

# FISHERIES NEWSLETTER

Number 32: March 1985

<u>Contents</u>	<u>Page</u>
(1) <u>SPC Activities</u>	2
(2) <u>News From In And Around The Region</u>	6
(3) <u>Fisheries Science And Technology</u>	13
(4) <u>Progress Report On Tuna Tracking</u> by Kim Holland, Randolph Chang and Scott Ferguson	19
(5) <u>Cardinal Fish And Fusiliers: An Alternative Baitfish Resource In Tuvalu</u> by Robert Gillett	24
(6) <u>Seafood Processing In French Polynesia</u> by S. Yen and W. Neagle	30

© Copyright South Pacific Commission 1984

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

Original text: English.

## SPC ACTIVITIES

### 17th SPC Regional Technical Meeting On Fisheries

This meeting has been provisionally scheduled to be held in Noumea, New Caledonia from August 5th-9th (inclusive) 1985. The meeting has been held on an annual basis for over a decade now, and has proved an excellent forum for the discussion of all aspects of fisheries development in Pacific Island countries, by national fisheries officers, technical specialists and representatives of development and other organisations. This year's meeting is expected to include sessions on deep-water snapper resource assessment and management, fish aggregation devices, fisheries training, and on refrigeration systems in the fisheries sector. The formal announcement and draft agenda for the meeting will be circulated by SPC Savingram shortly.

### Two SPC Fisheries Training Courses Get Under Way

February saw the commencement of two major coastal fisheries training programmes: the SPC/Nelson Polytechnic Pacific Island Fisheries Training Course held in Nelson, New Zealand, and the SPC/UNDP Regional Refrigeration Training Course, now under way in Rarotonga, Cook Islands.

The Nelson course, which is being attended by 12 students from 11 Pacific countries, began on 6 February and will run for 23 weeks. The aim of the course is to train participants in the variety of practical skills required to operate a successful fisheries extension centre or outstation in a remote location. Fisheries officers in this situation are generally required to provide assistance and advice to fishermen, as well as repair and maintain mechanical equipment such as boats, motors and freezers, often with little external support and limited facilities and communications. The Nelson course was initiated in 1979 to provide broad-based practical training geared to this situation. The first 18 weeks of the course deal with a range of practical skills, including the maintenance and repair of diesel engines, outboard motors and refrigeration equipment, welding, fibreglass construction and repair, rope work and net making, navigation and chartwork, fish quality control and business management. The students spend 2-3 weeks of this period at sea on a commercial fishing boat, and another 2-3 weeks working in a fish processing factory. For the last 5 weeks of the course, the students will travel to Fiji for instruction in small-boat fishing techniques under the supervision of an SPC Master Fisherman. The trainees will thus have the opportunity to put into practice some of the skills learnt in the classroom or workshop at the Nelson Polytechnic.

The second training programme to start in February was the SPC/UNDP Regional Refrigeration Training Course, which opened in Rarotonga on the 26th. The course, which will last for 19 weeks, constitutes phase II of the SPC/UNDP Regional Refrigeration Assessment and Training Project whose aim is to identify problem areas in the effective operation of fisheries-sector refrigeration equipment in the region. The lack of trained refrigeration technicians is seen as a major obstacle facing Pacific Island countries in establishing fish storage and distribution facilities, and this course has been designed to help overcome this situation. The 14 trainees selected are all engineers, mechanics or electricians, and the course will build on their backgrounds to train them

in the special requirements of refrigeration engineering. The Rarotonga venue was selected due to the availability of an ideal training complex, a former large supermarket which has now been converted to a classroom, tool store, office and large workshop, while still housing several walk-in cold stores as well as many items of refrigeration equipment acquired for the course.

The report of phase I of the SPC/UNDP Regional Refrigeration Assessment and Training Project has now been completed and drafts circulated to UNDP offices and several technical specialists for comment.

#### SPC Fisheries Training Officer Post Advertised

Following approval of the SPC Regional Fisheries Training Project by the South Pacific Conference in October 1984 (see SPC Fisheries Newsletter No.31, p.2), extra-budgetary funding has generously been made available by the Australian Government for the appointment of a Fisheries Training Officer. The post was advertised in SPC Savingram No.6/85 of January, with applications closing in mid-April. When appointed, the Fisheries Training Officer will be responsible for the supervision and administration of all SPC Fisheries training activities, including the identification of training opportunities, organising specialist courses in response to country requests, identification of resource personnel and supervision of their training inputs, development of training aids and materials, and supervision of trainees. Training activities, such as the Nelson Course and the Refrigeration Course (described in preceding article), will in future be carried out under the auspices of the Regional Fisheries Training Project, under the supervision of the Fisheries Training Officer.

#### Deep Sea Fisheries Development Project Notes

--Fiji--

Master Fisherman Paul Mead's gear development work on fish aggregation devices (FADs) near Suva concluded in late March with the scheduled end of his assignment to Fiji. Paul has been refining techniques for the capture of deep-swimming tunas, particularly by the use of vertical longlines, but also by deep-trolling and a variety of other methods. Catches, while variable, have been generally good and occasionally spectacular, with catches of 8 or more bigeye and yellowfin tuna each upwards of 15 kg in weight, on a single set of the line. Catches have shown a consistent improvement as Paul has experimented with changes to the gear configuration, setting time and bait type and presentation, incorporating improvements as they were developed. Paul's work will be of direct relevance to many other Pacific Island countries and will be discussed at the 17th SPC Regional Technical Meeting on Fisheries in August. Paul's next assignment, starting in April, is to Tonga.

--Federated States of Micronesia--

Master Fisherman Lindsay Chapman's assignment in Yap State of the FSM was extended until March, with continuing emphasis on experimental fishing around FADs. A number of exotic methods, including vertical longlining, the use of single-hook drift lines, and the palu-ahi methods were tried, but mostly with limited success. These methods all target on the larger tuna species which

were conspicuous by their absence from the FADs during this period. In contrast, standard surface trolling methods using small artificial lures yielded good catches of mahi-mahi (Coryphaena hippurus), wahoo (Acanthocybium solandri) and juvenile tunas.

During this period, Lindsay also made a 2-week study visit to Hawaii to learn more about the ika-shibi and palu-ahi techniques from local fishermen.

--Marshall Islands--

Master Fisherman Pale Taumaia travelled to Majuro in mid-February to start his assignment in the Marshall Islands. Pale's first job is to train Marine Resource Department staff in deep-water snapper fishing techniques, using the standard FAO-wooden handreel. Later in the assignment, Pale will supervise extension trips to some of the outer islands where similar training programmes will be offered to local fishermen.

#### Funding Confirmed For SPC Fish Handling And Processing Project

This new project was approved by the 24th South Pacific Conference in October 1984 (see SPC Fisheries Newsletter No.31, p.2) subject to the Commission's locating extra-budgetary funding which has now generously been committed by the New Zealand Government. The project is based upon, and will be closely linked to, the long-running SPC Deep Sea Fisheries Development Project, under whose auspices roving master fishermen undertake in-country assignments related to the development of the harvest sector of national fisheries. The new project will employ a Fish Handling and Processing Specialist who will act in a similar capacity, in the post-harvest sector, by assisting fishermen and fish marketers to upgrade handling procedures and develop new products and markets. Recruitment procedures for this post will be initiated in the near future.

#### Potential For Small-Scale Prawn Fishery In Papua New Guinea

Two reports (The Development Of Artisanal Prawn Fisheries Near Daru, Papua New Guinea by M.C.L. Dredge; and Small Scale Prawn Trawling In Western Province: A Pilot Study by D.C. Cook and C.D. Tenakanai) have recently been released on an SPC-funded consultancy in Papua New Guinea which aimed to assess the feasibility of small-scale prawn-trawling by boats based at Daru, on the Gulf of Papua. The consultancy was carried out by Dr Michael Dredge of the Australian Department of Primary Industry (DPI) in conjunction with the PNG-DPI Fisheries Division.

During the 17-day consultancy period, three small beam trawls (3.7-5m beams) were constructed and towed using three different vessels - a 7m wooden dory with a 30hp inboard diesel engine; a 5m aluminium dinghy with a 35hp outboard; and an 11m dugout sailing canoe. The two motorised boats produced catch rates of about 3kg/hour of trawling, while, perhaps suprisingly, the sailing canoe yielded almost 5kg/hour. The higher rate is attributed mainly to the canoes ability to operate in shallower water (during the highest-yielding tow, the canoe continually bumped the bottom) and possibly also to the fact that the motorised vessel's propellers may have disturbed and scattered the prawns.

Most of the catch (70%) comprised banana prawns (Penaeus merguensis), with the rest comprising mixed endeavour prawns (Metapenaeus spp.) and coral prawns (Parapenaeopsis sculptilis). In Australia, these species would fetch A\$7-8/kg, but in Daru the prices received were disappointing, with coral and endeavour prawns not being accepted, and banana prawns fetching only A\$2/kg. Nevertheless, the estimated nett income to a small-boat trawling operation would probably considerably exceed returns on other local fishing methods. For the sailing canoe, with no fuel bills and a modest outlay for ice, prawn trawling during the trials earned about 7 kina/fishing hour, with a maximum daily income of about 65 kina. The powered boats, with lower catch rates and fuel to pay for, earned 1.09 kina (outboard dinghy) and 2.92 kina (inboard dory) per hour respectively. Set against these earnings figures is the cost of the net, estimated at 50 kina for materials.

The resource is spread over about 130 nautical miles of coastline, but has not so far contributed significantly to Western Province's economy. Occasional beach-seining has in the past resulted in annual landings of about 4 tonnes/year. However, given that there are hundreds of sailing canoes in the province which could be used for trawling, there is a potential fishery of possibly 100 to 200 tonnes, which could be a major boost to the region's economy.

#### Tuna And Billfish Assessment Programme

There have been a number of staff changes in the Tuna Programme since October 1984. The Programme Co-ordinator, Computer Systems Manager, and two Senior Fisheries Scientists have been replaced. Additionally, two new posts, Assistant Fisheries Statistician and Computer Programmer/Research Assistant, have been created by re-organisation of the existing staff establishment. In all there are five new faces in the Tuna Programme.

The Fisheries Statistician, Tom Polacheck, spent a week in Tuvalu during the month of February. He was there to make recommendations for the improvement of the system of collection of data on catches of both tuna and reef fishes by local fishermen. During his visit, a new system for registering local fishing boats and recording their catches was established. Preliminary experience indicates that the system is currently functioning well. A longer follow-up visit by a consultant is planned for later in 1985, to further improve the system and expand its use.

Fisheries Research Scientist, Bob Gillett, spent February in French Polynesia to conduct a joint pilot study with EVAAM (Etablissement pour la Valorisation des Activites Aquacoles et Maritimes) to test the feasibility of tagging tuna from the small local pole-and-line vessels called bonitiers. The test was successful in that it was shown that it is practical to tag tuna from these vessels. Unfortunately, fishing was unprecedentedly bad, and very few fish were caught. EVAAM staff will be continuing tagging in conjunction with a proposed study of fish movements associated with FADs.

In March, SPC Deputy Director of Programmes, Vitolio Lui, and Tuna Programme Co-ordinator, John Sibert, attended the Forum Fisheries Agency High-level Meeting on Regional Co-operation in Fisheries Management and Development in Honiara. Alternative institutional arrangements for the Tuna Programme was an agenda item and featured prominently in discussions. Several

alternatives were discussed at length but no definitive conclusions were reached. During the course of the meeting, the Programme Co-ordinator presented preliminary results of the on-going analysis of purse seine and longline fisheries for yellowfin in the western Pacific. In general, conclusions are that although the potential for interaction between purse seine and longline fisheries is very great, this potential is not yet fully realised. There is some cause for concern, however, because the effects of the purse seine fishery on yellowfin stocks may be beginning to be felt. The Co-ordinator emphasised that these conclusions were only preliminary and that a more definitive analysis is underway.

Fisheries Research Scientists Bob Gillett and Richard Farman have made observer trips on several kinds of fishing vessels, including U.S., Japanese and New Zealand purse seiners. Reports outlining the results of these trips are in preparation.

#### Black Coral Survey Carried Out In Tonga

Dr Richard Chesher, consultant to the SPC-based South Pacific Regional Environment Programme (SPREP), has recently completed the report of his assessment of black coral resources in the Kingdom of Tonga. His work, carried out on behalf of the Tongan Government, aimed to survey stocks and provide recommendations on methods for resource management, in view of the fact that more intensive exploitation by commercial divers has recently begun.

The main conclusion of the survey is that the black coral resource in Tonga is limited in extent and is presently being overexploited. Very large specimens, probably 80 or more years old, were present in Nuku'alofa, but were threatened by commercial harvesting and by siltation caused by harbour works and dredging. In other areas, true black coral is much less abundant and is very vulnerable to rapid overexploitation. The report, therefore, recommends a total prohibition on harvesting live black coral (but not on dead specimens, which outnumber the live ones), and on the export of raw (unworked) black coral. In its raw form, the coral is sold for T\$2 to T\$5/kg, whereas as a carved jewelry item sold locally to tourists, its value may exceed T\$2,000/kg.

Dr Chesher also recommends the continuation of replanting experiments which he initiated during his survey. This involves snipping the branch tips from live colonies and wiring them back into the reef, where they may regrow. If this technique proves successful, it then becomes possible to augment the natural black coral population by a very large degree, as a single large specimen can yield thousands of branch tips.

#### NEWS FROM IN AND AROUND THE REGION

##### 'Pacific Sealink' Seminars To Be Held Via PEACESAT

For the past 12 years, a number of Pacific Island countries and regional institutions (including the SPC) have been able to make use of NASA's Applied Technology Satellite, ATS-1 to implement the PEACESAT (Pan Pacific Education

and Communication Experiments by Satellite) network. Discussions on health, education and technology among participants in several countries have been made possible via the 23 autonomous PEACESAT terminals in Hawaii, New Zealand, the Cook Islands, Mariana Islands, Caroline Islands, Fiji, Western and American Samoa, New Caledonia, Papua New Guinea, Marshall Islands, Australia and elsewhere.

This year, several seminars have been planned specifically for fisheries officers, to enable the interchange of information and experience on specific topics. The seminar series, called 'Pacific Sealink', is a co-operative programme between the Universities of Guam, Hawaii, and the South Pacific, and the Marine Resources Division of the Federated States of Micronesia. Sessions will last for one hour and interested individuals are invited to contact their local PEACESAT station in order to participate. Planned dates and subjects are:

- April 10    --    Illegal and Destructive Fishing Practices  
                  (Harry Kami and Lu Eldredge)
- May        8        --    Turtle Conservation in the Pacific  
                  (George Balazs)
- July       10       --    Training for Fisheries and Marine Science  
                          in the Pacific  
                  (Mike Gawel)
- August 14    --    Joint Ventures in the Pacific - Who profits,  
                          Who loses  
                  (Karl Samples)
- October 9    --    Culture of Tilapia in the Pacific  
                  (Steve Nelson, David Crisostomo)
- December 11 --    Ciguatera Poisoning  
                  (Yoshi Hokama, Paul Scheuer)
- February 12 --    Seaweed Mariculture  
1986                (Spenson James)

For further information, write to:

Peter Rappa, University of Hawaii  
Sea Grant Extension Service, Room 213  
1000 Pope Road, HONOLULU, Hawaii 96822.

We hope to present summaries of selected 'Pacific Sealink' transcripts in future issues of the SPC Fisheries Newsletter.

#### Western Samoan Fishermen End Up In Fiji

(Source: Fiji Times)

Four Western Samoan fishermen who drifted on the open sea for five days were happy to be back on dry land early in November, even though the land happened to be far from home. Lino Lia, Kome Peti, Mologa Pele and Pele Pele left Apia on Thursday November 8th to go fishing, with one can of fish and a

small container of water which they finished on Thursday night. On the return trip home, their 9-metre 'alia' catamaran developed engine trouble, and they began drifting.

Mr Lia said most of them kept praying throughout the five days, during which time they were often unconscious due to hunger and thirst. On Monday night (November 12th) he started waving a white bedspread in the air after he heard the roar of an aeroplane. Fifteen minutes later, they saw the shape of a large ship looming over the horizon and heading towards their boat. The ship was the merchant vessel Forthbank, which picked up the fishermen at about 10.15 pm.

The rescue was brought about by the Nadi-based Search and Rescue Department and a Royal New Zealand Air Force Orion aeroplane, which spotted the drifting 'alia'. The Forthbank, which was en route from Apia to Suva, was notified and diverted its path to pick up the drifting fishermen.

#### Second Announcement Of Fifth International Coral Reef Congress Made

The Coral Reef Committee of the International Association for Biological Oceanography (IABO), in conjunction with the Museum National d'Histoire Naturelle and the Ecole Pratique des hautes Etudes in French Polynesia have recently circulated a second announcement of the forthcoming Fifth International Coral Reef Congress. The meeting will be held in Tahiti, from 27th May to 1st June, and will be immediately followed (2-8 June) by a number of scientific field trips organised for interested participants.

The Congress is sponsored by the United Nations Educational Scientific and Cultural Organisation (UNESCO), with much financial and other support from a number of national and international institutions. Many scientists specialising in a wide range of disciplines (such as biology, geology, palaeontology, ichthyotoxicity, aquaculture, and reef-related tourism) are expected to attend, and every effort is being made to ensure participation by representatives of developing countries. Several types of scientific session are planned, including: the presentation of individual papers, either verbally, or by posters; symposia, in which a group of individual papers on a specific subject area are presented and discussed; and four seminars in which selected scientists lead discussions on the present state of knowledge and the need for future research in their specialist areas. Two of the four seminars entitled "Assessment and Management of Coral Reef Fisheries: biological, environmental and socio-economic aspects" and "Pollution, Degradation, Planning and Management of Coral Reefs" are of particular interest to fisheries personnel of the SPC region, as are some of the proposed symposium titles (eg. Protection and Conservation of the Reef Environment) and general sessions (The Reef and Man - 1. Fisheries; 4. Management; 7. Social and socio-economic studies).

Further details and registration information can be obtained from:

Fifth International Coral Reef Congress

Antenne Museum-EPHE

B.P. 562, PAFETE, Tahiti

Polynesie francaise.



### Aquaculture Trade Directory In Preparation

(Source: European Mariculture Society)

A multilingual European Aquaculture Trade directory (EATD) is currently in preparation by the European Mariculture Society (EMS). The publication will be a reference guide listing suppliers of aquaculture products, equipment, feedstuffs, services, sources of aquaculture information and aquaculture research centres and organisations. The directory will be published in 1985, and will cost US\$10. Anyone wishing to place an entry in it or obtain a copy can obtain further information from:

EMS, Prinses Elizabethlaan 69

B-8401 BREDENE, Belgium.

The EMS is to change its name in 1985 to the European Aquaculture Society. The new name is felt to reflect more accurately the range of the Society's activities and the interests of its members.

### Hong Kong Buyer Seeks Beche-de-mer

(Source: SPC)

Mr Koon-ying Wong of Nam Kwong and Co., Hong Kong, is seeking suppliers of dried beche-de-mer from the region. Any interested parties should contact Mr Wong's company at: P.O. Box 3042, HONG KONG (Telex: 75371 NKCHK HX).

### Taiwanese Vessel Caught Poaching In Palau

(Source: Rengel Belau/G. Heslinga)

A case went to Court in Palau last December that seems like a pirate story straight out of Bully Hayes or Errol Flynn movies. It began on November 7, when 4 Kayangel boys went to fish at Ngeruangel Reef - and what did they find but 8 Taiwanese fishermen fishing for clams in the water. The boys acted swiftly, seizing the Taiwanese skiff and circling the alleged poachers, as one boy cruised back to Kayangel in the outboard.

The people of Kayangel acted equally quickly. Grabbing a carbine rifle, 2 more boats joined the boy's outboard, and set out for Ngeruangel, where they found the Taiwanese prisoners of the Palauan boys still being circled by the skiff. By exchanging some Japanese words, the Taiwanese pointed to the north as the direction where their fishing vessel lay. Hitching a speedboat to the Teku (a Fishing Federation boat which had joined the chase), the Palauans and Taiwanese set off in quest of the mother ship, as the Taiwanese skiff was sailed to Kayangel.

When the Teku spotted the Taiwanese vessel Royal No.1 at Lemul, and vice versa, the commercial boat slashed its anchor and started its engines at full throttle, heading for the open sea. Undaunted, the Palauans cut the line of the speedboat which they were towing, and took off in it in hot pursuit of the Taiwanese craft.

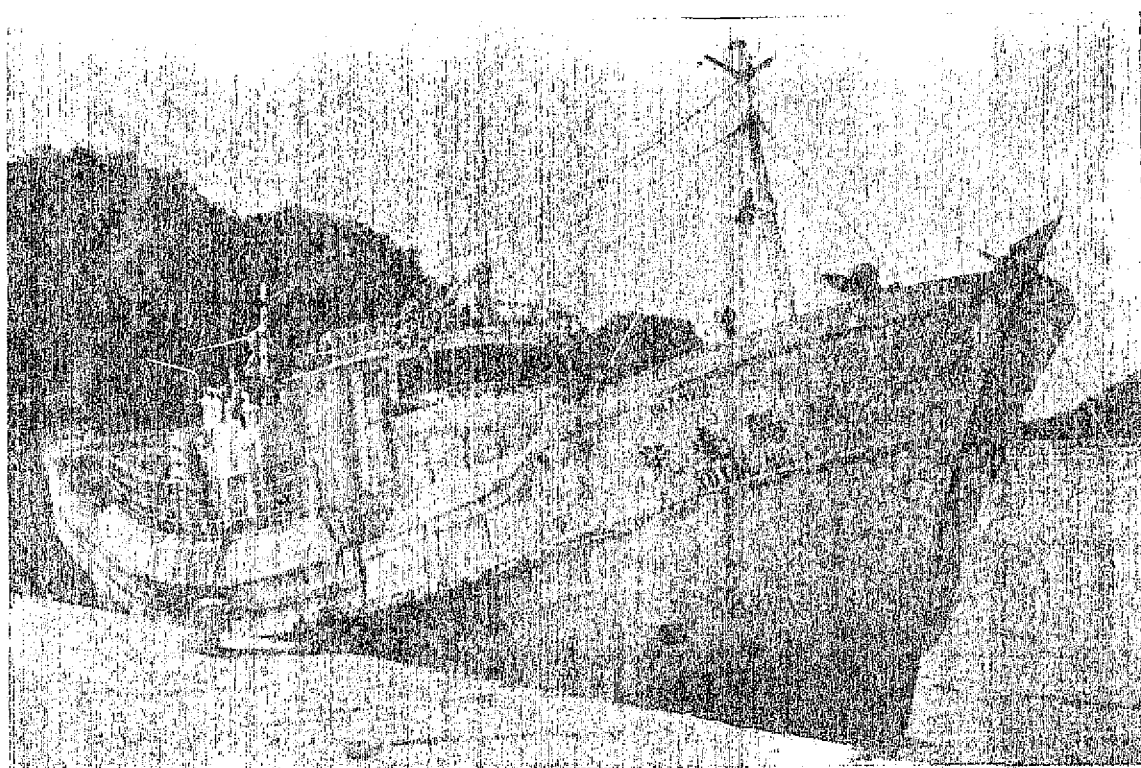
When the speedboat caught up to the Royal No.1, the Taiwanese boat just kept going, so the Palauans fired 2 shots into the water as a warning. When the Royal No.1 still refused to halt, a shot from the carbine was fired into the boat - and the Royal No.1 came to a dead stop. The high speed chase on the

high seas had lasted all of 5 minutes.

On board the Royal No.1, the Taiwanese captain - who at first refused to speak any Japanese - finally informed the Palauans that his engine's water pipe was broken, so that he couldn't move. Undaunted, the Palauans promptly hitched the Royal No.1 to the Tekuu (which had by this time arrived on the scene), and started towing it back to Kayangel.

However, around 4.15 pm, the Palauans became concerned that they would be unable to reach their atoll before nightfall and low tide, and would not be able to navigate through its channel. So, they calmly informed the Taiwanese captain that if this engineer was unable to get his motor working within 10 minutes, they would be forced to set the Royal No.1 on fire and cut it adrift.

Miraculously, within the prescribed 10 minutes, the Royal No.1 made a speedy recovery, and sailed into Kayangel's waters under its own steam. By November 10, the police from Koror had arrived on the scene, in order to bring the Taiwanese and their boat back to Koror to stand trial.



*The 'Royal #1'*

The case went to court on December 14 and on the 18, the defendant's attorney turned in a plea of guilty. The captain and crew of the Royal No.1 were charged with illegal entry into Palau. Defense attorney, John Rechuer, apparently entered the guilty plea at 6.00 pm, December 18, after hearing the government present its evidence and an overwhelming case, which included the discovery of 2,295 lbs of clam muscle aboard the Royal No.1.

In mid-February, the ship's captain, Chen Chong Man, was convicted of illegal entry into Palau, and received a sentence of 30 months in jail or a US\$50,000 fine. The stiff sentence was imposed in part because this is his second offence: he was caught poaching in Tobi last year along with ship's engineer, Chen Weng Sheng, and a crew member. The captain's second offence accomplices were also fined, while the other crew members were ordered to do 160 hours of community work. They were confined to their vessel pending their presenting to the court air tickets out of Palau.

According to Attorney General Russ Weller, the people of Kayangel are to be highly commended not only for their courage above and beyond the call of duty, but for their 'tremendous co-operation' in prosecuting the case. 16 people came down from Kayangel to testify on behalf of the government in the court cases.

#### Kiribati Shipyard To Be Rehabilitated

(Source: ADB)

The Asian Development Bank (ADB) has recently approved a loan to the government of Kiribati of US\$550,000 for rehabilitation work on the Betio shipyard. The loan, repayable at 1% interest per annum over 40 years, will finance the foreign exchange component of the total cost of the project, estimated at US\$665,000. Work to be undertaken includes upgrading of the various shipyard sections, buildings and utilities, repairing the slipway carriage and foundations, and procurement of equipment and tools, including a stock of ship repair materials. The rehabilitation is expected to be completed in March 1988.

#### Fisheries Joint Ventures Promoted Between PNG And Queensland

(Source: Queensland Fisherman)

Negotiations between the Government of Papua New Guinea and the Queensland Commercial Fisherman's Organisation (QCFO) have opened up a range of opportunities for Queensland fishermen in PNG waters in the Gulf of Papua. The PNG government is shortly expected to call for 'Expressions of Interest' in joint venture fishing arrangements whereby Queensland barramundi fishing boats would be allowed to operate in PNG waters.

There is a well-documented, historically stable 300-500 tonnes of barramundi per year available from the area, but catches have fallen by at least half over the past ten years, damaging local village economies and hampering government attempts to develop a fish marketing infrastructure. At present, the only boats fishing are small local vessels, and two Australian boats working the Fly River Province under an arrangement whereby they don't fish themselves, but supply nets, dinghies, etc., to villagers, who deliver the catch back to the 'mother boat'. All told, therefore, catches are well below the Total Allowable Catch of 500 tonnes nominated by the PNG government.

PNG is anxious to see better use made of this resource, but at the same time very aware of the need to guarantee that fish resources remain strong enough to support the village food chain. In Queensland, where local people do not rely on being able to go out and catch fish to feed the family, the attitude to resource management is clearly different to the policy of

deliberate 'under-exploitation' adopted by PNG. It has, therefore, already been decided that the number of Queensland boats allowed into PNG waters will be strictly limited, and none over 20m long will be accepted. PNG has also agreed with QCFO that there will be no third party involvement (ie. boats from anywhere other than Queensland) providing of course that the Queensland industry can come up with the boats, the fishermen and the commitment to assist in fisheries development.

Further progress will now depend on the response of individual entrepreneurs. The QCFO charter disallows it from becoming actively involved in direct commercial activities. However, the Organisation spokesman says there are obviously good opportunities for reputable Queensland fishermen in the barramundi fishery and possibilities for developing other arrangements to harvest prawns, crabs and other fin fish. "All things being equal", he said, "PNG has the welcome mat out for investors and entrepreneurs to help develop their fisheries".

Japanese Company Proposes Longline Fishery In New Caledonia  
(source: Les Nouvelles/SPC)

The Japanese international company Toho Shoji presented a proposal to the New Caledonian Territorial Assembly in January aimed at establishing a longline fishing company in Noumea.

If approved, Toho Shoji will establish a fishing company, called "Caledonie Kauin", in Noumea, retaining 88% of the shareholding, with the remainder to be taken up by local investors. Caledonie Kauin will then purchase three 300 GRT longliners from the mother company, capable of long-range fishing on trips of up to 45 days long.

The proposal has already been endorsed by the Central Bank and the Territorial Fisheries Service as being technically feasible and economically sound. If it goes ahead, New Caledonia will benefit from the 14 jobs reserved for New Caledonian people on each boat, plus revenue from the improved use of existing fisheries infrastructure and value added prior to export. The ultimate destination of the catch will be Japan, the idea being to concentrate on producing high-quality sashimi grade product, particularly marlins and billfish which command very high prices at present.

Toho Shoji are eager to see the proposal approved quickly, because otherwise difficulties could arise in the sale of the vessels to Caledonie Kauin. The Japanese Government strictly controls the number of new Japanese vessels exported each year, as one way of protecting the Japanese distant water fleet from competition. In 1985, only 20 permits will be granted to export longliners overseas. The committee which licenses these exports meets twice a year, in April and November. Toho Shoji want to get their application in to the April session, and if this proves possible then the first longliner could be in Noumea, flying the French flag, by June. The second vessel would arrive towards the end of the year, with no firm timing at present for delivery of the third vessel.

This proposal represents the third attempt to establish an industrial tuna fishery in New Caledonia. Previously, the pole-and-line fishing company, Transpêche, which was based in Noumea, went out of business after bait supply

problems coupled with poor fishing success forced it to close down. More recently, the longline company, Polypêche, based at Thio on the east coast, has been forced to close down. The closure was blamed on the out-of-the-way location, a handicap which has become more severe in recent months as political activities have resulted in an effective breakdown in communications between Thio and Noumea. However, from a technical viewpoint, the establishment of a local longline fishery in New Caledonia is entirely feasible economically (see SPC Fisheries Newsletter No.31: A Local Longline Fishery in New Caledonia, by Jean-Pierre Hallier). The new proposal hopefully will avoid the difficulties which terminated the activities of Transpêche and Polypêche, and lead to a more effective utilisation of New Caledonia's marine resources.

## FISHERIES SCIENCE AND TECHNOLOGY

### Troubled Times For U.S. Tuna Fleet

The following article by John Sabella appeared in the June 1984 issue of the American magazine 'National Fisherman'.

#### "U.S. Tuna Fleet treading water in flood of cheap imports"

The tuna men of San Pedro and San Diego, California, have been among the world's most successful fishing businessmen for most of the past two decades, but that hasn't spared them from having to confront regular challenges that have tested their viability. Even as the California tuna fishermen created one of the world's most sophisticated high seas fleets, and as the canners turned canned tuna into a staple that appears on virtually every American pantry shelf, the industry periodically stumbled under a "crisis" of competition, jurisdiction or regulation.

When the Japanese learned to "outfish" the Californians in the 1950s, virtually the entire fleet made a desperate switch from bait fishing to using purse seines, and soon the American "superseiner" was again the world's predominant tuna boat. More recently, there have been "tuna wars" with nations that strove to bar the California fishermen from their traditional fishing grounds; a conflict over marine mammal protection that cost the industry \$50 million; and ever-increasing competition.

Not the intensity but the frequency of tuna crises seems to have changed, and now the California tuna fishermen face what may be their stiffest challenge yet.

Reeling under a flood of cheap imports from the Orient, the California tuna industry has made an emergency plea to the International Trade Commission (ITC) for temporary relief under Section 201 (the "escape clause") of the Trade Act of 1974. The import crisis has provoked a rare degree of unanimity among California vessel operators, canners and labor unions, who have combined to petition the ITC for a five-year boost in the duty rate of imported tuna packed in water. While the industry has closed ranks for the ITC, however, it is the

fishing fleet that has the most to gain from duty relief, and the most to lose if none is forthcoming.

Currently, water-packed tuna imports carry a base duty rate of 6%, while the duty on oil-packed imports stands at 35%. Industry spokesmen claim the duty disparity has no logical basis but is the result of an historical "accident" in which tuna was lumped together in a "basket category" of canned fish packed in water during 1943 trade negotiations with Iceland, a nation that has never been engaged in tuna production.

Whatever the cause of the duty discrepancy, there is no disputing the result. While canned tuna in oil is virtually non-existent as an import item, imports of canned tuna in water have surged 128% over the past five years and rose 40% in 1983 alone. Also, the import growth curve appeared to be continuing its sharp upward trend in early 1984.

With Thailand skyrocketing into first place as an exporter of canned product to the United States, imports grew from 87 million lbs. in 1982 to 122 million lbs. in 1983. January 1984 imports climbed to 15.5 million lbs., or almost 2 million lbs. more than the figure recorded the previous January. Imports, which accounted for just 8% of domestic sales in 1979, had captured perhaps 25% of the market.

There was a simple explanation for the mushrooming growth of imports: their low price. It was certainly one that motivated the American consumer to boost his tuna consumption substantially in 1983: a standard 48-can case, (each can weighing 6 1/2 oz.) of chunk light imported product traded at prices as low as \$20 to \$24. Domestic packers quoted \$41 per case for their advertised brands and made sales at prices as low as \$33. Even the cheaper "private label" domestic tuna carried a price tag of \$28 per standard case. Domestic product was only competitive in retail "features", in which a 6 1/2-oz. can of brand-name tuna carried a supermarket price as low as 59¢, a figure that left the industry awash in red ink.

The effects of surging imports on industry ledgers was dramatic. One industry spokesman estimated that 50% to 75% of the California tuna fleet was technically bankrupt, unable to meet debt service and operating by the tenuous grace of the banks. Twenty-seven large seiners (out of a fleet of 124) with a replacement value of \$200 million were already tied to the dock as the result of business failures. Since the troubles struck in the fall of 1981, the fleet had endured sharply falling ex-vessel prices, long tie-ups imposed by the canneries and a major shift in effort to the distant western Pacific where operating costs were substantially higher. Numerous vessels had sold at prices as low as 15% to 20% of replacement value and were viable only because of the extreme discounting that had occurred, says one industry consultant.

The fleet had no market other than the domestic packing companies, and the canners were attacking the foreign competition by cutting the principal cost of tuna production - the price of fish. The U.S. boats began fishing operations in 1984 on "open tickets", while the on-going price "negotiations" with the canners had more to do with the cost of foreign fish than the needs of the domestic vessel operators. The fact that the canners were curtailing production and moving processing operations out of California compounded the fleet's problems.

At the canneries, a tuna industry fact sheet, prepared as background for the ITC petition, determined that net operating profits as a percentage of sales had declined from an average of 2.8% from 1979 to 1981, to losses of 5.5% in 1982 and 3.4% in 1983. Two major California processing facilities had closed in 1982, one idling 900 workers and the other laying off over 450. Another major plant closed for 1 1/2 months in 1982, while yet another closed for 3 weeks in 1982 and 1 1/2 months in 1983. Most processing facilities imposed wage freezes of up to one year during the 1982-1983 period, yet 4,100 cannery employees had lost their jobs by the end of last year.

Of the three remaining tuna canning plants in California, Van Camp Seafood, owned by Ralston Purina, has now announced that it will close its doors June 30 (1984 - Ed.), leaving 1,200 people unemployed. Representatives of Star-kist and Pan Pacific canneries say they will be forced to close down as well, unless the government halts the flow of the cheap imports. If the 35% tariff on water-packed tuna isn't approved, Star-Kist President, Richard Beattie, says, "the industry here will not survive".

California landings fell from 170,102 tons in 1981 to 138,335 tons in 1983, and the state's cannery production fell from 13,506,00 to 9,125,000 standard cases over the same period. According to August Felando, director of the American Tuna-boat Association (ATA), a Sea Grant study has determined that the state lost \$832 million in economic production, \$195 million in household income and 9,220 jobs as the result of the reduced activity. The Van Camp shutdown will only exacerbate the problem.

Felando calls this a "watershed year" for the tuna industry, one that will determine whether the domestic canners leave the continental United States entirely - and leave the fleet without a market at home. Under the most dismal scenario - no duty relief - Felando suggests that Hawaiian packing operations have a cloudy future, and that even the domestic packing operations in Puerto Rico and American Samoa could become unviable.

#### U.S. Innovations In The Development Of Sail-Powered Fishing Boats

(Source: Ocean Arks International/Professional Fisherman)

A prototype sailing trimaran, for use in developing tropical fisheries, has been designed and built in the U.S. Not only is this 32-foot boat breaking new ground by being the first modern fishing trimaran, it also employs a construction method designed to use basic raw materials available in developing countries. The work is being carried out by Ocean Arks International, a non-profit organisation of scientists and technologists dedicated to promoting the use of renewable energies and environmentally sound land and sea use.

The new trimaran, the Edith Muma, is built to the design of Dick Newick, and is now being used in a fishery survey off the coast of south America, jointly sponsored by the Canadian International Development Agency (CIDA) and Guyana Fisheries Ltd. Edith Muma is rigged for snapper reeling, long lining, gill netting, trolling and trap fishing. The sailing rig is a modified gaff rig supplemented by a jib, which together produce a speed of over 12 knots in moderate winds. Construction is by the wood-epoxy saturation technique (WEST) and uses thin strips of cheap timber layered together in an epoxy matrix. The resultant material is light, rot resistant, strong and resistant to fatigue, and like fibreglass can be laminated in a mould to produce compound curves not



normally possible with sheet plywood or similar materials.

The Edith Muma is 32 feet (9.6m) long, has a beam of 20ft. 6in. (6m), and an unladen draught with the centreboard up of 1ft. 3in. (0.4m), increasing to 5 feet (1.5m) with the board down. The light construction gives an overall weight of only 1800 lbs., with a payload of 2000 lbs. A 6hp outboard gives a speed of 8 knots in calm conditions, with a fuel consumption of 0.6 gallons/hour.

The Edith Muma is only one of a range of trimaran designs, of different sizes and load carrying capacities, developed by Ocean Arks International and called Ocean Pickups. One idea they are developing is the use of a single master mould, different sections of which can be used to produce "families" of panels for the construction of different sized vessels. In this way, a single mould can be used to produce a whole range of boat sizes.

The group have also been experimenting with improved sailing rigs more appropriate to the needs of small-boat fishermen, but have come up against funding difficulties. Ocean Arks president, Dr John Todd, writes:

"Joe Seale, the head of wind energy research for Ocean Arks has invented a new type of sailing rig, which, if successful, could be a genuine breakthrough in aiding the revival of wind-powered fishing vessels and other working watercraft. Yet our research on the rig, known as the "Aikido sail" in honor of the martial art term for deflecting harmful forces towards one's own creative ends, is at a standstill. We seem unable to convince international development agencies or private foundations of the importance of developing new and advanced design sailing rigs. Our suspicion is that supporting agencies, if they realize the need, believe that the yachting community is on the case, and that yacht racing and the forces of the market will give working watercraft the technologies they need. If third world fishermen were millionaires, this might be true, but yachting has its own agenda and it is a far cry from the real needs of the people who work on the water. The modern racing yacht rig, as typified by the America's Cup challengers, is designed to function optimally within a narrow set of design rules, usually where money is no object. The racing rig is costly, prone to catastrophic failure, requires large crews to handle winches and other exotic gear, and needs to be commanded by skilled sailors who under the best of circumstances would have little time to think about fishing or cargo handling.

"Because the modern rig is usually the one most widely known, it is being used on fishing vessels, but it does not serve the needs of the average fisherman working at sea. With the Ocean Pickup, Dick Newick solved the problem by designing a simple and traditional loose-footed gaff rig to be handled without winches. He added a contemporary touch with a roller furling jib. It has functioned well for us, both on the long voyage from New England to South America, and also in the Guyanese fishery where the Ocean Pickup has worked as a drift gill netter. The rig is workable but by no means optimal aerodynamically.

"The ideal rig would be reliable, self-tending, failsafe, relatively inexpensive, easily reefed, forgiving of the sailing inexperience of most fishermen, compatible with fishing gear handling, and of course be as advanced aerodynamically as modern craft.



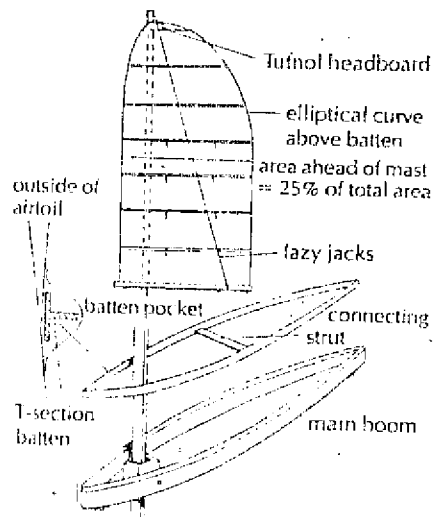


Figure 1 Gallant Rig

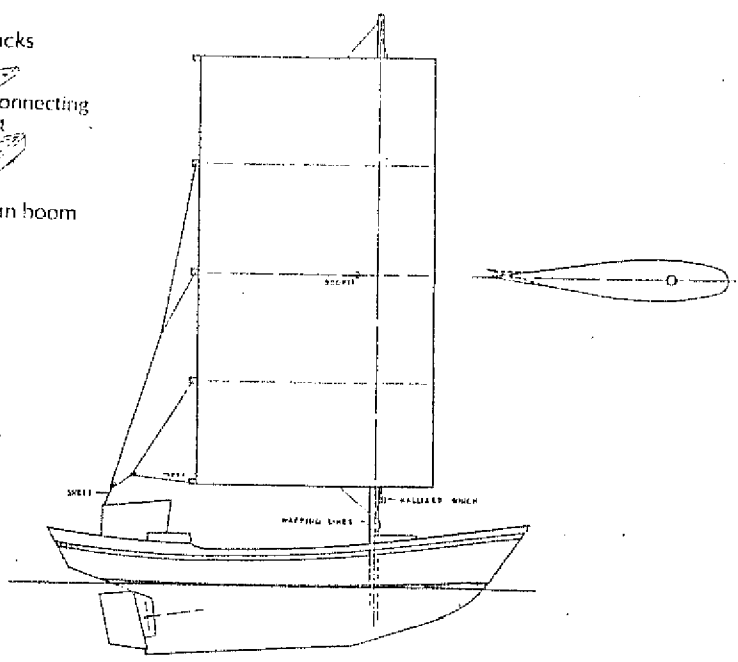


Figure 2 Tunny Rig

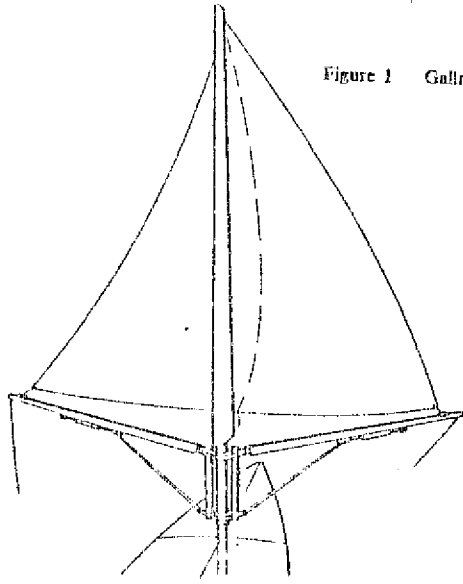


Figure 3 Angelwing Rig

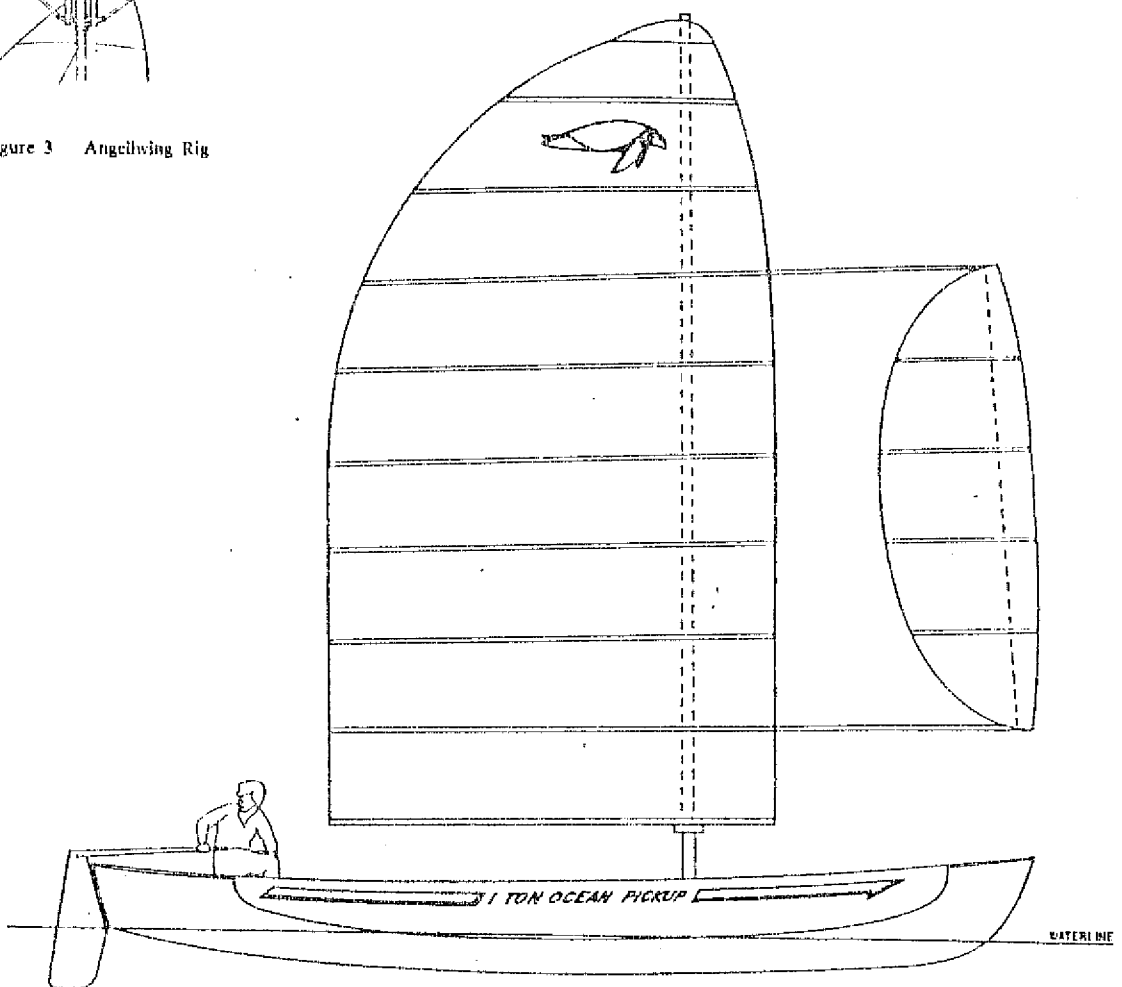


Figure 4 Aikido Rig

"Some experience into new working rigs is under way, but it is being done on shoe-string budgets by a small band of dedicated souls. We are anxious to join their ranks. This group is employing contemporary aerodynamic and structural engineering to create efficient and reliable rigs. Most notable of these are British engineer Jack Manners-Spencer's rigid wing sail or "gallant rig" (figure 1) and another Englishman, E.W.H. Gifford's variable camber flexible wing sail, or "tunny rig" which is also being worked on by a French inventor, M. Pierre Riolland (figure 2). In North America, Tom Godfrey has developed the "angellwing rig" (figure 3) which is a modern refinement of the earlier "Ljungstrom rig". All of these rigs have real merit, being significant attempts to apply advanced concepts to the needs, safety, and economics of working watercraft that have to pay their way under all kinds of weather and sea conditions.

"Ocean Arks International has its own contribution, the "Aikido Sail" concept. For the past five years, under the guidance of Joe Seale, we have been developing wind turbines that are both aerodynamically efficient and self-regulating without the need for complicated or expensive control devices common on most windmills. Our small prototype "Aikido" windmachine mounted on top of a pickup truck was tested at speeds up to seventy-five mph. It did what Joe said it would do. A more modern version has been designed and we are currently seeking patents for it.

"A year ago, I asked Joe if he could apply the same concepts to sail-boat rigs and for almosts nine months he ruminated on the challenge. There were several hurdles that had to be overcome, but one day he came up with a rig that is both radical and simple. Figure 4 gives an approximate idea of what the "Aikido Sail" would look like. In theory, the "Aikido Sail" can function without sheets, blocks, travellers, vang, winches and so on because it automatically finds the perfect alignment in relation to the wind no matter whether the vessel is tacking or reaching. It is able to sense and adjust to wind changes and determine when the vessel tacks onto a new course. It is designed so that when the wind gets too strong for safety, the "Aikido Sail" feathers up and spills the wind. The main airfoil of the rig is similar to Manners-Spencer's "gallant rig" or wingsail. For a prototype, we would not go to a variable profile wingsail, but further down the road "tunny rig" concepts might be added.

"In our opinion, the "Aikido rig" is worth developing. We would like to build a full-scale prototype for Dick Newick's proposed mini-fishing boat, the half-ton Ocean Pickup. The team that would work on it would include wind engineer Joe Seale, naval architect Richard Newick, hang-glider/wind surfer designer/builder Richard Sweeney, and myself. We estimate that the prototype of the rig, including research and design, would cost about fifteen-thousand dollars overall. We would be grateful for any interest or support for the project, or assistance in finding sponsorship. If anyone is interested in underwriting the costs involved, we will design and build for you both the "Aikido Sail" and the new mini-fishing boat or half-ton Ocean Pickup, if Ocean Ark International is allowed to use the prototype vessel and rig for a year to undertake experiments. If the "Aikido Sail" does not work, we will replace it with a traditional gaff or sprit rig."

PROGRESS REPORT ON TUNA TRACKING

by

Kim Holland, Randolph Chang and Scott Ferguson  
National Marine fisheries Service  
Honolulu, Hawaii

This is a brief, informal summary of the results from the first year of our tracking research. We have achieved the two goals we set for the first year, namely to: (1) outfit the vessel with all the equipment and modifications necessary for the programme, and (2) begin collecting data. We are very pleased with the data so far obtained and we anticipate a substantial increase in the number of tracks acquired over the remaining year of the project. Our technique involves placing a depth sensitive ultrasonic transmitter on the back of the fish and then tracking it using a directional hydrophone mounted on our fisheries research boat.

So far, we have tracked eight fish: six are from around fish aggregation devices (FADs) and two tracks (one of six days duration) are from non-FAD fish that were caught on the 50 fathom curve inshore from the FAD locations. These non-FAD tracks will be used for comparison with FAD-associated fish. Two tracks are from bigeye tuna (Thunnus obesus), an increasingly important species for the fresh market, and six tracks are of yellowfin tuna (T. albacares). A full report will be available at the end of the project, but some aspects emerging from our data to date are:

1. The effective range of movement of yellowfin and bigeye tuna of 55-75 cm length around FADs appears to be approximately 6 to 10 miles. We tracked one fish that returned to a FAD after making a 13-mile loop (farthest distance from FAD 6.5 miles) over 24 hours (figure 1). On another occasion, a yellowfin tuna tagged at "S" FAD proceeded directly to "V" FAD about 10 miles away. This track shows that (a) the range of influence of a FAD is at least 10 miles, (b) fish can learn the location of two FADs, and (c) these animals have the navigational capabilities to move from one small area to another (figure 2).
2. Yellowfin tuna have "home ranges" that they retain over at least several days. A fish caught on the 50 fathom contour returned to his area every day following nighttime excursions offshore (figure 3). This track also demonstrates that not all tuna in an area associate regularly with FADs because this animal passed by "V" buoy several times without actually visiting it.
3. One track of a yellowfin tuna arriving at a FAD indicates that 85% of the time spent at the FAD was on the up-current side (figure 4). This behaviour raises some fascinating questions with regard to the underlying mechanisms of fish orientation. This type of information may also prove very useful to fishermen regarding the techniques they use to fish around floating objects. We obviously need to replicate these tracks to be more certain of our conclusions.

4. The vertical movement data are particularly interesting. Among other things, it appears that both yellowfin and bigeye have "travelling depths" that they use when moving from one place to another. Daytime travelling depths for yellowfin appear to be at the bottom of the mixed layer (figure 5) whereas bigeye run much deeper. It is interesting to note the very consistent travelling depths (and temperatures) of the bigeye and also the extremely regular upward excursions (figures 6 and 7). These constant "travelling depths" may be of great value to longline and handline fishermen if additional data can be acquired. Both species swim much closer to the surface at night.

We intend to continue to track fish associated with FADs and a more thorough analysis of their movements will be forthcoming. We hope to acquire funding to expand the project in the future to include larger fish and additional species such as skipjack tuna (Katsuwonus pelamis) and mahimahi (Coryphaena hippurus). In this way, we will determine if the larger (more valuable) yellowfin and bigeye tuna have the same habits as the small/medium fish that we are now tracking and we will also be able to construct a detailed picture of how the several important pelagic species interact, divide the oceanic food resource, and orient around floating objects such as FADs and logs.

This research is being supported by Hawaii Institute of Marine Biology, University of Hawaii; Sea Grant College, University of Hawaii; National Marine Fisheries Service (Honolulu); and the Federation of Japan Tuna Fisheries Co-operative Association.

Footnote: since this report was prepared, a fisherman caught one of our fish carrying a transmitter three weeks after we abandoned it. The fisherman caught the fish trolling, and said that it was healthy and put up a good fight. This anecdote supports our claim that the transmitter does not seriously impair the animal's behaviour.

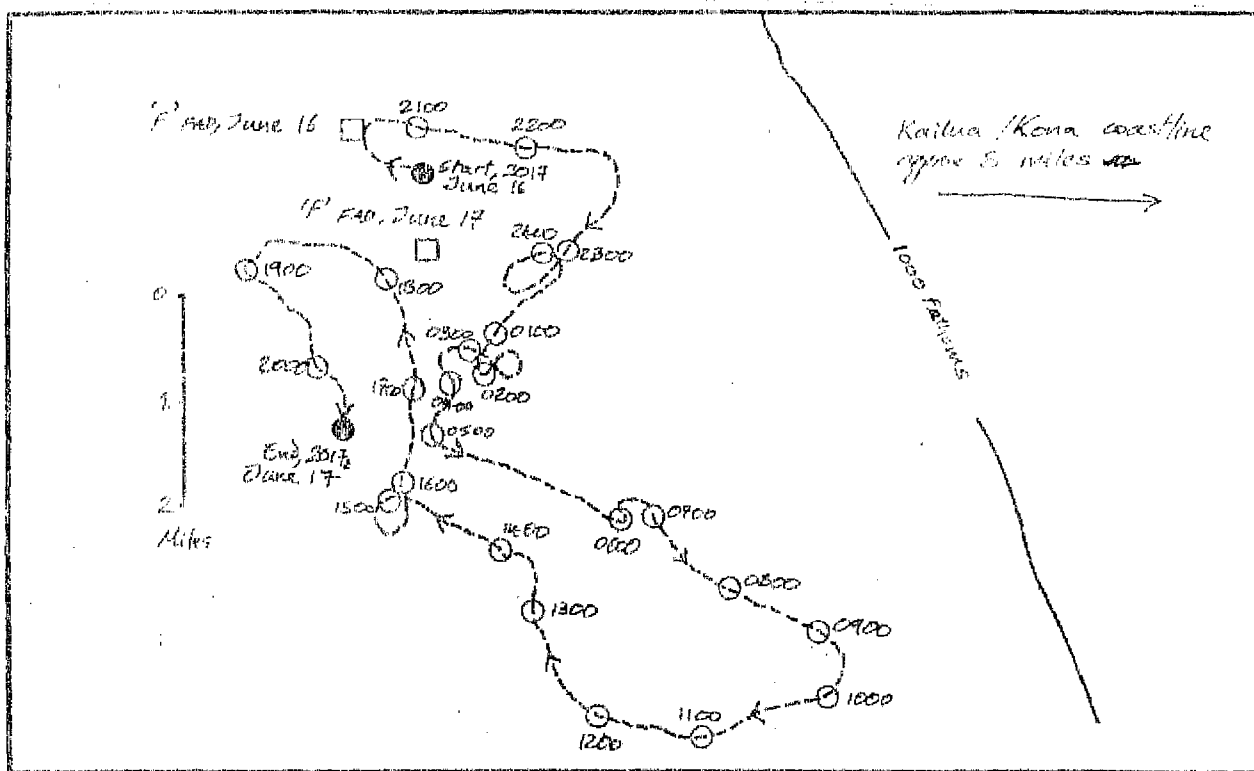


Figure 1. Track of a bigeye tuna returning to FAD "F" after a 13-mile loop. This animal (57cm) was caught just after sunset near F buoy and returned to the FAD at dusk the next day. Furthest distance from the buoy was about 6 miles.

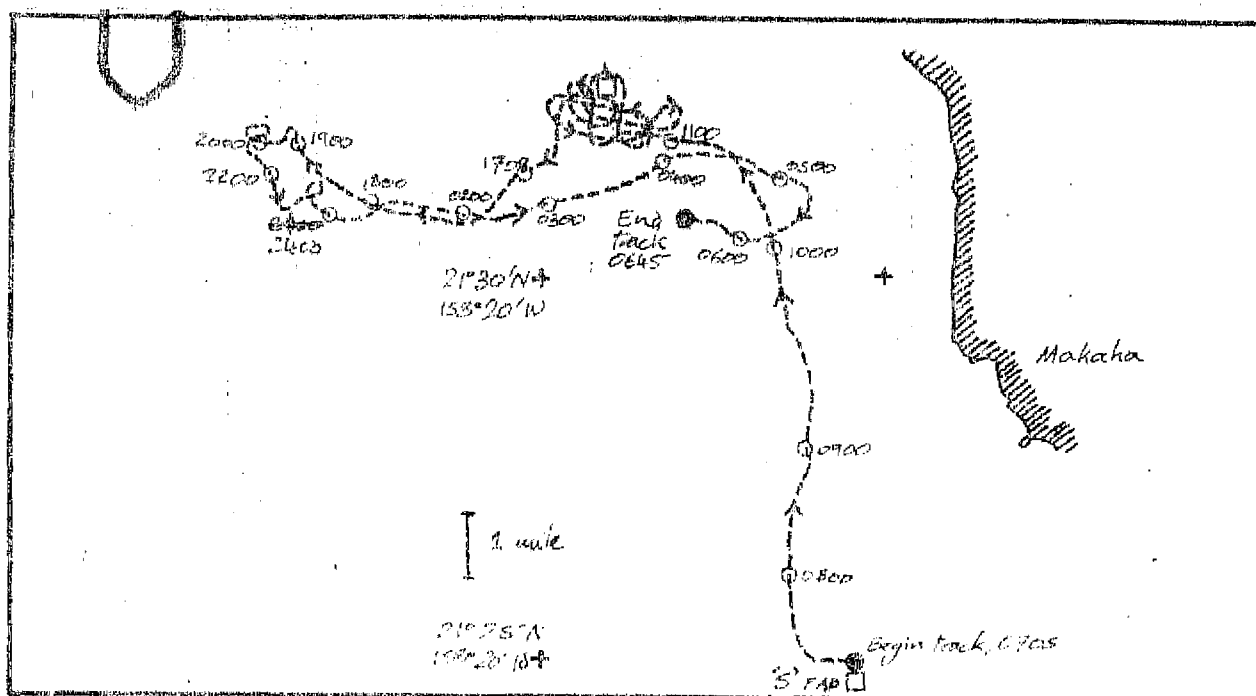
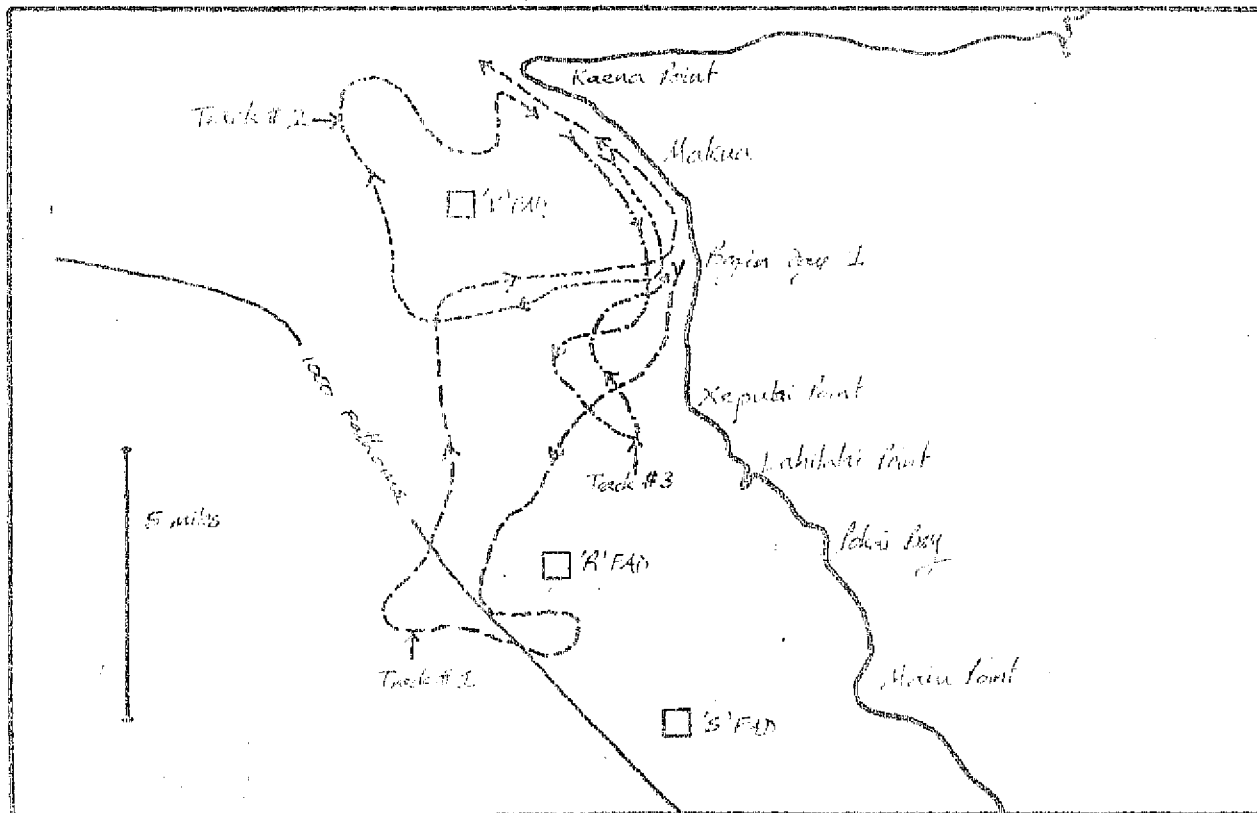
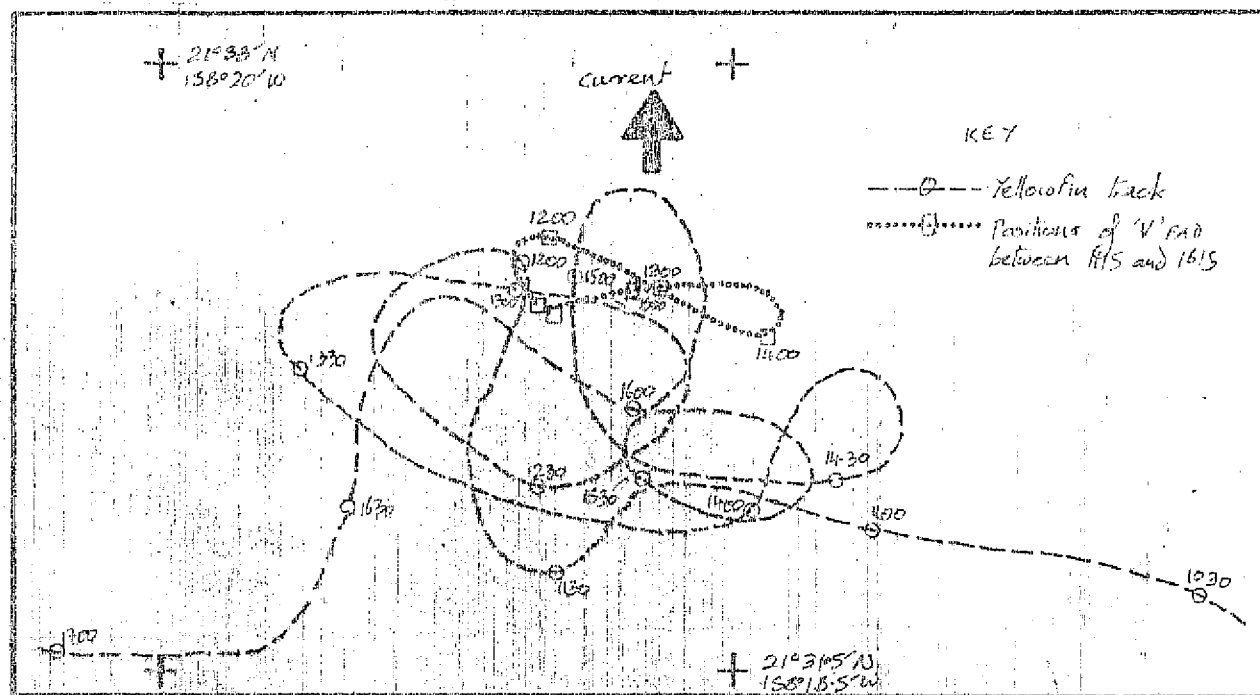


Figure 2. A 55cm yellowfin tuna caught at "S" buoy was released after having an ultrasound transmitter placed on its back. The released fish moved in a very direct course to the next nearest FAD "V" which was located about 9 miles away. After spending several hours near "V" buoy, the fish moved offshore at night before returning the next morning.



**Figure 3.** Repetitive movements of a 70cm yellowfin tuna during a six-day period. Three tracks of approximately 24 hrs were made spanning a period of six days. During daylight hours, the fish patrolled the 50 fathom ledge between Kona Point and Makaha and made extensive excursions offshore after sunset. The path of its nighttime movements took it beyond the locations of the adjacent FADs. FAD "R" was not on station at the time of these tracks.



**Figure 4.** After arriving at FAD "V", a 55cm yellowfin tuna spent about 85% of the next 5 hours on the up-current side of the buoy. The movements of the buoy were also recorded using Loran-C and radar data.

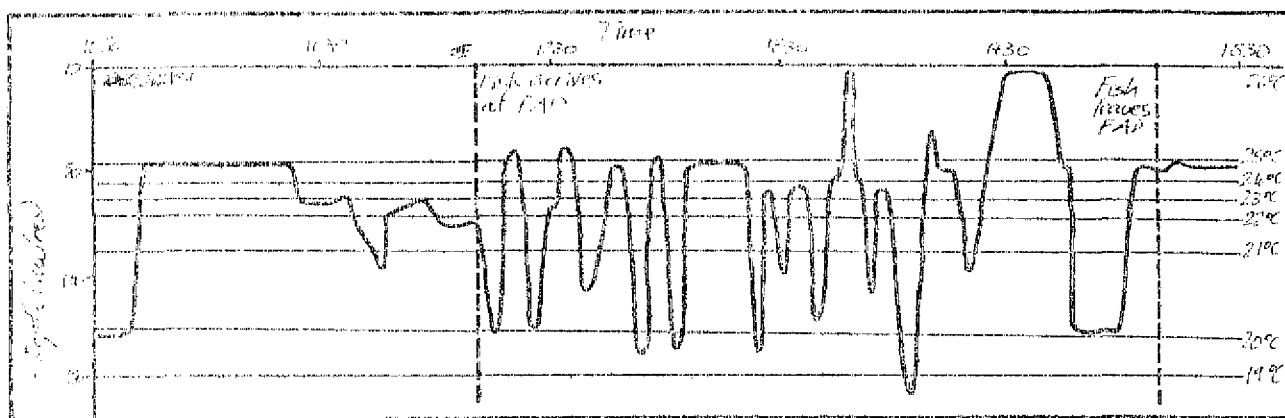


Figure 5. Vertical movements of a yellowfin tuna approaching and staying at a FAD. When moving from one location to another, yellowfin tuna appear to utilise "travelling depths" at which they spend extended periods of time. A frequently observed travelling depth appears to be the boundary between the bottom of the mixed layer and the top of the thermocline (in this case 25°C at about 50 metres). This fish exhibits a travelling depth while approaching the buoy and then displays quite regular vertical movements when in the immediate vicinity of the FAD. Again, these vertical excursions are frequently limited by the mixed layer boundary and the 20°C isotherm.

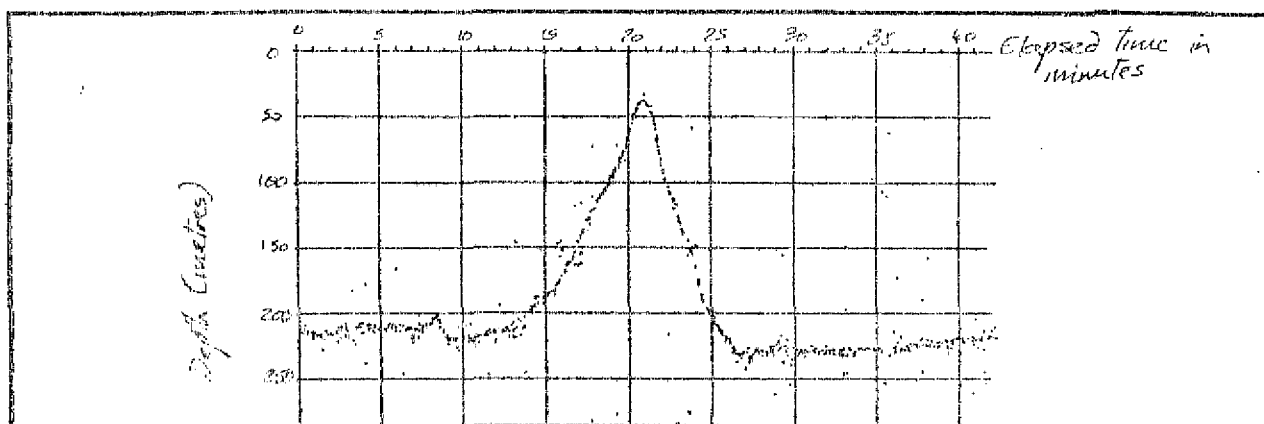


Figure 6. The swimming depth of this 54cm bigeye tuna was constant around 200 metres during the daytime. However, the fish also displayed dramatic upward excursions which occurred at very regular hourly intervals during daytime. This figure also displays the fine detail our system allows.

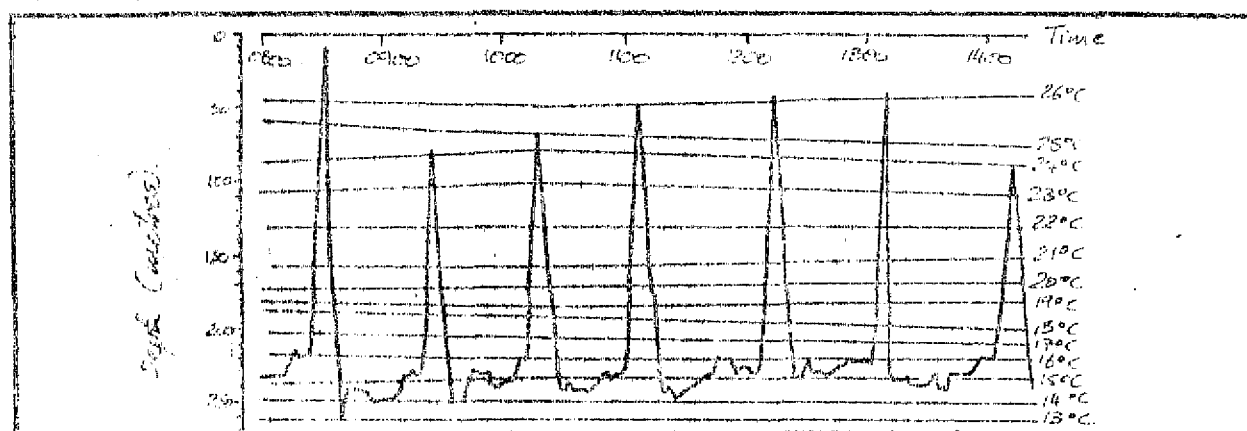


Figure 7. Predominant daytime travelling depth of a 57cm bigeye tuna. The travelling depth is almost completely restricted to the 14/16 stratum at 230-250 metres. This plot also shows the very regular upward excursions that seem to be characteristic of this species and size.

CARDINALFISH AND FUSILIERS:  
AN ALTERNATIVE BAITFISH RESOURCE IN TUVALU

by

Robert Gillett  
South Pacific Commission  
Noumea, New Caledonia

Previous surveys of the baitfish resources of Tuvalu have relied exclusively on night baiting techniques and catches have been overwhelmingly dominated by the blue sprat, *Sprattelloides delicatulus*. As the pole-and-line vessel owned by Tuvalu has experienced difficulty capturing sufficient quantities of this baitfish for tuna fishing operations, it has been suggested that different baiting methods be tried.

In October 1983, the author visited Tuvalu for a one-week period to determine the possibility of catching baitfish by methods other than those previously used. On the basis of a brief survey of Funafuti lagoon, it was concluded that an in-depth study aimed at identifying appropriate alternative baitfishing techniques would be worthwhile. The project, funded by UNDP, was carried out in April to June 1984.

In the early stages of the project, a close inspection by free diving in Funafuti lagoon, adjacent to the urban area, revealed that two types of baitfish, fusiliers and cardinalfish, were quite plentiful. This area is characterised by water 2 to 15 metres deep over a sandy bottom interspersed with coral boulders of various sizes, usually spaced 50 to 100 metres apart. Virtually every coral boulder, as large or larger than an automobile, with crevices and protrusions, and in water deeper than 2.5 metres had fusiliers associated with it. Estimated quantities varied from 1 to 30 kg per coral structure, usually in proportion to the size of the boulder. Cardinalfish were associated with about one third of the coral boulders in this area. It was not obvious why certain boulders had cardinalfish while others did not. Unlike fusiliers, the presence of cardinalfish did not seem to require crevices and protrusions on the coral; almost flat coral patches occasionally had large quantities. Estimated amounts of cardinalfish varied from 1 to 90 kg per boulder.

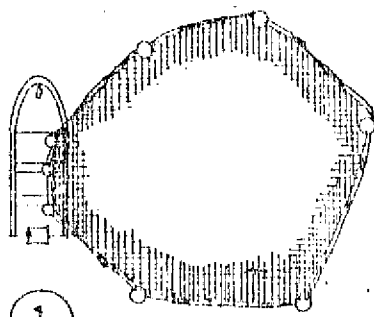
As it was known that cardinalfish leave the coral at night, a plan was made to set a liftnet at night over a suitable coral boulder and haul it during the day after the fish had returned. Two small boki ami nets on loan from Fiji were rigged as liftnets. This entailed attaching one of eight 15-metre lines to each corner and mid-point of a side of these rectangular nets. At each of the eight points of attachment, a weight of 2 kg was tied to the net. Each of the eight lines was threaded through the eye of a plastic long line float (one float per line). The finished product was a flat, 12.5m by 13.5m net with a weight/line/float arrangement attached to eight points around the perimeter (see figure 1).



TOP VIEW

FIGURE 1.

SIDE VIEW



1

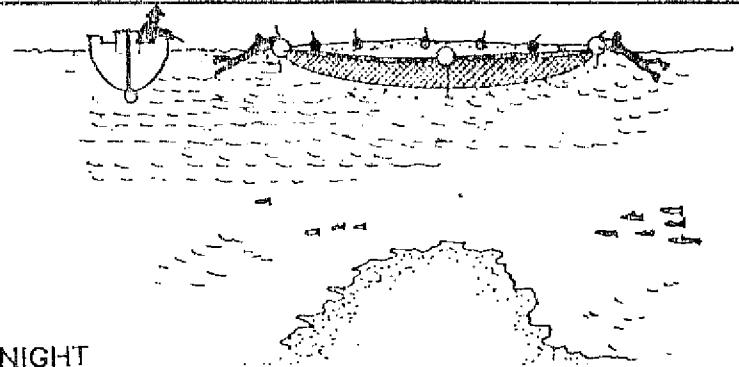
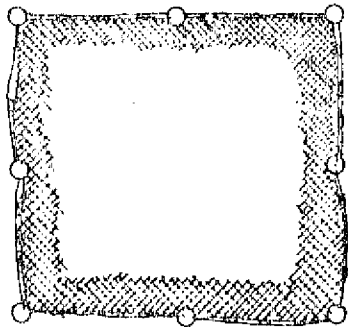


NIGHT

CORAL BOULDER



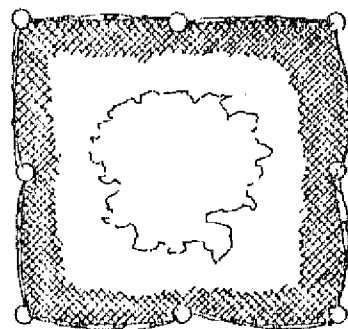
2



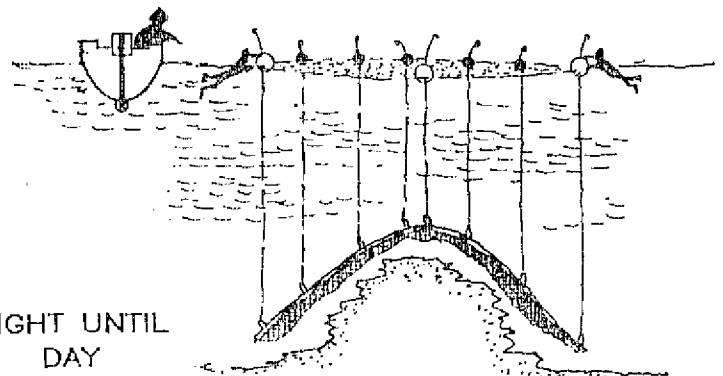
NIGHT



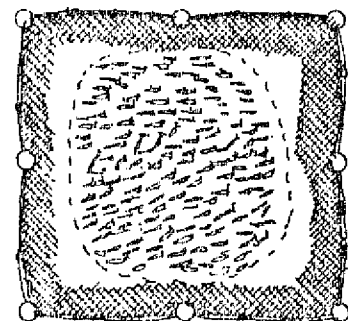
3



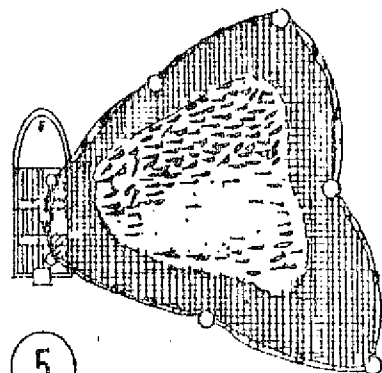
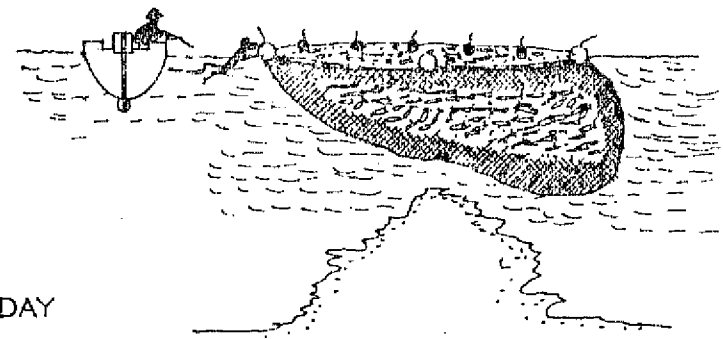
NIGHT UNTIL  
DAY



4

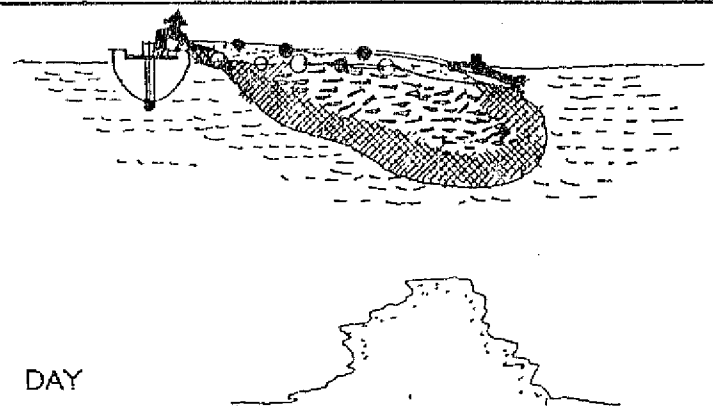


DAY



5

DAY



At night, the net was stretched out on the surface over a suitable coral boulder and then sunk to cover the coral. Adjustments to the positioning of the net to ensure that the boulder was completely covered were done by a scuba diver assisted by several free-divers. During daylight hours, the net was raised to the surface by having each of the free-divers pull on one of the eight lines attached to the longline balls. Figure one depicts the technique. In practice, when the net is pulled, the baitfish panic, but as the coral boulder is completely covered by the net, the fish have no refuge other than the centre of the net.

Several weeks of experimental fishing led to the development and refinement of procedures: 1) to ensure that when the net was sunk from the surface at night, the coral boulder was completely covered; 2) to encourage cardinalfish slightly outside of the net area to move towards the centre; and 3) to detect holes in the net as it is being raised to the surface so that they can be patched before becoming critical. As the project had access to two liftnets, two sets were possible each night. Setting the two nets could be done by nine crew members in about one and a half hours at night and hauling could be done the following day in about one hour. About half an hour was devoted to net maintenance every fishing day.

The liftnets were set 17 times at night during the study period, and captured from 12 to 88 kg per set, averaging 34.3 kg per set (see figure 2). Three species of cardinalfish (*Archamia fucata*, *Cheilodipterus quinquelineatus*, *Apogon polystigma*) made up 65% of the catch. Two species of fusiliers (*Pteronessio* sp., *Caesio saecularens*) contributed a total of 25%. Figure 3 details the average species composition of a nighttime liftnet haul. The maximum catch per night, made possible by the use of two nets, was 126 kg. In general, the amount of cardinalfish which can be captured on a particular coral boulder by nighttime liftnet fishing significantly exceeds what is visible on the boulder during the day.

The first bait catches made during the project were used for taxonomic and morphometric purposes. Afterwards, on four occasions, bait was transferred to the local 173 GRT pole-and-line vessel. This bait, averaging 71 kg per transfer, enabled the crew of the vessel to carry out more tuna fishing than would have been possible had the crew relied entirely on bait which they had capture themselves by conventional techniques at night. Baitfish captured by the project were also used on eight occasions for small scale pole-and-line fishing using a 10.3 metre catamaran. This vessel was modified during the course of the project for live bait fishing by the addition of a 600-litre bait tank and a spray system.

In the opinion of the staff working on the project, both fusiliers and cardinalfish are excellent baitfish. These fish, unlike many tropical bait species, survive quite well in bait tanks. In addition, when thrown as chum, they have an excellent action in the water. This view of fusiliers and cardinalfish is supported by Lewis, Smith and Ellway (1983), who state that these baitfish are robust and highly regarded as bait. Baldwin (1977) compares over 150 species of baitfish and concludes that the various species of fusiliers and cardinalfish are good or excellent as tuna bait. Smith (1977) reports that the handling characteristics of these two baitfish are excellent and are quite satisfactory as chum.

FIGURE 2. BAIT CATCH PER SET FOR LIFTNET FISHING

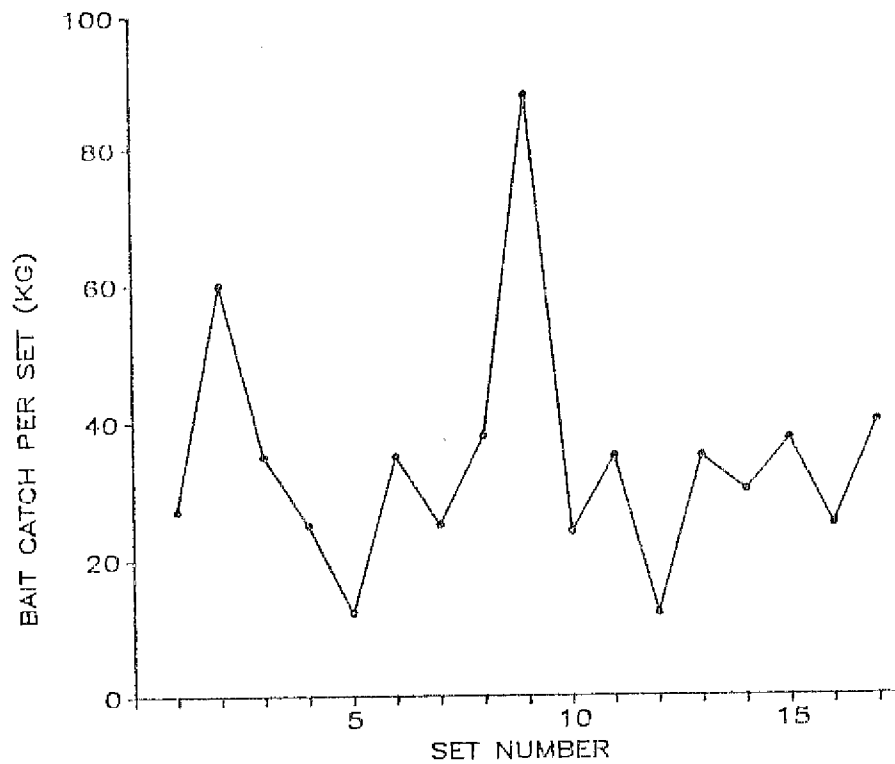
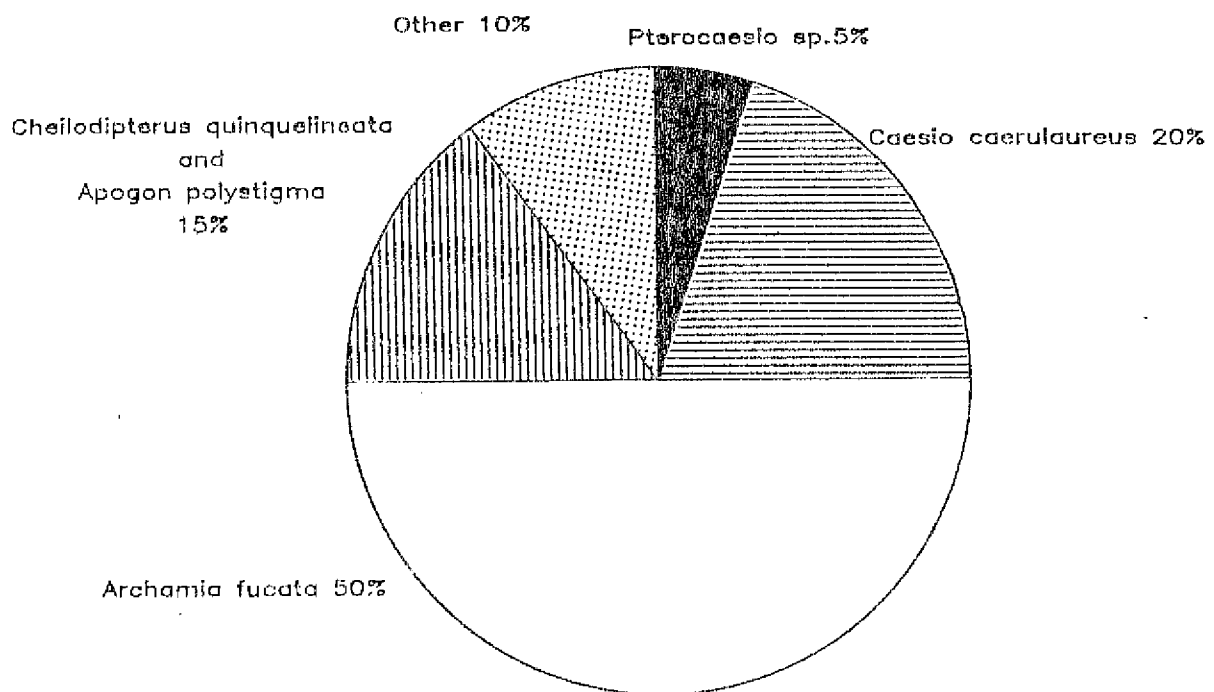


FIGURE 3. AVERAGE SPECIES COMPOSITION



Wilson (1977) stated that some Okinawan fishermen believe that cardinalfish are a better bait than anchovy as they return to the boat faster and remain there longer. He also stated that fusiliers are strong when confined and make extremely good bait for skipjack.

An important aspect which contributes to the value of cardinalfish as bait is that they are not used by the people of Tuvalu as a food fish. The capture of cardinalfish would not involve direct competition with small scale fishermen as would, for example, the capture of hardyheads, goatfish, or scads.

An attempt was made to determine the rate at which a coral boulder that has been harvested becomes re-populated with fusiliers and cardinalfish. On the night of 30 April, a relatively small coral boulder was set on and the following day the liftnet was hauled capturing 35 kg of baitfish (60% cardinalfish, 30% fusiliers). An inspection dive immediately after the haul revealed that virtually 100% of the baitfish had been captured and no fusiliers or cardinalfish remained on the coral boulder. Several inspection dives were made during the following month to observe the population level. It was estimated that 10 days after the set, the amount of fusiliers and cardinalfish was about two-thirds that of the pre-harvest state. Thirty days after fishing, the population had returned to its original level. Whether this repopulation consisted of fish from neighbouring coral boulders, or came about some other way, is not known.

One appealing aspect of liftnet fishing is the simplicity of gear requirements. Much of the equipment needed is available at little or no cost. In several South Pacific countries, there are many used boki ami nets which have been retired from service and are idle in storage. These nets can be modified fairly easily into liftnets. Longline cord and floats are in abundance in most island countries. Weights can be fashioned out of local scrap iron. SCUBA gear requires special mention. It was the most expensive equipment (over US\$450 for one tank and one regulator) used with the liftnet. Having one SCUBA diver is not absolutely essential, but very helpful. The liftnet can be set at night by a skilled crew in water up to 9 m deep entirely by free diving. However, the procedure takes longer, can be a hardship on the crew, and coverage of the coral boulder could be less than 100%, resulting in a reduced baitfish catch. In Funafuti lagoon, at least half of the suitable coral boulders are in water deeper than 9 m. Fishable locations in nearby Nukufetau atoll are perhaps slightly shallower.

During the survey, it was noted that in the lagoon area near the Funafuti urban centre, there are approximately 30 coral boulders for setting the net at night. Considering that an average haul yields 34.3 kg of bait, approximately one tonne of bait could be caught by setting the net once on each coral boulder.

The value of this baitfish resource to Tuvalu is highly dependent on two factors: (1) the speed and mechanism by which a harvested coral boulder becomes repopulated with cardinalfish; and (2) the degree of natural fluctuation in the cardinalfish population. Studies on a single coral boulder showed relatively rapid repopulation, and deep diving in the centre of the lagoon showed additional quantities of cardinalfish. We would hope that the population size of cardinalfish is habitat-limited, and repopulation of coral boulders is from a large reserve population in deep water. However, if the repopulation is from neighbouring coral boulders, the resilience to fishing pressure would be much

less.

The results of the project show that it is possible, through a technique not previously used in Tuvalu, to catch significant quantities of baitfish. The species captured, fusiliers and cardinalfish, are very good baitfish. Baitfish mortality would not be a major concern as survival in bait tanks is excellent. Competition with small scale fishermen would not be a problem. Their value as a supplementary bait for an industrial scale fishing operations is thus satisfactorily demonstrated, and the possibilities for a small-scale capture operation are promising.

#### REFERENCES

- BALDWIN, W.J. (1972). A review of the use of live baitfishes to capture skipjack tuna, Katsuwonus pelamis, in the tropical Pacific Ocean with emphasis on their behaviour, survival and availability. In R.S. Shomura (Editor), Collection of tuna baitfish papers, NOAA Technical Report NMFS Circular 408.
- LEWIS, A.D., B.R. SMITH and C.P. ELLWAY (1983). A guide to the common tuna baitfishes of the South Pacific Commission area. Handbook No.23 (1983), South Pacific Commission, Noumea, New Caledonia.
- SMITH, B.R. (1977). Appraisal of the live-bait potential and handling characteristics of the common tuna bait species in Papua New Guinea. In R.S. Shomura (Editor), Collection of tuna baitfish papers, NOAA Technical Report, NMFS Circular 408.
- WILSON, P.T. (1977). Observations of the tuna baitfish species and their habitats in the Palau Islands. In R.S. Shomura (Editor), Collection of tuna baitfish papers, NOAA Technical Report, NMFS Circular 408.

SEAFOOD PROCESSING IN FRENCH POLYNESIA

by

S. Yen and W. Neagle  
Etablissement pour la Valorisation des Activites  
Aquacoles et Maritimes (EVAAM)  
Papeete, French Polynesia

With an area of ocean equal in size to the area of Europe, French Polynesia naturally exploits the resources of the sea. The market for marine produce is expanding rapidly and the greater part of the catch is sold in the unprocessed state. But this form of marketing cannot dispose of the total yield of fisheries during the high season. The development of processing techniques is thus very appropriate for distant islands with a poor transport service in order to avoid a lot of waste.

Traditional smoking, drying or salting are the processes that island people will find easiest to adopt, since they already have some experience of such activities and they are fishermen. Such techniques make it possible to utilise fish surpluses, waste pieces and incidental catches, and to market species that are abundant but not much fished. This paper describes briefly the various techniques used in French Polynesia and elsewhere that have been tried out at EVAAM (formerly the Fisheries Department).

I. Fish

1. Salted and dried fish:

This type of processing was imported from Asia many decades ago. Salted fish has now become an accepted part of the diet of many Polynesian people.

Four species of fish have been used for this process in French Polynesia: Lethrinus miniatus, L. xanthocheilus, L. mahsena, and Epinephelus microdon. The fresh fish are scaled, gutted and headed. They are stuffed with salt and laid in a concrete basin with a layer of coarse salt at the bottom and thereafter alternate layers of fish and salt are made. When the basin is full, it is covered with jute sacks on which is placed a plank and on top of that a weight which thus forms a press. The size of the weight depends on the quantity and size of the fish in the basin. The time needed for salting is 3 or 4 days, during which the fish becomes dehydrated while absorbing the salt. Drying is done in a drying cabinet. The fish are first left in the upper part of the drier, which is in full sunlight, for a whole day. They are then transferred to a shady place lower down in the drier for 2 or 3 days. Three qualities of fish are obtained according to the length of drying, thus:

- salted fish with a high water content, intended for early consumption,
- salted fish of medium dryness, which will keep for a longer period of time,
- dry salted fish, which will keep for months if protected from

humidity, and which is ready for export.

The finished product, in water-proof plastic bags, is stored in a dry place.

## 2. Smoked fish:

Smoked fish is eaten by some families in the Tuamotu islands, where it is known as "hongu". The technique described in this section allows better preservation of this product.

The fish is scaled, headed, gutted and split by cutting along each side of the backbone, which is then removed. However, the caudal part is left in place in order to hold the two fillets together. The split fish is then dipped in a saturated brine or put in a container with alternating layers of salt.

The length of salting time depends on the thickness of the fish and the degree of saltiness desired. The fillets are subsequently hung in a smoke-house for a period of time varying between one and several hours. Smoking is done hot, in smoke produced by a fire made from the wood of Casuarina equisetifolia ("Aito"), Pometia pinnata ("Kava"), Psidium guajava (guava) or Guettarda speciosa ("Kahaia").

## 3. Fish meal:

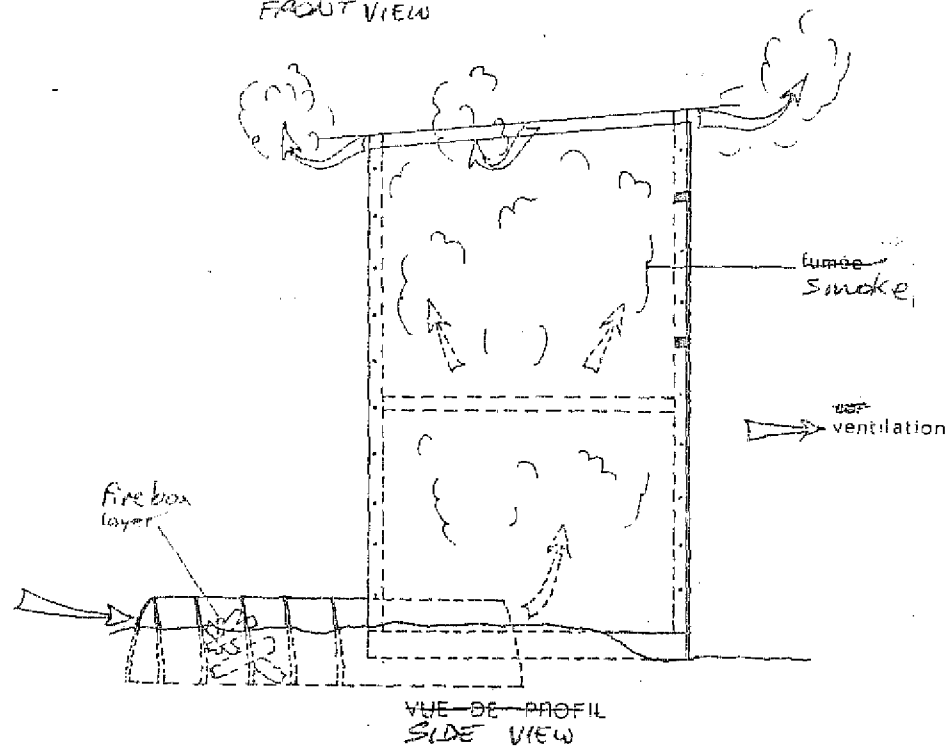
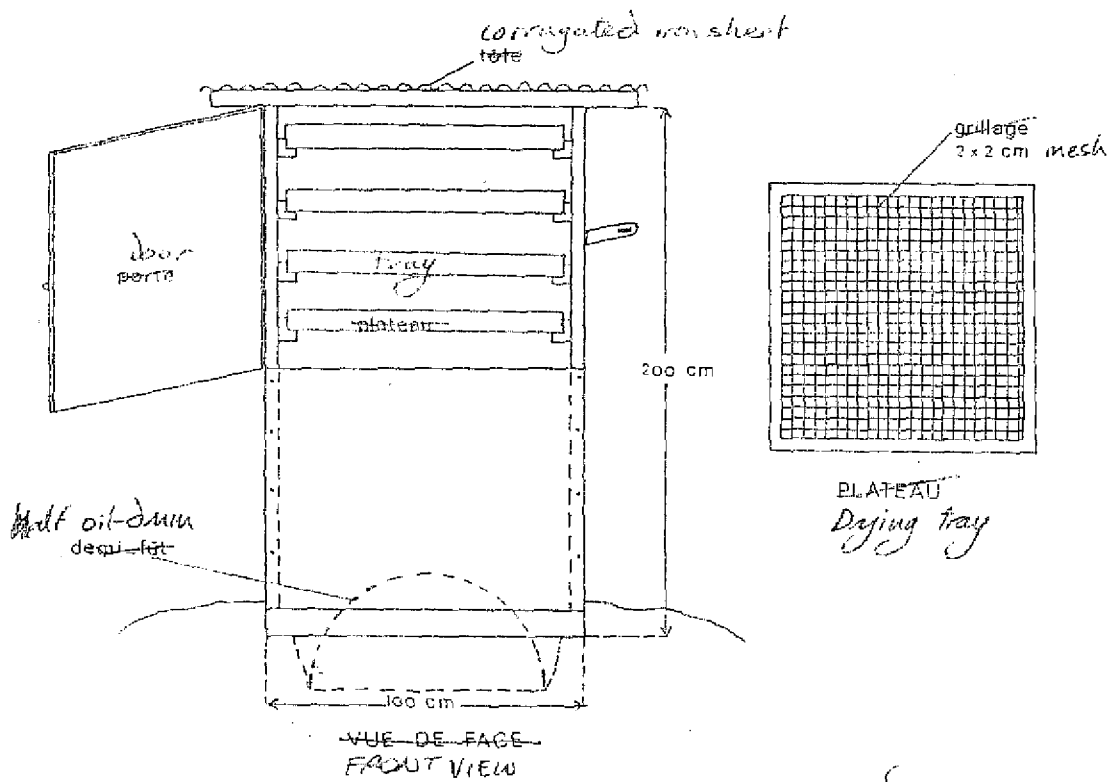
The manufacture of fish meal is complementary to the two foregoing types of processing since it uses up waste parts and subsidiary catches of little or no market value. All the waste is collected and boiled, then put into a screw-press which removes the water before the product goes into the drier to be completely dehydrated. Lastly, a crusher converts the fish pieces into powder.

Fish meal is used as a cattle feed supplement in the unprocessed form, and is also an ingredient of the feed granules used in aquaculture.

## II. Beche-de-mer

The processing of beche-de-mer used to be a lucrative activity in French Polynesia before the Second World War. Competition from exploitation of other forms of sea produce that proved more profitable, such as pearl-shell and fish, caused it to be given up subsequently. Now the present high price that can be obtained for beche-de-mer make them worth exploiting once again.

Basically, processing is the same throughout the South Pacific. For this reason, as regards the procedure used, we would refer the reader to Handbook No. 18 published by the South Pacific Commission (SPC) in 1979 entitled "Beche-de-mer of the Tropical Pacific". We have, however, made a slight modification to the drying shed (shown in figure 1), putting the fire outside so as to avoid too intense a heat and the risk of burning inside. The smoke is channelled into the drying shed by means of a 200-litre oil drum that has been halved and left open at each end, and which is placed over the fire.



Schémas du fumoir  
Plans of smoking shed



### III. Molluscs

Processing of molluscs concerns trochus only, the flesh of which is not used when they are taken for the shell. Rather than waste this flesh, which is perfectly edible, efforts have been made to utilise it.

When boiled, trochus flesh is ready for consumption, and it could therefore be preserved in cans or by freezing. But the shortness of each year's trochus harvesting season, the low demand for trochus flesh and the low price that it therefore fetches would make this an intermittent and not very profitable activity.

A more appropriate processing method, giving a product which would be more attractive and easy to keep, is desirable. With this aim in view, salting and drying trials have been carried out. The living animal is removed from its shell with a special instrument. After cleaning, the flesh is salted for at least 12 hours in a receptacle containing alternate layers of coarse salt and trochus flesh. Then the flesh is dried for 24 hours until a hard, dry, brown product is obtained. In a dry place, it will then keep almost indefinitely.

### Conclusion And Future Prospects

All these different kinds of processing techniques require only a minimum amount of light equipment, which makes them easily transferrable to the distant islands and particularly to the Tuamotu islands where the long hours of sunshine are a major asset for drying purposes. Nevertheless, a coldstore would be desirable, and even necessary, for keeping smoked fish. Satisfactory hygiene is also necessary for proper processing and preservation.

A project for building a pilot processing unit for marine produce, using the techniques described above, is to be put into effect in 1984 on one of the Tuamotu atolls. Briefly, this unit will comprise a work room with two salting tanks, a smoking room and a solar drier. If promising results are obtained, the project will be extended to other parts of the archipelago.

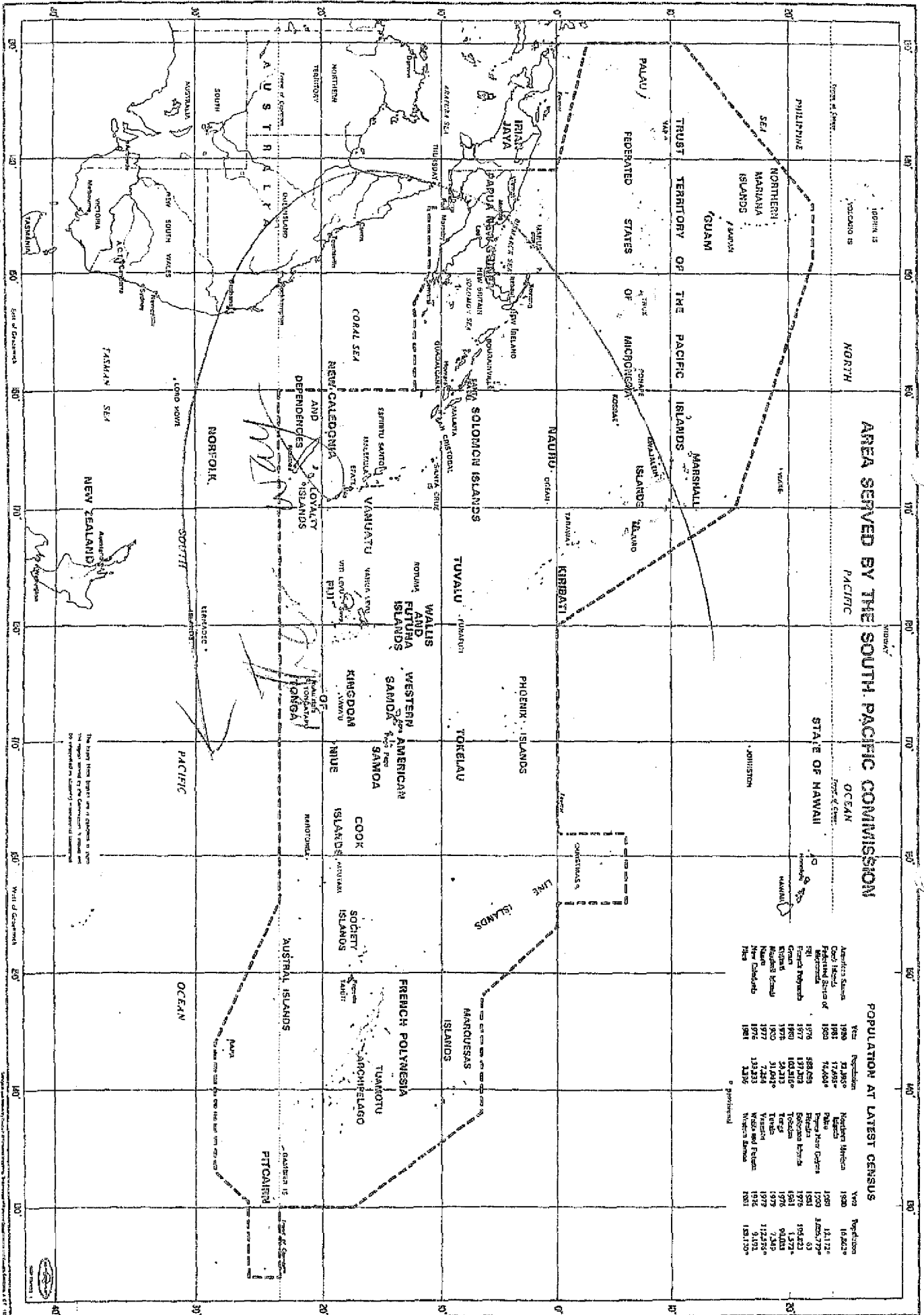
### BIBLIOGRAPHY

SPC. Reche-de-mer of the Tropical Pacific. Handbook No.18 (1979).

CUZENT, G. Archipel de Tahiti - Recherche sur les principales productions vegetales. Revised and supplemented by J. Florence, M. Guerin, F. and D. Margueron, D. and R. Koenig.

EVAAM. Milieu lagunaire: Etat des connaissances (1983).

FISHERIES DEPARTMENT. Internal documents 1979, 1980, 1981, 1982. C. tokoragi.



# AREA SERVED BY THE SOUTH PACIFIC COMMISSION

POPULATION AT LATEST CENSUS

Year	Population	Year	Population
1960	71,950*	1960	16,800*
1961	74,400*	1961	18,110*
1962	76,400*	1962	19,420*
1963	78,400*	1963	20,730*
1964	80,400*	1964	22,040*
1965	82,400*	1965	23,350*
1966	84,400*	1966	24,660*
1967	86,400*	1967	25,970*
1968	88,400*	1968	27,280*
1969	90,400*	1969	28,590*
1970	92,400*	1970	29,900*
1971	94,400*	1971	31,210*
1972	96,400*	1972	32,520*
1973	98,400*	1973	33,830*
1974	100,400*	1974	35,140*
1975	102,400*	1975	36,450*
1976	104,400*	1976	37,760*
1977	106,400*	1977	39,070*
1978	108,400*	1978	40,380*
1979	110,400*	1979	41,690*
1980	112,400*	1980	43,000*
1981	114,400*	1981	44,310*
1982	116,400*	1982	45,620*
1983	118,400*	1983	46,930*
1984	120,400*	1984	48,240*
1985	122,400*	1985	49,550*
1986	124,400*	1986	50,860*
1987	126,400*	1987	52,170*
1988	128,400*	1988	53,480*
1989	130,400*	1989	54,790*
1990	132,400*	1990	56,100*
1991	134,400*	1991	57,410*
1992	136,400*	1992	58,720*
1993	138,400*	1993	60,030*
1994	140,400*	1994	61,340*
1995	142,400*	1995	62,650*
1996	144,400*	1996	63,960*
1997	146,400*	1997	65,270*
1998	148,400*	1998	66,580*
1999	150,400*	1999	67,890*
2000	152,400*	2000	69,200*
2001	154,400*	2001	70,510*
2002	156,400*	2002	71,820*
2003	158,400*	2003	73,130*
2004	160,400*	2004	74,440*
2005	162,400*	2005	75,750*
2006	164,400*	2006	77,060*
2007	166,400*	2007	78,370*
2008	168,400*	2008	79,680*
2009	170,400*	2009	80,990*
2010	172,400*	2010	82,300*
2011	174,400*	2011	83,610*
2012	176,400*	2012	84,920*
2013	178,400*	2013	86,230*
2014	180,400*	2014	87,540*
2015	182,400*	2015	88,850*
2016	184,400*	2016	90,160*
2017	186,400*	2017	91,470*
2018	188,400*	2018	92,780*
2019	190,400*	2019	94,090*
2020	192,400*	2020	95,400*

The South Pacific Commission is a body of the United Nations established in 1947 to promote the economic and social development of the Pacific Island States and Territories.