a fishing licence to them', Mr Sewak said.

PRODUCTION OF LOCAL SEAWEED INCREASES
(Source: *Fiji Times*)

Seaweed production in Fiji is on the increase again, with the National Marketing Authority and a Philippine company, Farm Machinery and Colloids (FMC), joining in the venture, according to Mr Roberto Foscarini, aquaculture development project officer at the Suva-based office of the Food and Agriculture Organization.

A regional workshop on seaweed culture and marketing has been held in Suva to help boost production. The four-day seminar, held at the School of Marine Resources at the University of the South Pacific, aimed to promote seaweed farming in the region by introducing new and more effective culture techniques.

'This way we hope to advise and demonstrate appropriate product quality control and baling process of seaweed for export demand', Mr Foscarini said. 'We also hope to use this seminar to obtain advice on shipping and marketing channels from the representatives of FMC Marine Colloids Division of the Philippines.'

Three experts from the Philippines participated in the workshop, which was attended by seaweed farmers from Kaba, Kiuva, Motoriki, Rakiraki and Tavua. Fisheries officers from Palau, Tonga, Kiribati, Ponape, Tuvalu and Fiji also attended. Mr Foscarini added that he hoped that after this seminar farmers would have a much broader knowledge of how the seaweed industry works.

Seaweed farming was first introduced in Fiji following successful pilot trials in the 1984—85 period. Soon after that, several coastal villages began commercial seaweed farming, particularly in the Rakiraki / Tavua area. In 1986 total national production was around 188 t which increased in 1987 to 216 t valued at about $20,000.

However, production in 1988 dropped to about 65 t. The drop was attributed mainly to 'unfavourable circumstances', both political and climatic, according to Mr Foscarini. To make matters worse, the New Zealand company, Coast Biological Ltd., which had been the main market for Fiji seaweed, pulled out. This was due mainly to a drop in the world market price of seaweed and insufficient raw material being produced locally.

But last year the National Marketing Authority bought out the entire production, reselling to Farm Machinery and Colloids (FMC) of the Philippines. 'Now that we have the marketing experts here and with the help of fisheries officers, we hope that the seminar will help to boost production again', Mr Foscarini said.

ROTTING FISH KILL TWO AT SEA

(Source: *Pacific Fishing*)

Toxic fumes from rotting tuna aboard a Seattle-based vessel, the 98-foot *Margaret G.*, were blamed for the death of Captain David James Dowie and Engineer Martin Ferguson, both of Alaska. A third crew member, Lawrence Moon of Micronesia, escaped the deadly fumes by abandoning ship in a life-raft 300 miles from Hawaii on about in 1 May.

The captain apparently turned off the ship's refrigeration system in order to dispose of 15—16 tons of tuna that could not be sold in American Samoa. En route to Hawaii, the rotting fish produced hydrogen sulphide gas, which smells like rotten eggs. Dowie and Ferguson entered the fish hold to repair screens that had become clogged while the fish were being washed out. They were overcome by the fumes and both died in the hold, according to reports from the U.S. Coast Guard.

Moon tried to steer the vessel to Hawaii, but the generator failed and the rudder froze, causing the boat to circle. Moon abandoned ship in a radio-equipped raft and was picked up by a Japanese vessel and transferred to a U.S. Coast Guard cutter. The *Margaret G.*, owned by Cruzan Fisheries Inc., of Seattle, was towed to Honolulu and fumigated with chemicals to neutralise the hydrogen sulphide gas before the ship was allowed to enter port.

CALIFORNIA AND PACIFIC ISLAND FISHERIES RESEARCH TO GET US$ 850,000

(Source: NOAA Fisheries — Southwest Region)

The Federal Government has earmarked US$ 850,000 to fund 14 fisheries research and development grant projects in California and the Pacific, according to E. Charles Fullerton, Director of the Southwest Region of the National Marine Fisheries Service (NOAA Fisheries). About US$ 342,000 will be spent on 6 research projects relating to Califomia fishermen and about US$ 508,000 on 8 projects relating to fishermen in the U.S.-affiliated Pacific Islands, including Hawaii, Guam and the Federated States of Micronesia. Nation-wide, 48 projects will receive US$ 4.3 million in funding.

'The Saltonstall-Kennedy (S-K) grant programme is designed to assist in developing fisheries and to help the U.S. fishing industry find solutions to problems preventing full utilisation of our fisheries resources', says Fullerton. 'The research projects we fund through S-K grants can lead towards increased knowledge, better understanding and better use of the fisheries resources of Califomia and the Pacific Islands.' Among the 14 approved project proposals and grant recipients, those concerning the Pacific Islands are:

— Study of the longline fishery in Guam. Government of Guam, Tamuning, Guam;

— Can submerged lights enhance effectiveness of fish aggregation devices? University of Guam, Marine Laboratory, Mangilao, Guam;

— Palau deep water crab marketing survey. Pacific Fisheries Development Foundation, Honolulu, Hawaii;

— Clam reseeding in Marshall Islands, Phase I. Pacific Fisheries Development Foundation, Honolulu, Hawaii;

— Sea cucumber fishery development in Micronesia. Pacific Fisheries Development Foundation, Honolulu, Hawaii.

— Regional trials for two commercially valuable giant clam species, Federated States of Micronesia. Pacific Fisheries Development Foundation, Honolulu, Hawaii;

— Pohnpei pearl shell cultivation, Phase II. Pacific Fisheries Development Foundation, Honolulu, Hawaii;

— Regional standardisation of catch data systems, Federated States of Micronesia. Pacific Fisheries Development Foundation, Honolulu, Hawaii.

ASIA LEADS WORLD PRODUCTION AGAIN — 1986 FAO FIGURES

(Source: *Austasia Aquaculture Magazine*)

According to FAO estimates (FAO Fisheries Circular No. 815, 1989) in 1986, total world aquaculture production was 11.1 million t. The centre of aquaculture development is again in Asia (see Table 1) with 16 countries producing over 9 million t — this amounts to almost 82 per cent of the world total. The Republic of China was the major producer, followed by Japan, North Korea, South Korea, Philippines, Taiwan and Vietnam.

Table 1. World aquaculture production in 1986 by area

Area	Production (metric tonnes)	Per cent world total
Africa	61,430	0.55
North America	428,480	3.86
Latin America	160,115	1.44
Caribbean	17,129	0.15
Europe	1,042,887	9.40
USSR	305,000	2.75
Oceania	24,605	0.22
Asia	9,054,646	81.61

There has also been significant growth in the USSR, Europe (including the United Kingdom), Israel, the United States and South America.

Finfish produced from aquaculture was over half the world production in 1986 (Table 2).

Production was dominated by 28 species of carp (3.227 million t), 14 species of salmon and trout (318,000 t), 8 species of *Tilapia* and other cichlids (280,000 t) and the milkfish (31,000 t).

Freshwater crustaceans (such as *Macrobrachium*) contributed 118,000 t, while shrimps and prawns were the major producers with 156,000 t.

Mollusc production was mostly made up of 11 species of oyster (877,000 t), 12 species of mussel (798,000 t), 19 species of clams (360,000 t) and 5 species of scallops (140,000 t).

Seaweeds were mostly brown (1.766 million t) and red (859,000 t). The 'Others' category consisted of frogs and other amphibians, turtles, sea squirts and other tunicates, pearls and sponges. No mention was made of crocodiles.

Table 2: World aquaculture production in 1986 by species

Type	Production (metric tonnes)	Per cent world total
Finfish	5,580,435	50.3
Crustaceans	398,808	3.5
Molluscs	2,342,871	21.1
Seaweeds	2,742,005	24.7
Others	30,173	0.3

FINALLY, A PATROL BOAT FOR THE COOK ISLANDS

(Source: *Pacific Islands Monthly*)

The decision by the Cook Islands Government in March this year to defer acceptance of its Australian-donated patrol boat has proved to be the right one, says Cook Islands Prime Minister Geoffrey Henry. After five months of discussions with the Australian Government, the Cook Islands has finally agreed to accept the patrol boat and the vessel is expected in Rarotonga this month.

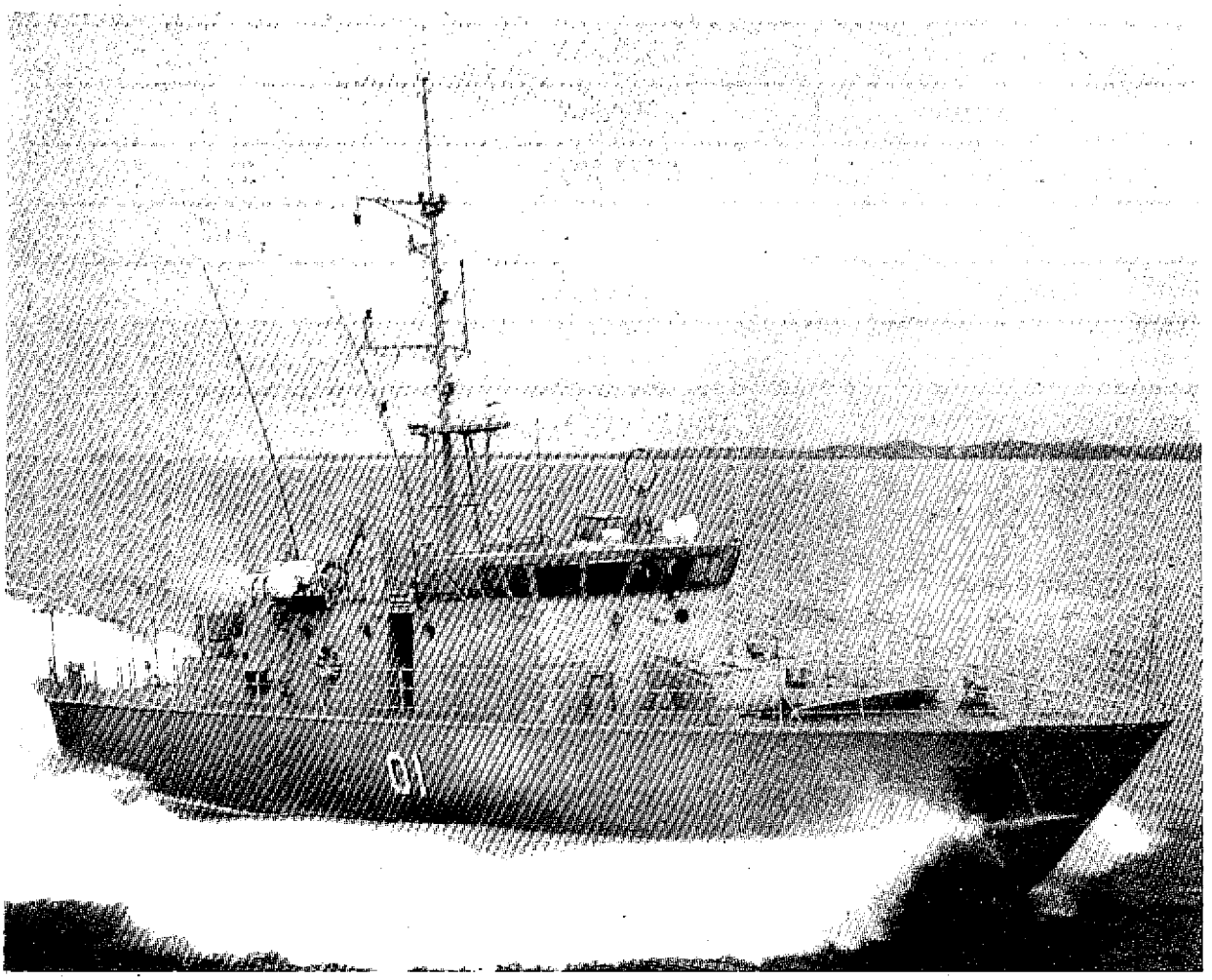
The *Kukupa* is one of 14 patrol boats to be donated to South Pacific Forum countries under Australia's Pacific Patrol Boat Project. So far, seven boats have been handed over — four to Papua New Guinea and one each to Solomon Islands, Vanuatu and Western Samoa. The Pacific Patrol Boat Project stems from the 1983 South Pacific Forum meeting in Canberra when Australian Prime Minister Bob Hawke offered to provide Forum Island Governments with patrol boats for surveillance within their Exclusive Economic Zones.

The Cook Islands agreed to participate in the project in early 1985 and prior to this year's general election, handover was expected in March. After the January election, Mr Henry announced the project was to be postponed until a comprehensive study of all aspects of the proposal has been carried out. Mr Henry and his new government were primarily concerned with the running and maintenance costs of the boat, which were estimated at about NZ$ 600,000 for the first year. Government also questioned the minimum certification and training requirements for the principal officers of the boat.

Under the initial proposal, valued at A$ 6 million, the Australian Govemment agreed to provide the patrol boat, two years supply of spare parts, a three-man advisory team, and an extensive training programme for crew members. They also agreed to meet the fuel, oil and maintenance costs for 800 hours of operations, which was under half the planned patrol time for the vessel. Mr Henry said at the time 'that the sheer cost of the exercise was very much against the Cook Islands accepting the patrol boat'. The Government simply could not afford to participate in the project the way it was. Additional assistance was sought from Australia.

'The tide turned in favour of our accepting the boat for three reasons', explained Mr Henry. 'Australia kindly showed a better understanding of our economic situation, so (they) increased their assistance in three areas: operating costs increased to 1,250 hours — that is three quarters of the recommended total patrol time; they agreed to accept responsibility for the training of the master and engineer of the boat, which would allow the Marine Board to issue them with a certificate; and finally, would assist in the development of a Cook Islands naval base at Penrhyn, 760 miles north of Rarotonga.

'The final straw in deciding to accept the boat, was that following Forum discussions in Kiribati, I was more convinced that the notion of an Integrated South Pacific Surveillance Scheme would, in due course, become a reality.'



Australian-made patrol boat of the kind being given to Pacific Island countries

The establishment of a base at Penrhyn provides a springboard for the multilateral surveillance programme that Mr Henry is keen to see developed. It will also provide the Cook Islands with a more effective base for monitoring its two million square kilometres of Exclusive Economic Zone. Minimum facilities already exist on Penrhyn, but these need to be upgraded in order to develop Penrhyn into an adequate base, capable of meeting the requirements of a patrol boat. Australian assistance in this area includes the construction of fuel storage, fresh water facilities, power, sewerage and a workshop area.

Mr Henry said: 'I insisted on Penrhyn, strategically the Penrhyn base is more important in the surveillance exercise than Rarotonga. From an administrative, operations and supply side, Rarotonga is best but Penrhyn is ideal because for nine months out of the year, most foreign fishing vessels are working out of this area. It is also the ideal position for boats from Kiribati and French Polynesia to co-ordinate efforts against illegal fishing.

'If the nations in the centre of the Pacific co-operate with New Zealand, Australia, France and the United States of America, we can, between ourselves, put together a very effective surveillance scheme utilising patrol boats from outside, as well as from within the region. If we organise ourselves, this huge expanse of central Pacific becomes very manageable. This is why

I am so keen to see a multilateral arrangement. Let's share our boundaries, our responsibilities and let's share our facilities to protect our resources for generations to come.'

Mr Henry feels the Australian Government has responded positively to the budgetary restraints and difficulties of the Cook Islands. Australia has agreed to review additional assistance towards the patrol boat's operations annually, taking into account the economic situation of the Cook Islands. Mr Henry says: 'I am most pleased that Australia came to understand our economic position better. I think it's important to learn to talk to people'.

EUROPEAN BANK TO GIVE FIJI F$ 30.6 MILLION
(Source: *Fiji Times*)

Fiji is to receive a loan of about F$ 30.6 million (19 million ECUs) from the European Investment Bank (EIB) for transport, telecommunications and tourism projects under Lome III. The funds attract an interest subsidy from the European Development Fund resources.

A F$ 9.7 million loan (6 million ECUs) for 15 years at an interest rate of 5.05 per cent is for extensions to the Lautoka wharf. The extension will include the construction of a berth for local tourist traffic and container handling, a fisheries port, equipment for roll-on, roll-off traffic and renovations to the existing port facilities. Total project costs are estimated at F$ 28 million (17.4 million ECUs) — one third will be financed by locally generated loans and the rest shared equally by the EIB and the Government of Japan.

The project is expected to be completed by the end of 1992 and will increase berthing capacity by 22 per cent. The fishing fleet will be transferred from the commercial wharf to a fully equipped fisheries harbour and storage capacity within the port area will be relocated to reduce traffic congestion and improve operational efficiency.

KOREAN FISHING BOATS RECRUIT WESTERN SAMOANS
(Source: *Samoa News*)

Arrangements for Western Samoans to work on Korean fishing boats based in nearby American Samoa are being held up over the question of insurance. The Apia agent for the Koreans says the insurance companies will provide coverage on condition that a body is sighted. The agent said that this has to be made clear to the men and their families and is a loophole which has to be settled.

A crew of 30 Western Samoans has been selected for the next fishing trip. The Koreans hired a crew from Vanuatu in place of the Samoans recently, while the insurance question was being sorted out.

TUNA FISHERIES JOINT VENTURE UNDERWAY
(Source: *JK Report on Micronesia*)

The Federated States of Micronesia (FSM) National Fisheries Corporation and Taiyo Fishery Company of Japan are forming a tuna fisheries joint venture, which will include tuna purse seine fishing and the future establishment of shoreside trans-shipment and processing facilities. National Fisheries Corporation (NFC) hopes the FSM-based fishery project eventually will replace most of the foreign-based fleets that currently fish within the FSM's exclusive economic zone. In August NFC and Taiyo signed a letter of intent to establish the joint venture, which will be the first major Japanese investment in fisheries in Micronesia.

Taiyo will own 51 per cent and the FSM 49 per cent, according to NFC Executive Director James Movick, who says the joint venture — which is not yet named — will start out small by leasing one purse seiner for a year. Movick hopes to have the boat begin fishing in November. The trans-shipment point in the FSM will be in Pohnpei or Yap, he said. NFC is a public corporation established by the FSM government to promote the commercial development of the pelagic fisheries resources of the FSM, especially through joint ventures such as this one.

ASIANS MOVE INTO TUNA CANNERIES

(Source: *Islands Business*)

America's last tuna canning companies are targets for Asian companies anxious to preserve their share of the huge United States market. Last year the Van Camp cannery, one of the two canneries in American Samoa, together with Van Camp's United States assets, was bought for US$ 260 million by an Indonesian food company, Mantrust, from the Ralston Purina company.

Now the biggest tuna exporter in Thailand, Unicord, has paid US$ 269 million for the Bumble Bee organisation, the third biggest United States tuna sales company. Unicord outbid a number of foreign competitors and is reported to be interested in obtaining fishing rights in Papua New Guinea's fishing zone to secure its supplies, only a small part of which are obtained from Thai fishing grounds.

Working from their own countries, the Asian companies are hit by a United States tax of 35 per cent on tuna packed in oil and 6 per cent on tuna packed in brine, rising to 12 per cent when a quota is filled. Their United States acquisitions enable them to dodge the taxes and given them control of about one-third of the annual US$ 1,500 million United States market.

Local canneries

The other cannery in American Samoa, run under the subsidiary Star-Kist label, remains in the control of the H. J. Heinz food organisation. Star-Kist has more than 35 per cent of the United States market. The two locally-owned South Pacific tuna canneries, Solomon Taiyo's cannery at Noro in Solomon Islands and the Fiji Government-owned Pacific Fishing Company cannery at Levuka, are not likely to be immediately affected. They cater mainly for European and other non-American customers.

TRANSPARENCIES OF VESSEL PLANS AVAILABLE AT FAO/UNDP SOUTH PACIFIC REGIONAL FISHERY SUPPORT PROGRAMME

(Source: FAO/UNDP)

KIR	**2**	**7.25 m**	**Proa**	**Oct 82**
KIR	2	1B	General	Oct 82
KIR	2	2	Lines	Oct 82
KIR	2	3	Construction	Oct 82
KIR	2	4	Details	Oct 82
KIR	2	5	Frames	Oct 82
KIR	2	6	Plywood utilisation	Sep 82
KIR	2	7	Materials	Sep 82
KIR	2	8	Materials	Sep 82
KIR	**3**	**5.9 m**	**Outrigger canoe**	
KIR	3	1	Lines	Feb 84
KIR	3		Materials list	Aug 88

KIR	**T**	**7.5 m**	**Traditional fishing canoe**	
KIR	T	1	General arrangements	Jul 84
KIR	**4**	**7.16 m**	**Proa**	
KIR	4	1	General arrangements	Jan 85
KIR	4	2	Lines	Dec 84
KIR	4	3	Construction	Jan 85
KIR	4	4	Details	Jan 85
KIR	4	5	Sections	Dec 84
KIR	4	6	Sail rig and rudder	Jan 85
KIR	4	7	Plywood utilisation	Dec 83
KIR	4	8	Building jig	Dec 84
KIR	4	9	Materials	--------
KIR	4	10	Fastenings	--------
KIR	4	11	Order list	--------
KIR	4	12	Alternative bottom plank	--------
KIR	4	13	Alternative side plank	--------
KIR	4	14	Alternative leeboard	Oct 85
KIR	4	15	Alternative leeboard	Oct 85
KIR	4	D-1	Alternative floats	Oct 85
KIR	4		Materials lists (2 versions)	Aug 88
KIR	4		Tarpaulin - emergency sail	Jan 88
KIR	**5**	**11.7 m**	**Single outrigger canoe**	
KIR	5	1	General arrangements	Sep 85
KIR	5	2	Lines	Sep 85
KIR	5	3	Construction	Sep 85
KIR	5	4	Frames	Sep 85
KIR	5	5	Outrigger	Sep 85
KIR	5	6	Building jig	Sep 85
KIR	5	7	Materials list (2 versions)	Aug 88
KIR	**7**	**4.7 m**	**One man canoe**	
KIR	7	1	General arrangements	Jan 87
KIR	7	2	Lines	May 86
KIR	7	3	System of construction	Aug 88
KIR	**8A**	**7.1 m**	**Sailing / motor canoe**	
KIR	8A	1	General arrangements	Jan 88
KIR	8A	2	Lines	May 86
KIR	8A	3	Frames	Jan 88
KIR	8A	4	Construction	Jan 88
KIR	8A	5	Details	Jan 88
KIR	8A	6	Rigging and rudder	Jan 88
KIR	8A		Materials list	Aug 88
KIR	**6**	**6.5 m**	**Outrigger canoe**	
KIR	6	1	General arrangements	Jan 87
KIR	6	2	Lines, construction	May 86
KIR	6		Materials list	Aug 88
KIR	6		System of construction	Aug 88

KIR	**10**	**7.0 m**	**Planing fishing boat**	
KIR	10	1	General arrangements	Oct 87
KIR	10	2	Lines	Oct 87
KIR	10	3	Construction	Oct 87
KIR	10	4	Detail	Oct 87
WES	**8**	**28 ft**	**Fishing catamaran (plywood)**	
WES	8	1	Lines	Jul 76
WES	8	2	Structural arrangements	Jul 76
SAM	**10**	**9.0 m**	**Aluminium catamaran**	
SAM	10	1	Structural arrangements	Jan 80
SAM	10	2	Sections 2 and 6	Jan 80
SAM	10	3	Plate plan and press	Jan 80
SAM			**Buoy for fish aggregating device**	
SAM		1	Plan	Jan 80
NIU	**1**	**11 m**	**Aluminium catamaran**	
NIU	1	1	General arrangements	Sep 87
NIU	1	2	Hull / Deck construction	Oct 87
NIU	1	3	Midship frames 4 - 8	Sep 87
NIU	1	4	Frames 10 - 12 - 14	Oct 87
NIU	1	5	Weight positions trim	Sep 87
NIU	1	6	Cabin shade lifting	Oct 87
NIU	1	7	Engine beds	Oct 87
NIU	1	8	Hull deck layout	Oct 87
TON	**5**	**8.6 m**	**Motor - sailer**	
TON	5	1	General arrangements	Feb 83
TON	5	2	Lines	Feb 83
TON	5	3	Construction	Mar 83
TON	5	4	Sections	Mar 83
TON	**7**	**8.8 m**	**Motor - sailer**	
TON	7	1	General arrangements	May 86
TON	7	2	Lines	Mar 85
TON	7	3	Construction	May 86
TON	7	4	Sections	May 86
TON	7	5	Details	Sep 87
SOI	**1**	**6.25 m**	**Proa**	
SOI	1	1	General arrangements	Sep 84
SOI	1	2	Lines	Sep 84
SOI	1	3	Construction	Sep 84
SOI	1	4	Sections	Sep 84
SOI	1	5	Building jig	Sep 84
SOI	1	6	Fastenings	Sep 84
SOI	1	7	Materials	Sep 84

SOI	**2**	**7.8 m**	**Fishing trimaran**	
SOI	2	1	General arrangements	Sep 87
SOI	2	2	Lines	Sep 87
SOI	3	3	Details	Sep 87
SOI	3	4	Materials list	Apr 88
PNG	**1**	**11.0 m**	**Transport / fishing canoe**	
PNG	1	1	General arrangements	Apr 83
PNG	1	2	Lines	Sep 83
PNG	1	3	Construction	Apr 83
PNG	1	4	Sections	Apr 83
PNG	**3**	**8.2 m**	**Fishing / transport catamaran**	
PNG	3	1	General arrangements	Mar 85
PNG	3	2	Construction details	Mar 85
PNG	**4A**	**8.2 m**	**Fishing / transport craft**	
PNG	4A	1	General arrangements	Mar 85
PNG	4A	2	Lines	Mar 85
PNG	4A	3	Construction	Mar 85
PNG	4A	4	Outrigger	Mar 85
PNG	**5**	**8.2 m**	**Fishing / transport catamaran**	
PNG	5	1	General arrangements	Mar 86
PNG	**7**		**Dugout outrigger**	
PNG	7	1	General arrangements	Sep 87
PNG	7	2	Details	Sep 87
PNG	**6**		**Oro Bay outrigger canoe**	
PNG	6	1	General arrangements	Sep 87
PNG	6	2	Details	Sep 87
PNG	**8**	**9.3 m**	**Canoe**	
PNG	8	1	General arrangements	Feb 89
PNG	8	2	Lines	Feb 89
PNG	8	3	Frames bottom	Feb 89
PNG	8	4	Construction	Feb 89
PNG	8	5	Details	Feb 89
PNG	**9**	**9.4 m**	**Canoe**	
PNG	9	1	General arrangements	Mar 89
PNG	9	2	Frames	Mar 89
PNG	9	3	Construction	Mar 89
PNG	9	4	Details	Mar 89
PNG	**10**	**8.35 m**	**Canoe**	
PNG	10	1	General arrangements	Mar 89
PNG	10	2	Aft body	Mar 89

FIJ	**5**	**8.6 m**	**V-bottom fishing boat**	
FIJ	5	1	General arrangements	Jul 84
FIJ	**6**	**6.4 m**	**Fishing / transport boat**	
FIJ	6	1	General arrangements	Mar 85
FIJ	6	2	Lines	Mar 85
FIJ	6	3	Construction	Mar 85
FIJ	6	4	Sections	Mar 85
FIJ	6	5	Building jig & backbone	Mar 85
FIJ	6	6	Plywood utilisation	Mar 85
FIJ	6	7	Materials	---
FIJ	6	8	Fastenings	---
FIJ	6	9	Order list	---
FIJ	6	10	Order list	---
VAN	**1**	**10.0 m**	**Handliner**	
VAN	1	1	General arrangements	Aug 84
VAN	1	2	Lines	Aug 84
VAN	1	3	Construction	Aug 84
VAN	1	4	Sections	Aug 84
VAN	1	5	Building jig	Aug 84
VAN	1	6	Materials	Aug 84
VAN	1	7	Fastenings	Aug 84

HARVEST FROM BELOW

(Source: *Islander*)

Looking at century-old traditional Pacific fishing methods

Two teen-age boys stand on a reef near an island in the Kiribati archipelago. They have been told by their father to bring home an octopus for that night's supper. Its tentacles will be cut into bits and boiled until tender in coconut milk. About 30 ft below them, a big one lurks in a cave in the face of the reef. Its long, snakelike arms wave and undulate. The larger boy dives down to his quarry. He coaxes it out and it immediately wraps its arms around him. He wrestles it from its hole and struggles to the surface where the other spears it and they return victorious to the shore.

Islanders all over the Pacific continue in many ways to be daring and innovative fisherfolk. Women assiduously gather molluscs, crustaceans, squid and other such desirable food inshore. Throw-net and spear fishermen, often at night with flaming torches aloft, are still common sights in the Pacific's many lagoons. Edible denizens of the deep are caught in basket-type traps, behind rock walls on the beach and inside circles of people who wade into the surf and gradually close in toward the centre, yelling and beating the water with their hands.

I-Kiribati and Tuvaluans relish flying fish. These odd fish won't readily take a baited hook or lure and are next to impossible to net. So the islanders outfox them in a novel way. Entire villages of people go out the sea in boats just after sunset. They hoist the big inverted triangular sails and hold flaming torches aloft. The fleet cruises over the water, close together, in a long line. Startled by the bright lights, flying fish by the dozens flip out of the sea few feet above the surface in their usual manner, hit the sails and slide down into the boats. The holds are soon full.

Atoll dwellers of Micronesia have long been expert hook and line fishermen. Their carved bone hooks and lures are considered the most artistic, various and effective in the entire Pacific. They

relish lobster and have invented many imaginative ways of catching them. Their traditional traps are intricately and cleverly designed. The casting of arm nets, especially those shaped like a butterfly, is a beautiful sight to behold. It's curtains for schools of shallow-swimming surf fish that wait too long to get out off the way.

Samoans lasso sharks, whose meat they consider a delicacy. Fishermen in dugout canoes dangle mullet fish on the end of long poles over the water. Loops of rope hang behind the fish. In order to eat the bait the shark must poke its head through the loops. When they do—bingo! They are caught around the neck and lashed to the boats.

The use of pearl shell lures for hook and line fishing for tuna has been common all over the Pacific. The hooks are barbless so that the fish fall off easily upon retrieval, freeing the line for another cast. Tuna fishing is exciting. The tuna stay on the surface only a short time, while the fishermen try to catch as many as possible before they submerge.

Fishing is big with Pitcairn Islanders. These descendants of the Bounty mutineers sell their catch to passing ships. The island contains only from 60 to 70 people, yet they catch with hook and line, from shore and boats, more than 7000 fish a year. Not long ago three teenagers landed 200 in one day!

Oyster fishing, for shell and pearls, is still popular in the Torres Strait Islands between Australia and Papua New Guinea and among the islands south of Tahiti. Nowadays it is mostly done by machines, but traditionally it was a hazardous and exciting enterprise that called for courage, not unlike underground gold mining. Men and women dived down to the oyster beds, tore the shells loose by hand and put them into baskets as long as they could hold their breaths. Many died from this pursuit.

But the Pacific Ocean is more beneficial to man than dangerous. It provides a vast quantity and variety of good foods. One of these is most unusual—a wormlike annelid called palolo. Polynesians consider it most delicious. Palolo is shaped like spaghetti, colored brown or green and about 18 inches long. The parent creature lives on the ocean floor, attached to coral reefs. Twice a year it sets free its rear portion, which rises to the surface. The head part remains on the bottom and grows another tail. Palolo is a wonder to science. This simple sea organism observes both solar and lunar time. It rises only two days a year, in October and November. The moon directs its choice of the day and the sun of the month. For two years it rises again after 12 months. Every three years it rises in the 13th month. Every 28 years it waits another 29 days.

Its behaviour is probably caused by a combination of the sun's rays and the moon's pull on the tides. At a certain position the sun shines directly into the sea and strikes the worm. The last quarter of the moon occurs when the tide is low. Water pressure is less then. This is when the worms comes apart. The male tail is full of sperm and the female one of eggs. They mix on the surface. The warmth of the sun dissolves them. Fertilisation takes place and the eggs drop to the bottom to rear a new generation of palolo.

Gathering of the palolo is a gala event. Nearly everyone congregates on beaches before dawn, equipped with dip nets and baskets. Just after the sun rises someone with sharp eyes shouts and echoing the announcement, the crowd rushes into the surf to stand hip or neck deep for the harvesting. As many as possible must be gathered before they sink out of sight. The scene is a turmoil of activity. Palolo is eaten fried or as a soup. It is slightly salty and tastes a little like caviar.

Commercial fishing aside, the modern seafishing method most closely related to traditional practice is the use of hook, line and sinker. Spear fishing by snorkellers and scuba divers also stems from traditional methods. Another thing present and past fishermen have in common is that proverbial alibi: 'The biggest one got away'.

FISHERIES SCIENCE AND TECHNOLOGY

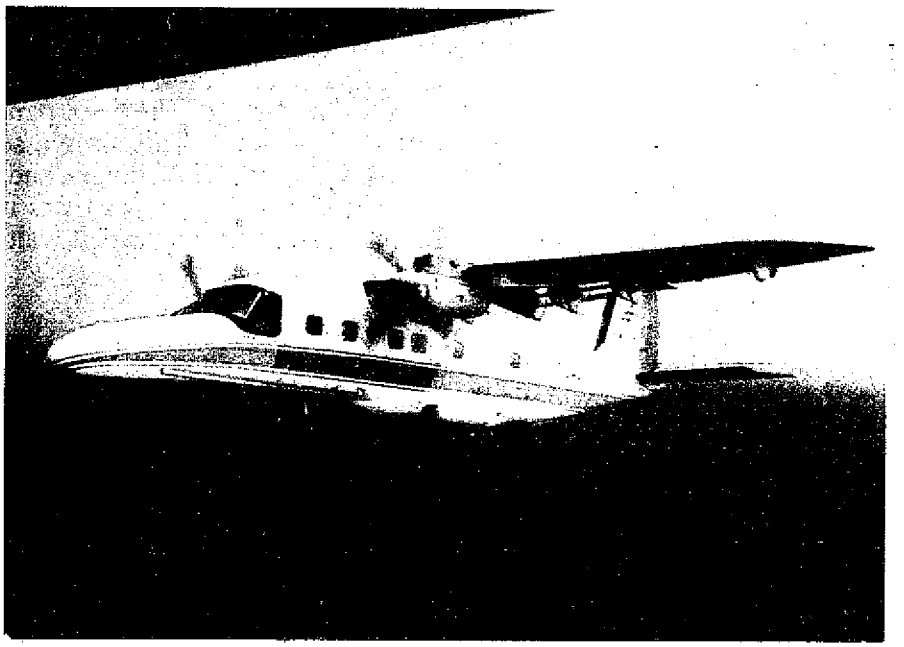
A WORLD PREMIERE — AERIAL REMOTE SENSING AND THE TUNA FISHERY

(Source: Institut français de recherche scientifique pour le développement en coopération)

A pioneer operation of assistance to fishing by microwave remote sensing was successfully conducted in the 'Golfe du Lion' (France) from 1 to 14 August 1989, by the French Institute for Scientific Research for Development in Co-operation (ORSTOM), with the help of the Mediterranean Tuna Fishermen's Association (Interthon), the Bluefin Tuna Fishermen's Organisation (OPTR), IFREMER and the 'Groupement pour le développement de la télédétection aérospatiale — GDTA' (Aerospace Remote Sensing Development Group). This experiment, the first of its kind ever carried out in the world, was made possible by the financial contributions received from these bodies, as well as from the Languedoc-Roussillon Regional Council, the Ministry for Foreign Affairs and the Ministry for the Sea.

The operation, called HAREM (Halieutique et radar, expérimentation Méditerranée) consisted of inventorying surface tuna schools along a strip of ocean 4 km wide from an aircraft flying at an altitude of 3,000 m and equipped with a synthetic aperture radar (SAR). This type of radar, which has been used for some years in aerospace remote sensing, has a very high resolution obtained by electronic simulation of its antenna. For the same resolution, a conventional antenna would need to be several hundred metres long. The European Space Agency's ERS 1 satellite, which is to be launched in the 1990s, will be fitted with the same type of antenna.

The aircraft and sensor used were made available by the German air/space research institution DLR (Deutsche Luft und Raumfahrt) and the bluefin tuna fishermen of the Sète area were responsible for the ground truth checks.



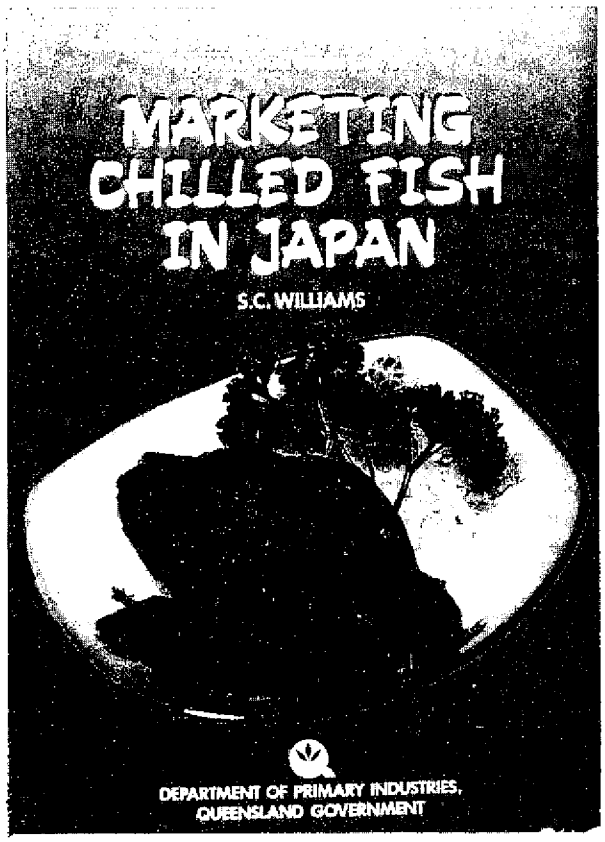
Aircraft equipped with a synthetic aperture radar

The western coasts of the Mediterranean proved an excellent laboratory for the development of a direct method of assessing tuna abundance in an area of sea. The experiment has been extended to the artisanal fishery of the Languedoc-Roussillon lagoonal area, for identification of the fishing gear used (nets, fish traps, oyster tables) and estimation of the fishing effort (number of units of gear deployed).

The results already yielded by this experiment open up new horizons for management of fisheries and hold promise not only for local tuna fishermen, but also for those operating in the tropical waters of the Atlantic, Indian and Pacific Oceans.

NEW BOOK FOCUSES ON MARKETING CHILLED FISH IN JAPAN

A book designed to improve the marketing of chilled fish on the lucrative Japanese seafood market has been released by the Queensland Department of Primary Industries (QDPI). *Marketing chilled fish in Japan* is a comprehensive 'hands-on' book for fishermen and seafood marketers looking to improve their market position in the highly competitive Japanese market.



Marketing chilled fish in Japan

Director of the QDPI's division of fisheries and wetlands management, Peter Neville, said that the book was a practical guide to achieving better sales of Australian fish in Japan.

Mr Neville said that although Japan has been a major market for many years, the Australian fishing industry has tended to concentrate on exporting frozen products, particularly prawns. However, in recent years, the industry has shown a growing interest in the Japanese chilled fish market, because of the potentially higher returns. Opportunities now exist for particular segments of the Australian industry to diversify into this area.

Mr Neville added that the book gave readers an insight into the Japanese fishing industry and its marketing structure. He said: 'It reviews the major markets and their seafood preferences. It also acquaints potential exporters with the types of fish-handling and marketing techniques that are absolutely necessary for penetrating the Japanese chilled fish market. Information on this market's operations and on the special demands of the Japanese makes this book essential reading for anyone considering the chilled fish trade'.

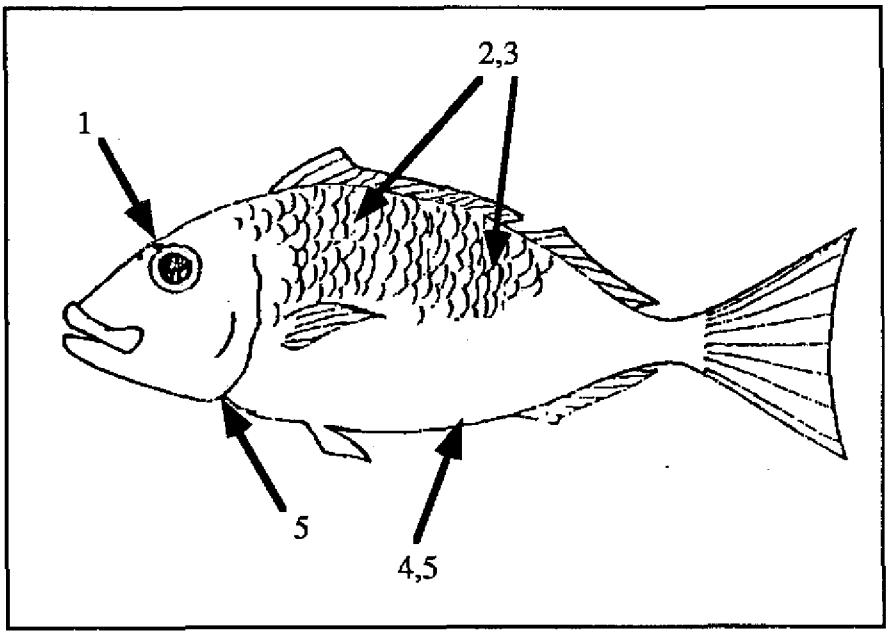
Mr Neville said the book gave a unique look at fish species with export potential in a chilled form. He said that, although the book had, in part, a Queensland emphasis, it had application Australia-wide to anyone contemplating entering the Japanese market.

Marketing chilled fish in Japan has 61 colour plates in its 66 pages. Its recommended price is A$ 20.00 and it is available from QDPI Publications, GPO Box 46, Brisbane 4001 (Telephone: (07) 239 3100) and the QDPI Bookshop, Ground Floor, Primary Industries Building, 80 Ann Street, Brisbane. If buying the book by mail through QPDI Publications, add A$ 4.00 to cover handling costs.

SEAFOOD SURVEY
(Source: *Fiji Times*)

The Fiji Department of Agriculture and Fisheries has provided the following guidelines for shoppers going out to buy fresh seafood. In Fiji, shell fish and crustaceans are also a popular seafood. These are plentiful and are mostly sold at food markets around the country. Unlike fish, shellfish and crustaceans should be still alive when sold.

The following is a checklist for the quality and freshness of various fish, shellfish and crustaceans available throughout the country:



The Fish

1. **Check the eyes** — They should be clear and jelly-like, not dark, shrivelled or sunken. This is one of the easiest and most reliable indicators of the state of the fish.

2. **Press side of the fish** — Meat should be firm and elastic. A thumbprint should disappear quickly.

3. **Check the colours** — The colours should be sharp and bright, not dull and faded.

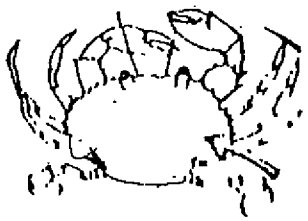
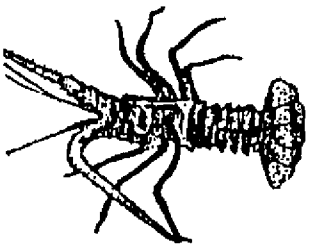
4. **Smell the fish** — If it is fresh, the body cavity will also smell fresh.

5. **Check gill area and body cavity** — To be sure that the fish has been properly cleaned. There should be no pieces of intestine, gills or blood clots to be seen. If for some reason the gills are still in the fish, they should be bright red in colour, not faded.

Octopus	Seaweeds	Sea cucumbers	Sea urchins
Usually found smoked at market. If fresh, try to buy alive. If dead, check skin texture.	Poor keepers. Once picked, will last only a few hours at market. Should feel crispy, not limp. Should smell fresh.	Sold alive or smoked/ dried. Should not be slimy if alive and not mouldy or insect-eaten if dried.	Sold in baskets. They should still be alive when sold. Will keep alive for a reasonable time out of water.




Reef clam	Crab	Lobster
Usually sold singly in market. May gape slightly open and still be alive.	Check the shell. If bright in colour and soft under shell point, may be little meat inside. Eyes should be flicking if still healthy.	Sold individually. If speared should be eaten immediately. Pull tail to see if it springs back into head. Check for blackening at junction of head and tail.

FRENCH PONTOON SYSTEM COMES TO AUSTRALIA

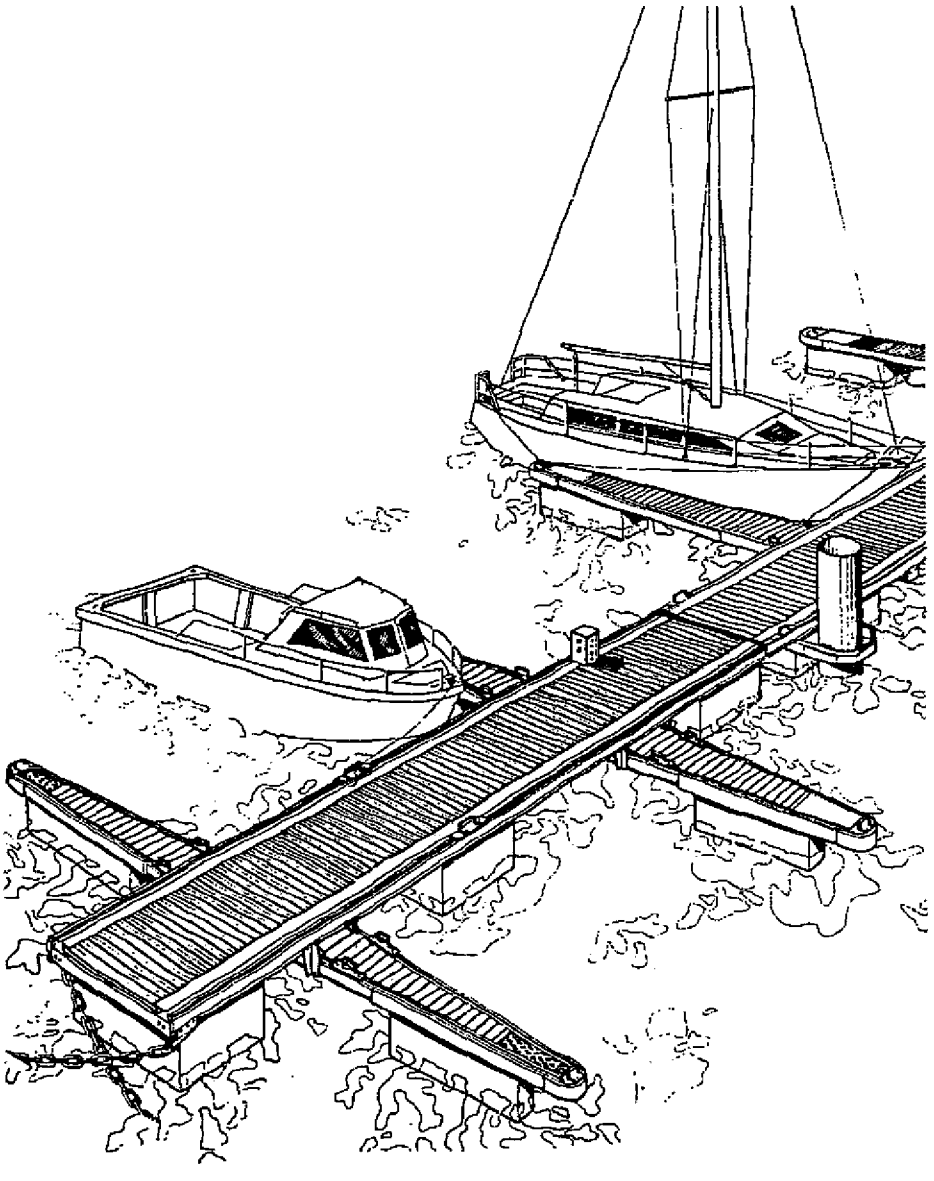
(Source: *Professional Fisherman*)

One of Europe's most versatile and widely used pontoon systems will soon be available in Australia. The French Metalu company's Equiport pontoons, which are a familiar sight along the coasts of Europe in a wide range of applications from swimming platforms to accommodating ocean-going vessels, are to be made in Werribee (Vic) by a company set up to do so. A small but progressive general engineering company, founded by Belgian-born Raymonde Haveaux, who came to this country 19 years ago, has obtained the Australian licence to manufacture the pontoons, together with the popular French-designed Aludory dinghy, from Metalu Industries SA, of St Brevin les Pins.

Raymonde Haveaux's company, Metro Metal Workers Pty Ltd, will continue its general engineering business, which is expanding rapidly. A second company, Metalu Industries

Australia Ltd, has been set up to handle the French manufacturing licence. Both will operate in the same premises in Lock Avenue, Werribee, reaping the benefits of a rationalised sharing of overheads and work force. Metalu's Equiport system is something like a giant Meccano set. Consisting of standardised components, it can be set up to cover just about any kind of mooring operation, in any kind of water.

Its series-produced, standardised elements, made of specially developed marine aluminium alloy extrusions, require no paint or other protection. With tropical hardwood planking and foam-filled floats of fibreglass-reinforced polyester or corrosion-resistant alloy sheet, the system consists of lightweight components which ensure low transport and handling costs, and absolute freedom from maintenance problems.



Standard 12 m long main walkways fitted with bilateral and unilateral finger piers. Alternative anchoring systems by chains or vertical steel/wooden piles.

A major advantage of Metalu's pontoons, which has made them so popular in Europe and the Mediterranean, is the ease with which a harbour installation can be modified to cope with changing needs. Assembly is by the ALRA Equiport bolting system, for which patents are pending: its operation is based on quarter-turn bolts and integrated bolting rails. The system ensures maximum stability by rigidly bolting the finger piers to the main walkways, and provides total access to water pipes and electric cables in lateral cable ducts with hinged aluminium covers.

Some of the components and their applications are:

— The extreme heavy-duty pontoon, 3.5 m wide, for fishing vessels up to 40 tons displacement (produced in special heavy duty tubular aluminium extrusions);

— The normal heavy-duty pontoon, 3 m wide with unilateral finger piers, for pleasure craft and smaller fishing vessels up to 20 m long and 25 tons displacement;

— The hinged aluminium access bridge, internal width 1.5 m, maximum standard length 30 m;

— The standard (12 m long) pontoon, 1.6 m wide, parallel to quay, anchored on vertical steel beams;

— Standard pontoon, 2 m wide with unilateral 440-PR type finger piers, for boats up to 6.5 m in length;

— Standard pontoon, 2 metres wide with bilateral 600-PR type finger piers, for boats up to 9 m long;

— Standard pontoon, 2.5 m wide, with unilateral 1000-PR or 750-PR finger piers for boats up to 14 and 11 m respectively;

— Type PCE visitors' pontoon, perpendicular to the main walkway, with integrated sliding guides at both ends, allowing concentration of visiting vessels;

— Standard pontoon, 2.5 m wide, with both bilateral 1000-PR and unilateral 650-PR and 400-PR finger piers;

— Standard pontoon, 2 m wide, anchored by articulated triangular steel frames and access bridges;

— Small visitors' pontoon, 1.5 m wide, anchored to quay by vertical beams;

— Electrically operated horizontal bridge over access channel.

Metalu Industries Australia have imported a limited number of components from France. These will have a dual purpose — to set up demonstration models of the Equiport system, and to serve as hands-on templates, so to speak, for the company's own work force. Thereafter, the Metalu Equiport pontoon system will be entirely manufactured in Australia.

DEVELOPMENTS IN AQUACULTURE IN TAHITI

(Source: *Austasia Aquaculture Magazine*)

Under the auspices of the French Government Agency IFREMER, much exciting development work is being carried out at their extensive COP (Centre Océanologique du Pacifique) research facility located at Vairao on the island of Tahiti. IFREMER and its commercial offshoot, France Aquaculture, have, within the field of aquaculture, a similar role to CSIRO in Australia.

Tropical aquaculture development

The COP facility is involved in developing aquaculture in tropical environments. Its principal aims are:

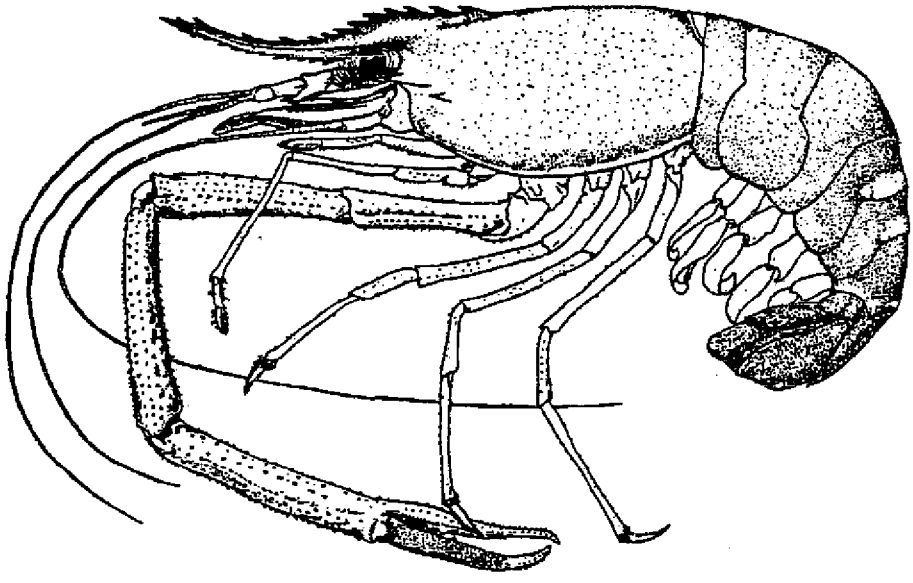
— Selection of species most suited to proposed farming areas;

— Completion of reproductive cycles in captivity and development of complete closed-circuit hatchery technology;

— Investigation of nutritional requirements and formulation of artificial feeds for all phases of life cycles;

— Technical and economic feasibility studies for new projects.

In practical terms, this has translated into the establishment of a local freshwater prawn industry based on *Macrobrachium rosenbergii* .



Macrobrachium rosenbergii

This species was introduced to Tahiti in 1973 and hatchery technology based on the clear-water method was developed. Today, post-larvae are consistently produced at densities of around 100/l in 35 days and annual production has been as high as 7.5 million. It is lower today as the optimum grow-out stocking density has been found to be 2—3/m^2 rather than the 15/m^2 which was originally used.

Closed-circuit water system

The hatchery has particularly low energy, manpower and water requirements, as it uses a closed-circuit water system. Water is purified for recirculation by passage through a sand bed and a biological filter consisting of a bed of coral pieces 30—50 mm in diameter. This provides a large surface area for micro-organisms which reduce ammonia and nitrate concentrations.

When this closed-circuit system was introduced, water usage was reduced by 90 per cent, staff required by 28 per cent, pumping costs by 60 per cent and heating energy requirements by 25 per cent. A joint venture farm of 10 ha, as well as a number of private farms, used post-larvae from the COP hatchery to produce 20 t of *Macrobrachium rosenbergii* in 1988.

Penaeid culture

Penaeid prawns have also attracted attention at COP, with larva production from many generations of hatchery-grown and mated prawns. This technology has been necessary in Tahiti as there are no naturally occurring penaeid species and hence no fishery to supply berried females for hatcheries. Most of the work in closing the reproductive cycle has been carried out on *P. monodon*, *P. vannamei* and *P. stylirostris*.

A pilot broodstock grow-out/hatchery area within COP is now producing 12 million larvae (mainly *P. monodon* and *P. vannamei*) annually and a fully commercial hatchery is under construction in Tahiti to transfer this technology to the private sector.

Last year, production of penaeid prawns in French Polynesia was 40 tonnes with one farm using intensive techniques developed at COP yielding 22 tonnes/hectare/year. Yields approaching 40 tonnes/hectare/year are being predicted for next year's harvest.

Satellite imaging for site selection

IFREMER has developed an ingenious technique to locate potential prawn farm sites. The spectral distribution of light reflected from flat land with suitable soil type has been determined for known good sites. This spectral 'fingerprint' is combined with digital satellite imaging at selected frequencies to survey large areas and choose favourable zones. These are photographed in greater detail by the spot satellite to determine the actual area available and its precise location.

This makes it possible to have a good idea of the size and viability of suitable sites before even a preliminary visit is necessary and saves much time and effort at the planning stage. This satellite survey work is available for a large part of the intertropical coastlines around the world.

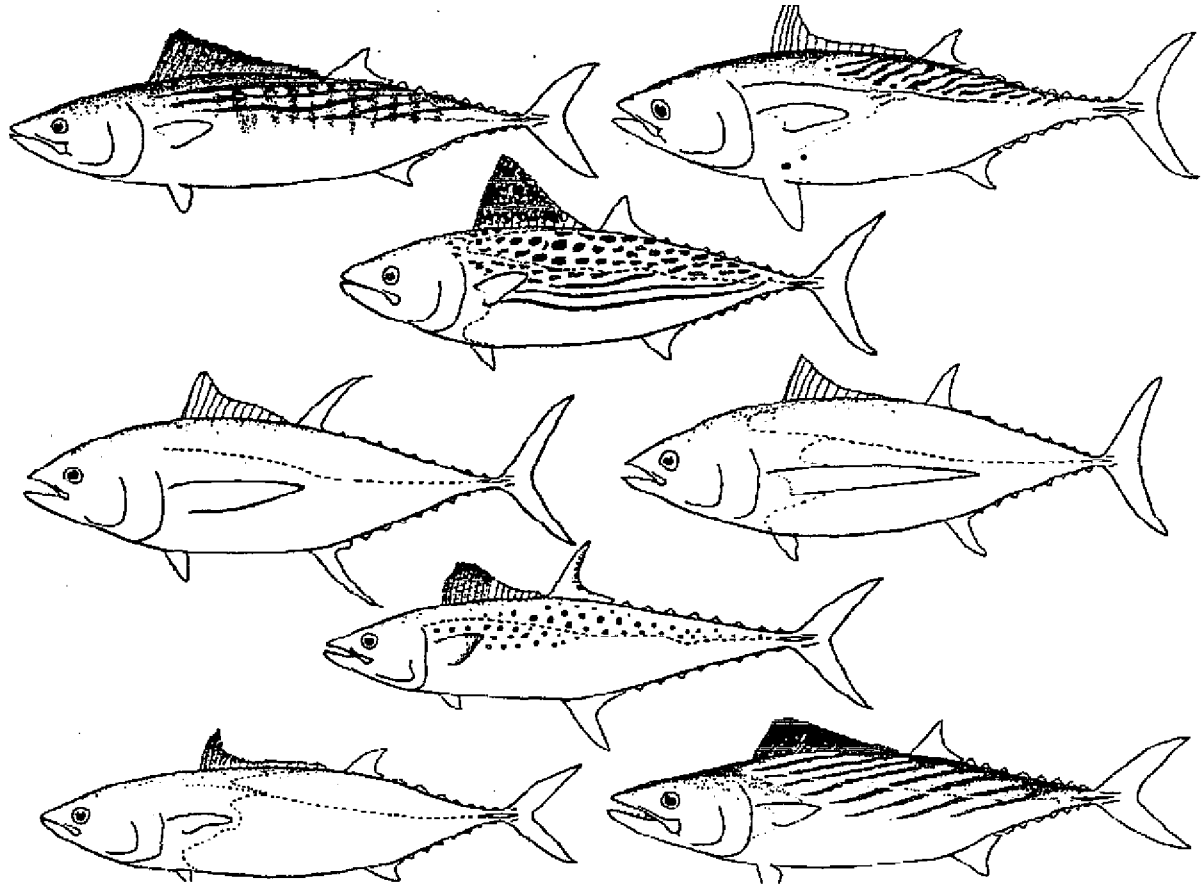
ABSTRACT

WORLD TUNAS AND BILLFISH

The Inter-American Tropical Tuna Commission has produced the fourth edition of its book *Tuna and billfish*. With its excellent line drawings and superb colour pictures, the book, which is sub-titled *Fish without a country*, is a treasure-trove of information for fishermen, the fish trade and biologists. It provides a clear and authoritative reference for all 61 species of tuna, billfishes and their relatives. Among the 28 full-page colour plates are 23 reproductions of outstanding water-colour paintings of tunas by Georg Mattson.

Tunas and their relatives are truly remarkable fish. The more they are studied the greater the mystery surrounding them becomes. Tunas must swim constantly to survive, forcing water over their gills to gain oxygen. Even when relaxed they still must swim at least one body-length a second, a speed which would outstrip the fastest human swimmer. Tunas, unlike other fish, are warm-blooded. Many of their problems involve trying to lower their temperature and find the vast amount of food they need. Some species eat 25 per cent of their body weight each day.

The book, written by James Joseph, Witold Klawe and Pat Murphy, explores several features of tuna life including the family tree, breeding habits, physiology, migration patterns and fishing methods.



SHRINKAGE AND WEIGHT LOSS OF NINE COMMERCIAL SPECIES OF HOLOTHURIANS FROM FIJIAN WATERS

by

Veikila C. Vuki, Institute of Marine Resources, University of the South Pacific, Fiji

and

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Introduction

In Fiji, several species of beche-de-mer (or sea cucumbers) are traditionally used for food; they include *Holothuria scabra*, *Holothuria atra* (**loliloli**), *Stichopus chloronotus* (**tarasea**) and *Bohadschia* spp. (**vula**). *Holothuria scabra* specimens can either be eaten fresh, marinated in lemon juice and salt or cooked in coconut milk. Other species are also prepared by cooking them in coconut milk for a few hours. *Holothuria atra* is sometimes fermented for a few days before marination or before it is cooked in coconut milk.

At present, 15 species of beche-de-mer are exported in dried form to Hongkong, Singapore and Taiwan, although Hongkong is the 'traditional' market.

Beche-de-mer have historically been important to Fiji. They replaced sandalwood to become Fiji's main export in the early 19th century. By 1840 stocks of beche-de-mer had been depleted to levels where it was non-economic to harvest them.

In the early part of the century, the beche-de-mer trade started to pick up again. But the trade was interrupted during the Second World War. In the 1970s, production was never more than 30 t but in 1984 beche-de-mer exports began to increase dramatically. In 1987 alone, over 600 t of beche-de-mer were exported. The marked increase in exports can be attributed to several factors, such as an increase in the number of species exploited. Currently about 15 commercial species are exported compared to the 2—3 species traditionally exported. New trade links between Hongkong and mainland China also provide new markets for beche-de-mer. In addition, many people in Fiji have become interested in the industry as a quick source of cash and 27 exporters were registered at the Fisheries Division in 1988.

However, the increase in beche-de-mer production has led the Fisheries Division to introduce guidelines on minimum size limits for beche-de-mer so that some degree of control can be exerted over exploitation of the resource. Since the animal shrinks during the process of cooking and drying, it was essential to determine the shrinkage and weight loss of beche-de-mer after processing, to enable the Fisheries Division to establish minimum size limits for dried products. The shrinkage rate would also be used to tell fishermen the minimum size of beche-de-mer to harvest from the sea, so that when dried, they would be greater than the minimum size allowable for export.

Method

Nine species (*Microthele nobilis*, *Microthele fuscogilva*, *Holothuria atra*, *Actinopyga miliaris*, *Thelenota ananas*, *Holothuria fuscopunctata*, *Stichopus chloronotus*, *Stichopus variegatus* and *Actinopyga mauritiana*) were collected from Suva Reef. In the field, the length of each individual was measured dorsally from the mouth to the anus. Each individual was tagged and

placed in a labelled plastic bag. Then they were all transported to the laboratory where they were weighed individually. Eviscerated specimens were excluded from samples.

Three major processing stages—boiling, smoking and drying, as outlined in the SPC Handbook *Beche-de-mer of the tropical Pacific*—were used. The boiling stage varied for each species but was within a range of 30—60 minutes. All species were smoked for approximately 48 hours and sun-dried for 3—4 days.

Results

The summary of results is presented in Table 1.

Table 1. Summary of results showing mean percentage weight and mean shrinkage of nine commercial species of beche-de-mer after processing (n = sample size)

Species	No.	Mean per cent Wt ± SD	Mean per cent shrinkage rate ± SD
Microthele fuscogilva	30	9.8 ± 2.6	52.5 ± 6.3
Microthele nobilis	6	8.1 ± 1.9	55.3 ± 6.3
Actinopyga miliaris	30	9.7 ± 4.5	52.3 ± 8.9
Holothuria atra	30	7.7 ± 3.5	47.7 ± 8.4
Thelenota ananas	12	5.6 ± 0.6	35.9 ± 2.1
Holothuria fuscopunctata	30	9.3 ± 2.9	50.1 ± 5.1
Stichopus chloronotus	37	2.7 ± 0.7	32.4 ± 3.8
Stichopus variegatus	7	3.9 ± 1.1	33.6 ± 3.9
Actinopyga mauritiana	30	4.9 ± 1.1	45.7 ± 5.0

Results showed that all species of holothurians processed had a very high weight loss and very high shrinkage rate. *Stichopus chloronotus* had the highest percentage weight loss of 97.3 ± 0.7 per cent and also the highest shrinkage rate of 67 ± 3.8 per cent.

Stichopus variegatus, *Thelenota ananas* and *Actinopyga mauritiana* had a very high weight loss and shrinkage rate when compared with other species processed.

Microthele fuscogilva, had the lowest mean percentage weight loss (90.2 ± 2.6 per cent) while *Microthele nobilis* had the lowest mean shrinkage of 44.7 ± 8.9 per cent.

Discussion

In general, the results of this study (see Table 1) indicate that the majority of species of holothurians processed had shrunk by almost 50 per cent. This suggests that the length of the dried beche-de-mer represents half the length of the live animal. Thus, there is a considerable reduction in the length of holothurians during processing.

In contrast, the weight of the dried product would be approximately 10 per cent of the live animal. The variable weight may not be practical for resource management but will be a useful measure for approximating equivalent dried product for those exporters who are currently purchasing live animals for processing.

The relatively high loss of processed beche-de-mer is mainly due to the removal of guts and the high water content lost during gutting, smoking and sun-drying.

A comparison of this study and other studies by Crean (1977) and Conand (1979) is shown in Table 2. The results of this study and of Conand (1979) are similar in terms of shrinkage and weight loss for *Microthele nobilis*, *Thelenota ananas* and *Microthele fuscogilva*.

The weight loss of *Microthele nobilis* was slightly higher in Crean (1977) than in Conand (1979) and this study. This could have been due to Crean's very small sample size (n=5) and variable drying period in the different studies.

Table 2. Shrinkage (L) and weight (W) of dried bêche-de-mer as a percentage of the live animal from various studies in the South Pacific (n = sample size)

	Microthele nobilis			*Thelenota ananas*			*Microthele fuscogilva*		
	No	L	W	No	L	W	No	L	W
Crean (1977) Solomon Isl.	5	51.8	6.8	-	-	-	-	-	-
Conand (1979) New Caledonia	70	51.0	9.0	18	38.0	5.0	13	44.0	8.0
This study	6	55.3	8.1	12	35.9	5.6	30	52.5	9.8

In terms of resource management, it is suggested that size limits for individual beche-de-mer species would be easier to implement than weight limits. When imposing the size limit, the 50 per cent shrinkage must be taken into consideration.

It may be possible to give special consideration to species such as *Stichopus chloronotus*, *Stichopus variegatus*, *Thelenota ananas* and *Actinopyga mauritiana*. These species have a much higher shrinkage rate and a recommended 30 per cent shrinkage rate should be taken into account.

It must be emphasised that the size limit obtained from a study such as this can be only used as a temporary measure until research has been undertaken on the reproductive biology and age-maturity-size.

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The following article is reprinted, with slight modifications, from *Australian Fisheries*.

TOO MANY CANOES SPOIL THE LAGOON
(A South Seas tale of boats, licence values and over-capitalisation)

by

Frank Meany

Recently I was asked to explain (not for the first time) why money invested to put too many boats into a fishery is termed over-capitalisation by economists, while the same amount of money invested in fewer boats but large licence values is not. The former occurrence has been known to leave dedicated economists near to tears, while the latter is considered to be rather a good thing. Why, my questioner asked, should this be so when the same amount of capital is involved in both cases.

Although I tried, I am not sure my explanation was totally convincing. It was only later that I remembered an anonymous report I had read in a learned academic journal. This report recorded a series of events in a remote area of the South Seas and helps explain the problem of over-capitalisation. As I remember it, the story went as follows.

There were two islands on opposite sides of a large lagoon, one called East Island and the other called West Island. For most of the year, life on the islands was idyllic — sunshine, gentle breezes and clean sandy beaches. But for two months of the year, the islands suffered from high winds and cold biting rain. There were no trees of any size on the islands because of these great winds. The islanders were self-sustaining. There were vegetables and fruits from the gardens, pigs and chickens, and of course fish from the lagoon.

There was one export, a very attractive shell which was unique to the lagoon, and this was used for trading with other islands. In particular, it was used to buy the canoes from which the islanders did their fishing and shell gathering (the few trees able to grow on the islands were not big enough for making canoes).

Rivalry

There was intense rivalry between the inhabitants of the two islands, although since the advent of missionaries 100 years before, they no longer included each other as part of their diet. Whatever one island had the other had to have also. Still, they got on reasonably well and had long ago agreed to divide the lagoon into two parts. No poaching was allowed.

West Island had recently acquired a new chief, a young man with a university education (B.A.) courtesy of Australian foreign aid. He was all gung-ho for 'development'. East Island was ruled over by a chief of some antiquity, well taught in the school of hard knocks. He watched with interest developments on West Island.

The young chief first sought aid from the United States and Russia, but as the islands had absolutely no strategic value his requests were politely turned down. His approaches to Australia were listened to even more sympathetically but in the end he was told regretfully that the coffers were bare. France showed considerable interest, but when their negotiators started talking about filling in the lagoon to build an airstrip and casually sought the young chief's views on his people's attitude to their possible relocation, he decided it was best to discontinue negotiation. The only solution was to fund the development themselves.

The young chief's ideas for development were, as he explained them to his fellow islanders, quite modest. His initial plan was to build what he termed a 'civic centre'. This would serve a number of functions — it would be used as a school, as a meeting place for tribal gatherings, as a place where the young chief could greet visiting dignitaries and (this was the main selling point) as a place where they could all shelter during the two months of gale force winds and freezing rain. In actual fact, this was only the first stage of a grand plan the young chief had developed in his own mind. Knowing that his fellow islanders were rather conservative, he considered it better to reveal this plan only one step at a time.

The old chief on East Island heard of the civic centre and wondered why he had not thought of it himself. He realised that his own people were impressed with these new ideas. From then on, he watched the young men of his tribe most carefully. He took the precaution of writing a very fatherly letter to East Island's first two undergraduates who were now completing their degrees in New Zealand, congratulating them on their progress and urging them to stay on for a further period to take maximum advantage of this once-in-a-lifetime opportunity. Apart from this, the old chief did nothing but continue to watch and wait.

Public meeting

The young chief called a public meeting to discuss his building programme. Most of the building materials and all the labour needed were already available on the island. There was coral which could be broken up and used for foundations and floor, and palm leaves that could be woven to make walls and roof. However, as there were no trees of any size on the island, the posts needed to support the structure and the main roofing beams would have to be imported. How to pay for these imports was the problem.

The young chief reviewed the economy of his island. In total, the islanders landed five canoe-loads of shells each year. These were used as money on the island. The shell-gatherers used them to buy fruit and vegetables from the gardeners and fish from the fishermen. Once in circulation, the shells became general currency. There were five canoes used by the shell-gatherers and five by the fishermen. Each canoe had a life of five years, so two were replaced each year.

Each year a trading ship visited the islands, and at that time two new canoes were purchased as well as essential trade goods like beads, mirrors, home computers and Michael Jackson records. As each new canoe cost one canoe load of shell, the island had, after buying the two new canoes, three canoe-loads of shell with which to buy trade goods. The young chief believed in forward planning and persuaded his people to forego part of their expenditure on trade goods and instead to use the shells to buy two more canoes for shell gathering.

Strategy

His strategy was to double the catch of shell by increasing to ten the number of canoes used — two more boats in the first year, two in the second and one in the third. At the end of the first year, he would have seven canoe-loads of shell, four to be used to buy canoes (one to replace a fishing canoe, one to replace a shell-gathering canoe and two new shell boats). The other three boat-loads would be used to buy the old level of trade goods. In the third year he would have nine boats shell-gathering, and of the nine loads of shell, three would be used to buy canoes (one replacement shell and one new shell), three loads of shell would be used to buy the usual amount of trade goods and with the other three, three of the corner posts for his civic centre. In the fourth year he would of course be able to complete his building and have resources available to spend on the next stage of his as yet undisclosed 'grand plan'.

With a considerable amount of grumbling, the islanders bowed to their chief's superior knowledge and reluctantly accepted the proposal. That year, when the trading ship arrived, the

West Islanders parted with their five canoe loads of shells for one fishing canoe, three shell-gathering canoes and one-third of their normal amount of trade goods.

When he heard of these plans the old chief called his own meeting. He proposed a similar civic centre for East Island but outlined a less ambitious strategy. He suggested that they divert one canoe-load of shell from trade goods and put it aside to cover the cost of their first corner-post. With great difficulty, he persuaded his fellow islanders to accept. The old chief had in mind a story told by his grandfather that when traders had first come to the islands they had encouraged greater shell exploitation. This worked fine for a while. The islanders gave up gardening and fishing and all worked at taking shell to exchange for trade goods. The people prospered until catch rates fell and things then became very difficult. To survive, they stopped shell-gathering and ate the traders. It took many years for the shell beds to rebuild and the sharing arrangement with West Island was a result of this.

For the first few months, things went well on West Island and they were well on target for their seven canoe-loads of shell. Then catch rates began to drop, and, by the end of the year, they had only six canoe-loads.

Muttering something about 'adverse environmental factors', the young chief told his followers that to stay on target for their building programme there would be only two canoe loads of shell left for trade goods after the projected four canoes (one fishing, one replacement shell and two additional shell) had been bought. At this there was much shouting and yelling, but in the end he had his way.

On East Island they had their usual five canoe-loads of shell; they purchased their replacement boats and two canoe-loads of trade goods and put aside the fifth canoe load to meet the cost of their first corner post.

Even with the nine canoes fishing, the West Islanders' catch continued to drop. At the end of the year there were only four canoe-loads of shell. The young chief again muttered about adverse environmental factors but had it pointed out in no uncertain terms that East Island had still taken five canoe-loads of shell.

Remembering the fate of the first traders, the young chief decided the time was opportune to take up a scholarship to continue his studies at a Canadian university. He quickly packed his belongings and embarked on a trading ship one dark night, leaving his formal resignation as chief under a rock on the beach.

The diversion of labour from vegetable-growing and fishing to man the additional shell-gathering boats had also resulted in a shortage of food.

The old chief from East Island saw his chance. In exchange for a couple of canoe-loads of yams he acquired the four near-new canoes. These became his replacements for the fishing and shell-collecting canoes for the next two years (two being stored until needed).

Because of reduced shell production from West Island, he was also able to demand a higher price for his shell. In this way he found he was now able to complete his civic centre and restore the purchase of trade goods to their previous three-canoe level.

The old chief was acclaimed as a great leader and his first official function in the new civic centre was to formally welcome home the island's first two university graduates.

Over-capitalisation

What, you may well ask, has this to do with over-capitalisation and value of licences? At first sight, not very much. In reality, quite a lot.

Over-capitalisation in shell gathering on West Island is quite evident. The three canoe-loads of shell the island had to buy trade goods each year represented a profit or the excess of income over expenditure this shell gathering was generating. The young chief had diverted part of this profit from expenditure on consumer (trade) goods into capital expenditure on new boats.

The old chief had diverted part of his island's expenditure on consumer goods to savings and later to capital works in the form of his civic centre.

Outlay on the additional boats was in the long run unproductive, as it did not add to the West Islanders' store of goods. Outlay on the civic centre was, on the other hand, a significant asset to East Island and added to the standard of living there.

Money (the shells in this instance) is simply a means of exchange, with no real value in its own right. The shells were used to buy goods and services. The logs used to build canoes could not be used as corner posts for a civic centre and the labour used to take shell could not at the same time be used for fishing or gardening. Resources were being used up.

When we look at expenditure on a boat, or on a boat and licence, we tend to consider it through the eyes of the individual. It costs a fisherman the same to borrow $1 million for a boat alone as it does for a half million dollar boat with a half million dollar licence. From a broader community view this is not so.

Just as using shells to buy additional non-productive canoes rather than consumer goods or capital items represents a waste of resources, so does expenditure on boats that add additional capacity to an already fully exploited fishery. Even in an economy as large as, say, Australia's, the amount of resources (capital, labour etc.) available is limited. If used for one purpose, they cannot be used for another.

Fishing licences acquire a value because of the profit their use can generate. If the rate of return that can be obtained from some comparable investment is 20 per cent, and if investment in fishing earns 25 per cent, more capital will be invested in fishing. If boat numbers are restricted, licence values will rise until the return on boat and licence is 20 per cent.

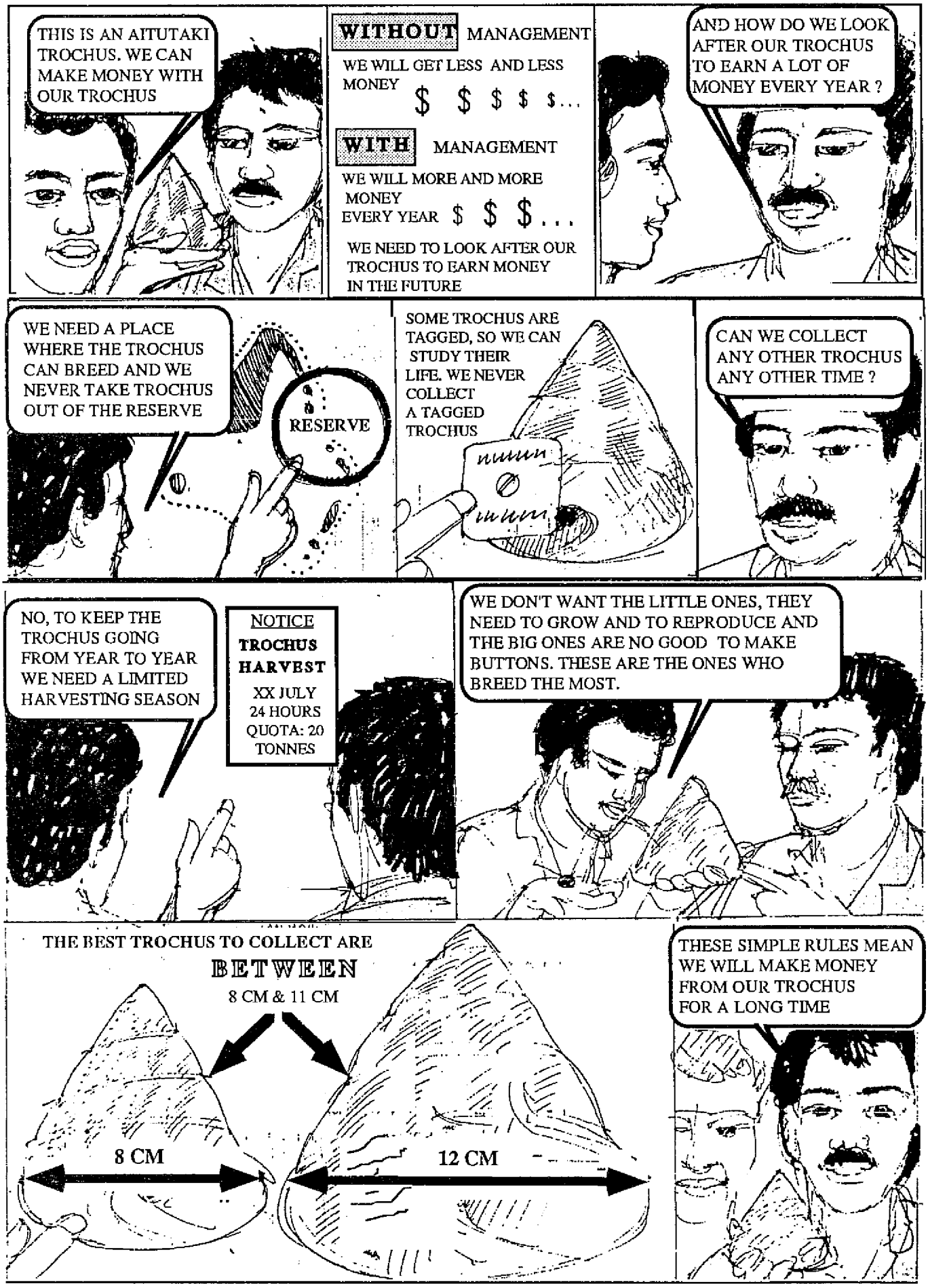
The capital invested in licences is not, however, used up. The ownership of the money has changed, but the total amount of investment capital available to the community has not. The new owners of the money can use it to buy consumer goods or build civic centres. If it had been used to build more boats, this could not have happened.

Postscript

After considerable investigation, I have obtained additional information on the fate of the two island leaders.

The ex-chief, now a Ph.D. but not quite so young, never returned to West Island, having found university life more to his liking. There he prospered. He was quickly appointed a professor and became widely acknowledged as a lecturer and contributor of papers to learned academic journals, his two fields of expertise being developmental problems in Third World countries and politics of South Sea islands.

The old chief is now very old, but much venerated and respected by his people. His position as chief is beyond dispute. For 10 months of the year he sits in front of his civic centre looking out across the lagoon, passing judgment on various disputes brought to him by his people. Behind him in the civic centre, the island's children are receiving excellent education from the university graduates (one of whom also works part-time as official secretary to the old chief). When the two months of high wind and cold driving rain arrive, the old chief joins the rest of his people in the shelter of the civic centre.



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