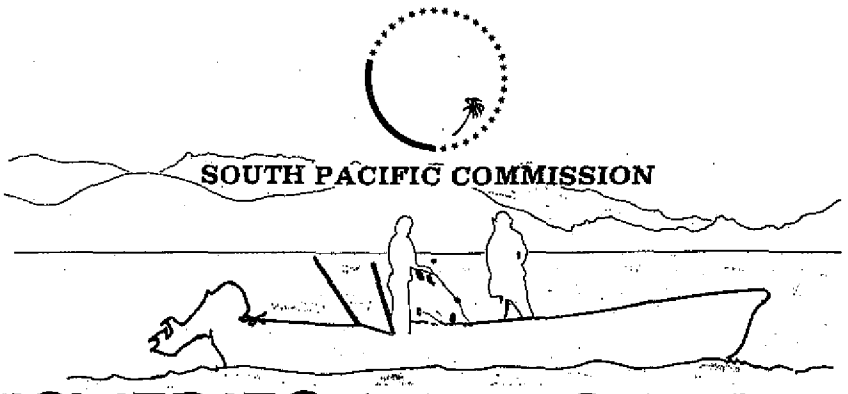

FISHERIES NEWSLETTER

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Contents

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SPC ACTIVITIES

PALAUAN FISHERIES OFFICER ON TRAINING ATTACHMENT TO SPC

Mr Noah Idechong, of Palau's Office of Marine Resources, spent the period Friday 10 July to Saturday 15 August 1987 on attachment to SPC headquarters in order to become familiar with the work and scope of its fisheries programmes. The attachment formed part of a broader training and familiarisation programme in which Noah undertook a 3-month fisheries management course at Humberside College in the UK, and visited several other international organisations involved in fisheries. These were FAO (Rome), FAO-INFOFISH project (Kuala Lumpur), the FAO Bay of Bengal project (Madras), the FAO South Pacific Regional Fishery Support project (Suva), and FFA (Honiara).

As with the first such training attachment (for Mitiele Baleivanualala of Fiji, in 1986), the SPC philosophy was to involve Noah in the work programme as fully as possible, as this would enable him to become completely conversant with the SPC's activities and operational methods, as well as contributing to the work of the Commission itself. In line with this approach, a detailed work programme was planned before Noah's arrival, designed to give him a rapid introduction to the Commission, following which he would undertake a number of specific work activities. The work programme was revised shortly after his arrival to emphasise specific areas of interest, rather than areas where he already had experience (e.g library familiarisation).

As well as participating in routine activities relating to the Deep Sea Fisheries Development Project, the Fisheries Training Project, and the Tuna and Billfish Assessment Programme, Noah undertook some specific tasks of direct relevance to Palau. These included a more detailed examination by area of catch and effort records from the 1983 Deep Sea Fisheries Development Project visit to Palau, and an analysis of historical tuna catch records from Palau's now defunct Van Camp tuna canning operation. Noah also participated fully in the Nineteenth SPC Regional Technical Meeting on Fisheries, and the two TBAP-related meetings (see article p 3 this issue) which preceded it.

Both of the training attachments of this kind that the Commission has been involved in have been extremely valuable. As well as familiarising the individuals concerned with SPC's work and the ways in which it can help with national-level activities, there is great value for both sides in establishing and developing personal contacts. In addition, the individuals who have undertaken attachments so far have made real contributions to the Commission's daily work.

THIRD REFRIGERATION COURSE STARTS

The SPC Regional Refrigeration Training Course, the third of its kind to be held, got under way on 3 August 1987 in Kavieng, Papua New Guinea. As with the previous two courses, which were held in conjunction with FAO/UNDP in Rarotonga, Cook Islands, this course will be supervised by Senior Refrigeration Tutor Michael Vincent, and will last for 18 weeks. Assistant tutors are Siegfried Hermann, refrigeration engineer with the PNG national government, and Paul Moabe, provincial government refrigeration mechanic and graduate of the 1985 SPC/FAO/UNDP refrigeration course.

The material to be covered in the course is as follows:

Subject area	Lecture/ demonstration hours	Workshop/ practical hours	Total
1) Basic refrigeration	60	60	120
2) Electrical	60	100	160
3) Diesel maintenance and repair	10	30	40
4) Welding - gas and arc	20	40	60
5) Refrigeration maintenance, service and troubleshooting	80	140	220
6) Refrigeration unit and facility construction	10	30	40
7) Product storage and quality control	40		40
8) Evaluation	40		40

The main aim of the course is to provide much-needed refrigeration training for mechanics and operatives of PNG's coastal fisheries stations and provincial fisheries departments, which own and operate a variety of freezers, cold stores and ice plants around the country's long coastline. Ten of the sixteen places on the courses are allocated to PNG, with the remainder taken by trainees from other countries of the region that have an on-going requirement for fisheries-sector refrigeration mechanic training.

19TH REGIONAL TECHNICAL MEETING ON FISHERIES

The SPC's Nineteenth Regional Technical Meeting on Fisheries, held in Noumea, New Caledonia from 2-7 August 1987, was attended by 58 delegates and observers from 24 SPC member countries and organisations. The meeting was chaired by Mr Ray Tulafono, Director of American Samoa's Office of Marine and Wildlife Resources. The purpose of the meeting, which is held annually, is to present the work of the SPC's fisheries programmes for regional review, to provide an up-date on the major issues facing fisheries development in the Pacific, and to facilitate the interchange of information and ideas among the region's fisheries managers.

The meeting started with a review of the activities of the Tuna and Billfish Assessment Programmes (TBAP) during the preceding year. Substantial progress has been made with the development and maintenance of the regional oceanic fisheries database, and over 80,000 records were processed in 1986. Data coverage has improved, but is still less than adequate in some areas, particularly on the high seas. The TBAP's work on interaction amongst tuna fisheries was described, and future tuna fisheries research needs were discussed in some depth.

As well as reviewing its technical work, the organisation and function of the TBAP was discussed in some detail, since the programme had been the subject of two external reviews during 1987, both commissioned by the SPC. The consultants conducting the reviews had visited almost all member countries to seek input on the programme's effectiveness and future directions. As a result of those studies, the consultants recommended changes in six areas: long-term research needs; the tuna database; the integration of SPC fisheries programmes; communication, advisory and information services; staffing, management and financial issues; and assistance from countries and organisations. After extensive discussion of the consultants' reports, the meeting approved a revised mission statement for the TBAP and made a total of 12 recommendations that would result in modifications and improvements to the way the programme operates.

One of these recommendations will have implications for all the Commission's fisheries programmes since it recommends that all fisheries activities be brought under the direction of a single fisheries co-ordinator. The aim of this recommendation was to promote greater integration of the Commission's fisheries activities, a response to the long-held perception that the TBAP and the Coastal Fisheries Programme have operated largely independently of each other. Although the two programmes do in fact interact extensively during their normal operation, the move towards a more formal integration was seen as a positive step by the Secretariat which, after the extensive discussions that this subject produced, undertook to propose a restructuring of the Commission's fisheries programmes to the next meeting of the Committee of Representatives of Governments and Administrations (CRGA).

Also discussed in connection with the TBAP was the establishment of a Standing Committee on Tuna and Billfish. The establishment of such a committee has already been approved in principle by CRGA, so this meeting was able to focus specifically on its terms of reference. The intended role of the Committee is advisory and consultative and its work will assist in the conduct of pelagic fisheries research through the provision of expertise, information, and technical advice. The Committee will advise future regional technical meetings on fisheries about biological research on stocks which support oceanic fisheries for tuna and billfish in the SPC region. It will also assist with reviews of the TBAP work programme, suggest improvements to the scope and techniques used in the programme's research work, assist with and advise on the acquisition of relevant data, and arrange collaboration between SPC staff and outside workers on problems of mutual interest. It is expected that the Committee will vary in its composition, but in general will consist of the SPC Fisheries Co-ordinator or his representative, an FFA representative, scientists from countries with a commitment to tuna fishing in the SPC region (specifically including island states and distant water fishing nations), and technical experts invited by the Fisheries Co-ordinator as necessary.

The next item on the agenda was a review of the Coastal Fisheries work programme. Items covered in depth included the work of the SPC Master Fishermen during country assignments and in the gear development project, reporting and analysis of Deep Sea Fisheries Project data, and progress with the Fish Handling and Processing Project and the Regional Fisheries Training Project.

A draft proposal for the development of a Pacific Islands Marine Resources Information System (PIMRIS) was then presented by the two consultants commissioned to prepare it. The proposal was based on a technical meeting on fisheries information needs and availability which had been held at SPC headquarters in March 1987. This meeting, which drew together information specialists and fisheries officers, led to the identification of a number of areas in which the flow and accessibility of fisheries information could be improved. The consultants' proposal built on this, with suggestions for institutional arrangements and linkages, and details of the manpower, equipment and funding that would be required to enhance the production and use of fisheries information in the region. The meeting discussed and strongly endorsed the proposal, and recommended that the three co-operating organisations, SPC, FFA, and USP, collaborate to obtain funding for the early implementation of PIMRIS.

Another new proposal discussed was that to establish an SPC Inshore Fisheries Research Project. This project was needed in order to increase SPC's capacity to respond to requests for assistance in small-scale and inshore fisheries research work. The meeting requested that the SPC Secretariat obtain approval for the creation of an Inshore Fisheries Scientist position, and also endorsed the suggestion that a workshop be held, early in 1988, which would update Pacific Islands fisheries scientists on recent advances in knowledge of the biology and management of inshore fishery resources.

A number of other new projects and initiatives were also supported by the meeting, including a co-operative programme with the Forum Fisheries Agency to develop regional training in the use of computers in fisheries departments and related institutions, and a port sampling programme to be developed under the multi-lateral fisheries treaty with the government of the United States of America.

As is the practice each year, a short workshop was held on an issue of topical interest in Pacific Island fisheries development. The subject of this year's workshop was marketing of Pacific Island fisheries produce. The workshop focused on a number of issues: the consideration of marketing as a complete system — involving elements from the processing of catch to the consumption of the product; that successful marketing usually requires entrepreneurial skills and an element of risk taking; that the relatively small supplies of most fish species in the Pacific may be best marketed domestically or aimed at the top end of appropriate export markets; the importance of obtaining maximum benefit from limited resources by taking advantage of value added to the product; and the importance of determining appropriate, reliable transport arrangements between producer and supplier.

Many other technical issues arose, and during the discussions it became clear that most countries have an interest in fish aggregation devices (FADs) as a possible means of improving efficiency in catching pelagic species; the degree of interaction between artisanal fisheries, local industrial fisheries, and foreign fishing ventures may increase in future; training programmes in all aspects of fisheries, from catching through to marketing, are seen as a priority; the need for scientific assessments of inshore and deep-sea fish stocks, both of which are appear to be particularly vulnerable to exploitation, was of concern; several countries were interested in developing aquaculture and marine farming projects, especially for giant clams; and above all else, the need for regional communication of research, development and technical advice was considered paramount.

The RTMF once again provided a forum for frank and open discussions on a wide range of topics of common interest to regional fisheries bodies, and provided the technical guidance necessary to ensure that SPC fisheries activities retain their relevance to the needs and requirements of Pacific Island member countries.

DEEP SEA FISHERIES DEVELOPMENT PROJECT NOTES

Kosrae - Federated States of Micronesia

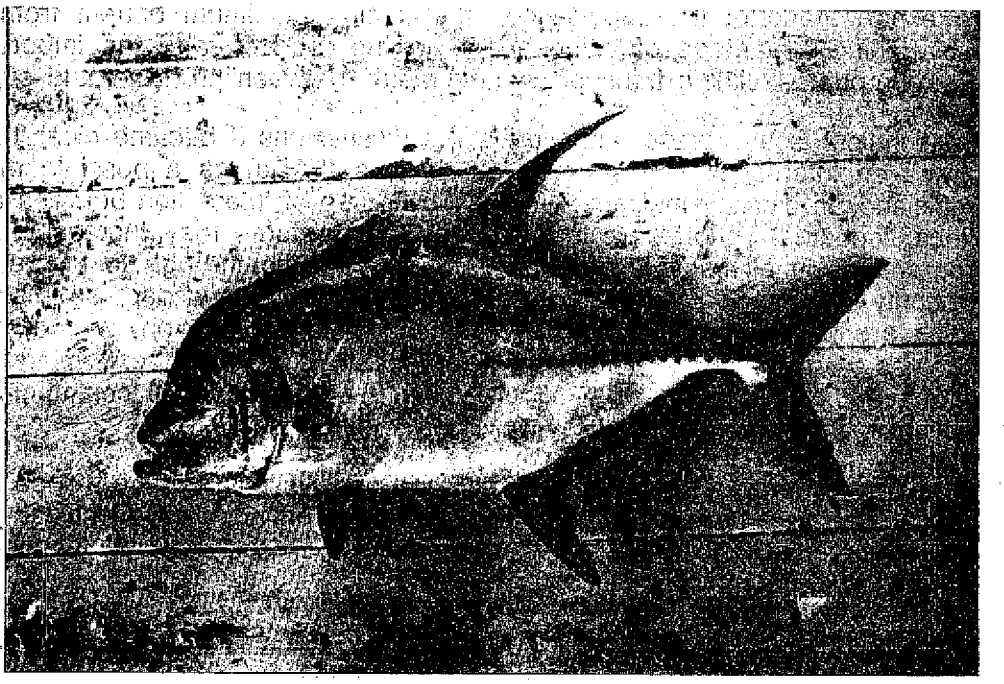
The Project's most recently recruited Master Fisherman, Archie Moana, continued his assignment in Kosrae in very wet and often blustery conditions; 'It seems to rain here every day,' Archie reports.

For the past few months Archie has been occupied with assisting new owners of Japanese-supplied fibreglass catamarans (see *SPC Fisheries Newsletter* #41) outfit their boats and get out fishing. As of September, 60 of the new catamarans had been handed over to their new owners, most of whom had received some training from Archie in basic seamanship and safety at sea, deep-bottom droplining technique, the use of outrigger booms for multiple-line trolling, and on-board catch handling and storage.

After offering to help the first four new boat owners build their own FAO Western Samoa-design wooden handreels, Archie found himself literally besieged by other prospective owners seeking the same assistance. The building of the first reels at the MDR facility turned into a reel-construction workshop, and before long the limited supply of such essential materials as galvanised bolts, washers, and ceramic spike insulators (which are used as line guides on the reel arms) became apparent. Unfortunately for the power supply authorities in Kosrae, the fishermen soon discovered that the galvanised bolts used on power-poles would serve very well as reel axles. The Kosraeans were also quite ingenious in coping with the

shortage of spike insulators and some innovative line guides were rigged from Ubolts and odds and ends of plastic.

The deep-bottom fishing trials conducted to date indicate that the extent of suitable grounds around Kosrae is quite limited. Archie's best catches have been made over a few shelves extending a little way offshore, which are found mainly around the points of the island. Unfortunately these points appear to be subject to consistently strong currents which make anchoring difficult. The best catches from these areas have been taken in depths around 100 m — somewhat shallower than the usual target depths for deep-bottom droplining - and have included good numbers of Kosrae's favourite table fish **srohme**, or black trevally (*Caranx lugubris*).



Kosrae's favoured table fish srohme, or black trevally, *Caranx lugubris*

Archie also rigged a vertical longline to test the depths around Kosrae's FADs for large tunas. To date a shortage of suitable bait has held up these trials, but Archie is preparing gear to catch local scad (*Decapterus* spp.) for bait, and also plans to try scooping flying-fish at night to rig as trolling baits for wahoo - a practice unknown in Kosrae.

French Polynesia

Following the completion of his work at Rurutu and Tubuai in the Australs (see *SPC Fisheries Newsletter* #41) Master Fisherman Lindsay Chapman travelled by inter-island vessel from Papeete to Ua Pou in the Marquesas, arriving there in mid-June in company with EVAAM counterpart officer Georges Maorii. Unfortunately Lindsay had to make the trip without much of the Project's fishing gear — the ship carrying the gear from Tubuai being diverted to Rapa for a medical emergency and thereby missing the rendezvous in Papeete for freight to the Marquesas.

Nevertheless Lindsay managed to organise fishing trips with Ua Pou fishermen (assisted by Georges appearing on local TV to broadcast an invitation for fishermen to participate in the programme) and fished with them using their gear. Although Lindsay was able to demonstrate the essentials of deep-bottom fishing technique, he sorely missed having tuna circle hooks to rig, these hooks being little known on Ua Pou.

With the eventual arrival of the Project's gear it was decided to extend the visit a little so that fishermen could compare the efficiency and productivity of the wooden handreels and other deep-fishing gear, and so that Lindsay could demonstrate the rigging and setting of vertical longlines to capture tuna. Although the weather was kind throughout the visit, the sharks weren't, taking many hooked fish and disrupting fishing completely on occasion.

Lindsay returned to Papeete on 18 July and then joined EVAAM staff aboard the *Moana Nui* on a 7-day fishing trip to uninhabited Mehetia island, a volanic cone which rises steeply from the sea about 100 km south-east of Tahiti. The purpose of this trip was largely to demonstrate some of the techniques, already shown to outer island fishermen, which EVAAM staff might adopt in their own promotion of artisanal fisheries.

Tonga - Gear development sub-project

The long-term gear development sub-project, based in Vava'u, Tonga, continued under the supervision of SPC Master Fisherman Paul Mead (see *SPC Fisheries Newsletters* #40 and 41).

After attending the Nineteenth Annual Regional Technical Meeting on Fisheries at SPC headquarters in Noumea, Paul returned to Vava'u and continued with his regular fishing trials in trolling and vertical longlining. In addition, he established an inspection and monitoring programme for the three surviving FADs of the four deployed last year. He runs regular echo-sounding transects around the FADs to monitor the attracted fish populations and follows this up with visual inspection by snorkelling and scuba-diving. The scuba dives also allow Paul to check the condition of the FADs' mooring components at the upper levels.

Paul notes in his recent reports that fishermen working offshore reefs and shoals have lately reported that some reefs are emitting strong hydrogen sulphide-like odours. A number of earth tremors have shaken Vava'u recently.

NEWS FROM IN AND AROUND THE REGION

MICRONESIA NATIONAL FISHERIES CORPORATION ESTABLISHED

(Source : *JK Report on Micronesia*)

The Federated States of Micronesia National Fisheries Corporation (NFC) is getting underway on Pohnpei with a tiny budget of $ 42 000 for six months and old furniture from a government warehouse. Enthusiastic executive director James Movick and his brothers recently spray-painted the desk and tables for the NFC office located on the waterfront in Kolonia. Movick said he would prefer to use available funds for a computer system rather than new furniture.

Conveniently located in the same building are the offices of the Micronesian Maritime Authority (MMA), the FSM government's marine resources office, and the Pohnpei branch of the FSM Development bank, all of which Movick plans to work with.

Movick will be looking for joint venture proposals from companies wanting to develop tuna resources in FSM. The NFC will work with the states and foreign investors in setting up joint venture corporations. NFC also will be ready to assist states in marketing their fresh fish and in controlling the quality of fish to be exported. In addition, Movick hopes to bring in experts to identify alternative methods of fishing suited to small-scale fishermen. Developing alternative ways to process fish, such as vacuum-packing tuna in plastic containers rather than cans, is another area he wants the fledgling corporation to look into.

Anyone interested in enquiring further into joint venture corporations for developing the tuna industry in the FSM can contact: James Movick, PO Box R, Kolonia, Pohnpei, FSM 96941.

QUEENSLAND STUDIES FISH POISONING

(Source: *Catch/Australian Fisheries*)

The possible occurrence of ciguatera fish poisoning among consumers, caused by the consumption of fish which have eaten toxic dinoflagellates, is of concern to fish sellers in Queensland because of the prospect of legal action arising. Research projects into ciguatera poisoning have now received grants for 1986-87 of nearly $87 000 from the Australian Commonwealth Government's Fishing Industry Research Trust Account (FIRTA). One project is looking to develop a rapid test for detecting the ciguatoxin which causes the poisoning. It is also planned to produce a method for immunisation. Another line of research concerns the growth and bloom formation of the dinoflagellate algae *Gambierdiscus toxicus* which is associated with ciguatera poisoning. Reef disturbance as a possible factor contributing to incidences of ciguatoxicity is one aspect of the research being carried out in Brisbane and at inshore and offshore Queensland coral reefs.

KIRIBATI FISHERMEN RESCUED

(Source: *Samoa News*)

The American flag tuna vessel *MV Patrician*, fishing for the Samoa Packing Cannery some 900 nautical miles south-east of Tarawa in late August, came upon three Kiribati fishermen drifting in a small open boat. The men, who were all in fair condition considering their ordeal, had been adrift for about 21 days.

This was the second rescue of Kiribati fishermen by a Pago Pago-based vessel in as many months. In July 1987 the purse-seiner *Carol Linda* picked up four I-Kiribati who had been adrift for 18 days.

ICOD GRADUATE-LEVEL SCHOLARSHIPS AT REGIONAL UNIVERSITIES

(Source: *USP Bulletin*)

The International Centre for Ocean Development (ICOD) is inviting Governments or regional organisations to nominate candidates for the ICOD Regional Scholarship Programme. Scholarships are granted to support students of high academic calibre who demonstrate a commitment to contribute to the development and management of ocean resources in their country or in the Pacific region. Acceptable fields of study include, but are not limited to Physical, Biological, Environmental or Social Sciences, Law, etc.

In order to be eligible for scholarship consideration, an applicant must be a citizen of a developing country in the Pacific region; be eligible to apply for, and be admitted to, a Master's degree programme at either the University of the South Pacific (USP) or the University of Papua New Guinea (UPNG); be nominated by his/her government or a regional organisation; and intend to pursue a programme of study which is relevant to the development and management of ocean resources.

Candidates should apply directly to the university concerned for admission and, in a covering letter, indicate that they have been nominated for an ICOD scholarship. A copy of the completed university application form and any supporting documents should be forwarded to ICOD before 30 November each year.

Applications for admission to USP are to be sent to : The Registrar, University of the South Pacific, P.O Box 1168, Suva, Fiji. Further details may be obtained from the Information Office, USP.

WESTERN SAMOA JOINS GIANT CLAM PROJECT

(Source: *Clamlines*)

The Western Samoa Fisheries Division is now participating in the International Giant Clam Mariculture Project (see *SPC Fisheries Newsletter* #39), preparatory to commencing culture operations on *Tridacna squamosa*. It hopes to have funding from an aid agency arranged by August.

The Division's team is headed by Mr Lui Bell and facilities currently available include two 20 000 litre, 1 m deep concrete tanks which will be used for larval rearing and four 1 000 litre plastic tanks which will be used as broodstock/spawning tanks. The team is waiting on aid funding for a diesel-powered seawater pump (30-40 l/min), filter mesh bags, salinity refractometer and scuba gear.

The first steps will include a 2-3 week attachment at the Micronesian Mariculture Demonstration Centre (MMDC) in Palau, followed by rearing experiments on *T. squamosa*, and field surveys. The possibility of reintroduction of *Hippopus hippopus* will be examined in due course.

MORE RUBBISH THAN FISH

(Source: NZFIB/FINS/SPC/NMFS)

Marine researchers estimate that the amount of rubbish discarded in the oceans each year now outweighs the fish harvest by three to one. Much of the trash consists of plastic which will not rot. The accumulation of plastic is already a hazard to marine life and the problem is getting worse. The State of California may soon take steps to ensure plastic containers are biodegradable. One bill now before the State Legislature calls for a survey by public bodies to determine the extent of damage. They would also be asked to make recommendations on the clean-up of coastal waters. Legislation has been introduced in the US Congress seeking better control over the disposal of plastics at sea.

Seal trapped in discarded netting

U.S. anti-marine debris poster

A conference of Pacific rim fishermen, convened in Hawaii in October by the Marine Debris Program of the U.S. National Oceanic and Atmospheric Administration and the National Marine Fisheries Service, described the damage caused to sea life by discarded ropes, nets, and other fishing gear, as 'immeasurable' and sought to establish codes of behaviour for fishermen relating to the dumping or loss of such gear.

Plastic bags, packing bands from cardboard cartons, and other rubbish which has been disposed of incorrectly at sea continue to be a major problem. The packing bands become entangled around sharks and the plastic bags have damaged outboard motors and marine engines. As well, the bags and bands are washed ashore where they make an unsightly mess on beaches and make conditions unpleasant for swimmers.

In a recent incident in Western Australia a pleasure boat was disabled by a plastic bag. The boat had to be towed to safety in bad weather because the engine failed when the plastic bag blocked the cooling water intake. Plastic bags are often mistaken for food by leatherback turtles and other animals that feed on jellyfish. Once ingested, the bags block the animal's digestive tract and cause its death.

Since the 1970's when plastic straps were first introduced to package bait for the Western Australian fishing industry, many banded sharks have been reported. Records kept at the Western Australian Marine Research Laboratories show that at least five species of sharks have been banded. The most common is the bronze whaler. The sharks are probably snared by the bands after being attracted by the smell of the open bait boxes. The bands may become looped over the body while the fish is foraging for bait scraps and, as the shark is unable to swim backwards, it cannot shake off the band. In time the strap tightens and starts rubbing and cutting into the fins and body. Eventually an ulcerated sore is produced at the site and as the fins grow forward the strap's incision may heal and produce a 'scar track'. Muscle and tissue wastage develops as the band continues to tighten, usually around the body anteriorly at the level of the last or fifth gill slit, where it rubs and cuts into the body, and the first dorsal fin. When captured by a professional shark fisherman, a shark in an advanced case of banding is unsaleable and has 'watery' flesh. Sharks in such condition are also believed to be more menacing to divers due to their debilitated condition.

A bronze whaler shark showing damage caused by a baitbox band

Recently a number of recommendations aimed at solving the problem were proposed by a senior Australian fisheries officer. He believed that the straps should be made in such a way they were no longer a danger to sharks. The straps could be made with a metal clip comprised of two dissimilar metals. Each clip would come in two parts for example, one of them aluminium, the other steel. Once pressed together the bond would be strong, but immersion in salt water would immediately produce a galvanic action which would cause the clip to disintegrate or weaken sufficiently for the pressure exerted by the shark's expanding body to result in the separation of the clip segments. Another suggestion involved the use of some form of natural material which will break up once immersed in salt water.

EAST-WEST CENTER TUNA STUDY ENDS
(Source: PIDP)

In 1985, the Pacific Islands Development Program at the East-West Center in Honolulu started an intensive study of the world tuna industry. The purpose of the study was to evaluate options for island countries wanting to develop or expand domestic tuna industries.

Tuna was selected as the first industry to be investigated in an ongoing research programme because of its critical importance to all island countries. Most island countries have limited avenues for development and they see tuna as being one resource that will enable them to promote sustained economic development and growth. Each year about 40 per cent of the world's total tuna harvest is taken in the Pacific, but island countries receive only a very small portion of the revenues or benefits accruing from this exploitation. Countries are generally dissatisfied with this situation and want to obtain an increased share of the returns from the region's tuna fishery.

The study produced a series of reports which have been widely distributed. The study was under the direction of Dr David J. Doulman, formerly Chief Fisheries Economist with the Government of Papua New Guinea. He left the East-West Center in early July to join the Forum Fisheries Agency based in Solomon Islands.

The Pacific Islands Development Program study focused on a number of research areas. Reports produced concerned the study of the domestic and distant-water tuna industries in the Pacific Islands, world tuna markets, profiles of competitor countries, the role of international business in the international tuna industry, and development options and issues for island countries.

Twenty-four reports were produced by internationally-known professionals in the tuna and fisheries fields. The study is one of the most comprehensive ever undertaken of the world tuna industry and the only one that has focused on the world tuna industry from a Pacific Islands perspective.

The reports produced for the project have been condensed into a book entitled *The development of the tuna industry in the Pacific Islands region: an analysis of options.*

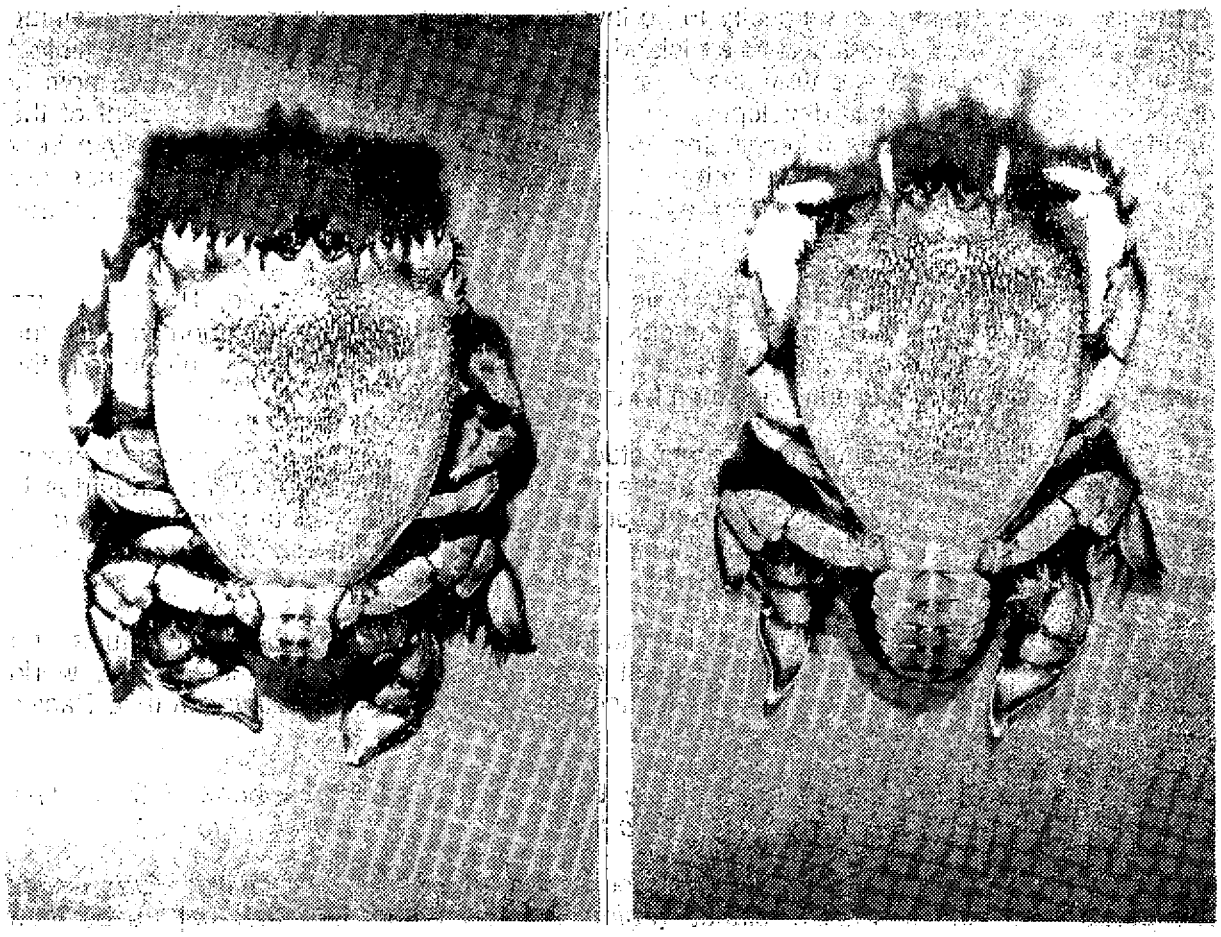
An earlier East-West Center publication, also edited by Dr Doulman, and entitled *Tuna issues and perspectives in the Pacific Islands region*, brings together 17 other papers by tuna authorities which address the socio-economic issues related to the development of the tuna industry in the Pacific. Issues discussed include fisheries management, the impact of the Law of the Sea, biological aspects of development, U.S. and Japanese tuna fishing efforts and attitudes, artisanal and domestic tuna fisheries, and regional and international conflicts and treaties.

The book's overall conclusion is that it is not yet clear how fisheries should be developed, who should develop them, and what the role of the public and private sections should be. The contributors conclude, too, that politics and ideological perspectives will continue to play a central role in the industry's development.

Both titles are available from the East-West Center's Publications Office (1777 East-West Road, Honolulu, Hawaii 96848) at a cost of US$ 10.00, and US$ 12.00 respectively, plus postage if airmail is required.

DEEP-WATER CRAB FISHING TRIALS
(Source: FAO/SWIOP/MMDC)

The Kona crab (*Ranina ranina*) is found throughout the tropical Pacific Ocean (Hawaii, Japan, Taiwan, Philippines...) as well as in the Indian Ocean. The two major fisheries are those of Hawaii, which started prior to 1950, and of Queensland in Australia, which has operated since 1970.



Mature male (carapace length — 122 mm) left, and mature female (carapace length — 85 mm), kona crabs

In the Western Indian Ocean, there are only two small established fisheries, in Mauritius and Réunion, for which no statistics are available. These crabs also occur in the by-catch of shrimp trawlers in Seychelles, and a fishery for them is presently developing there.

The Kona crab was first reported in Seychelles when the Seychelles Fisheries Division caught the first specimens with gill nets in 1974 and 1975. More than 10 years later, the Seychelles Fishing Authority (SFA), in the context of an EEC technical assistance programme, started to search for them again. Between October 1986 and February 1987, results were very encouraging, and, as of March 1987, two commercial vessels entered the fishery.

Landings from October 1986 to May 1987 totalled 9.4 t, of which 7.2 t were taken by commercial vessels Most of the crabs are sold through a semi-government authority, the Seychelles Marketing Board, Fish Division (SMB), at a producer price equivalent to about US$5/kg. The SMB has had problems selling so much of a new product, and now only purchases crab once some stock has been sold. Export marketing trials are afoot, and 2 t have already been exported to Réunion where the kona crab is known and is sold for a high price.

Kona crabs are commonly caught with hoopnets which are made up on an iron ring about 1 m in diameter, hung loosely with a double layer of netting (usually 5 cm stretched mesh). 10 to 20 hoopnets are strung at 10 to 20 m intervals on a longline. The nets are baited, preferably with fresh bonito, and each set lasts 40 minutes on average. The crabs, which are carnivorous, are meshed by the legs. Up to 30 crabs have been caught on a single net, but average catches are 1 to 4.

Boats of different sizes are used in this fishery in Seychelles: 6.5 m to 14 m (with a catcher boat), depending on the area fished. They usually use 4 lines of 15 nets. Fishing trips last 1 - 4 days, and the crabs are kept on ice.

The Kona crab normally lives buried in the sand, so that extensive fine sand areas are its habitat. In Seychelles it is found mainly at depths of 30 m to 50 m, while in Australia the range is 0 m to 80 m, and 2 m to 200 m in Hawaii. The crabs seem to exist all over the Mahé plateau where the substrate is appropriate, but occur in varying densities.

Catch and effort (number of hoopnet sets) are kept by the SFA, which is also conducting a biological sampling programme in order to determine the population characteristics. Table 1 gives preliminary results, compared to those obtained in Australia and Hawaii.

Table 1 : Comparative biological data from Seychelles, Hawaii and Australia

	Seychelles (Onizuka, 1972)		Hawaii (Onizuka, 1972)		Australia (Brown, 1985 Brown, 1986)	
	Male	Female	Male	Female	Male	Female
Sex ratio (%):	7	43	55	45	75	25
Reproductive season:	summer		summer		summer	
Mean weight per crab (kg):	0.45	*	*	*	*	*
Mean size (mm):	103	88	85	80	105	89
Size at sexual maturity (mm):	*	99	75	*	*	70
Minimum size observed (mm):	58	58	*	*	*	*
Maximum size observed (mm):	145	115	178	141	*	*

*Data not available

Statistical sampling of the Hawaiian fishery started in 1950. Maximum annual catches were recorded in 1968 (18.8 t) and 1972 (29.2 t). Three to four boats are engaged part-time in the fishery. The crabs are kept alive in wells (mortality rate under 5%), and in 1985 were sold at prices ranging from US$ 7 to US$ 10/kg. Stocks do not appear overexploited despite a large sports fishery. A maximum sustainable yield of 70 t/year has been suggested.

The Australian fisheries of Queensland and New South Wales are more recent (1970) and much larger, with annual catches of the order of 500 t. Prices range from US$ 4-5/kg. The fleet comprises 6-7 outboard-propelled craft, using several lines of 20 traps. The fishery is not seasonal and catch rates are high, averaging 4.3 saleable crabs per net set. Export of crabs to Hawaii is envisaged at this time.

A minimum size limit is applied both in Hawaii (95 mm, posterior carapace margin to right eye stalk) and in Australia (100 mm). A closed season for females during the reproductive period (summer) may be more appropriate than limiting fishing effort. In both countries, as in Seychelles, fishing berried females is prohibited. No attempt is made to control mesh sizes, as trials have demonstrated that there is little relationship between mesh size and the size of crabs caught. In Hawaii, the high mortality among crabs released if legs are broken off while unmeshing them (70% mortality for one broken leg) was publicised among fishermen.

Kona crab resources are most probably present in the waters of many western Indian Ocean and Pacific Island countries. The ease of fishing and high commercial value of this crustacean are strong motivations for prospecting this resource and developing fisheries.

This species does not migrate, and there is little intermixing in adult populations. All attempts at age determination from modal size progression so far have failed, the only stock size estimates coming from tagging studies. These have established a growth per moult of 9.9 mm for males and 7.5 mm for females.

In Palau, a deepwater shrimp trapping project has resulted in the unexpected but potentially significant discovery that large numbers of the deep-water red crab, *Geryon* sp, were taken on a regular basis in the shrimp traps. These crabs, which may average 1 kg in weight, may be numerous - as many as 15 were taken in a single trap on several occasions. It is notable that this genus is fished and marketed commercially in the US, but apparently has not previously been fished commercially in the Pacific. Whether this is a product of shrimp trap designs (which typically have openings too small to admit *Geryon*) or whether Palau hosts an unusually prolific crab fauna is not known. However, the potential for exploiting deep-water crabs along with shrimps in Palau should be determined. It is notable that these crabs were enthusiastically received by all Palauans to whom they were given - and many regarded the flavour as superior to mangrove crabs. It is also of note that it was possible to revive and to keep these deep-water crabs alive after they had been brought to the surface, by placing them in cool water (20°C). This raises the possibility of marketing live crabs to epicurean consumers at several resorts and 'white-tablecloth' restaurants in Palau.

References:

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Brown, I.W., 1985. *The Hawaiian kona crab fishery.* Study tour report (mimeo), Queensland Department of Primary Industries, Brisbane.

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TUNA LANDINGS IN AMERICAN SAMOA
(Source: NMFS)

NMFS scientists Victor Honda and Gordon Yamasaki have completed a draft report on the NMFS purse seine sampling programme in American Samoa. Their report summarises a vast quantity of data collected in 1980-86 from the U.S. purse-seine fleet that off-loads in American Samoa.

In American Samoa, the number of purse-seiners off-loading grew from 4 vessels (5 trips) in 1980 to 30 vessels (87 trips) in 1986. Total purse-seine landings rose on an index basis from 100 in 1980 to 2 700 in 1986. The number of transshipment off-loadings declined from 55 trips in 1980 to 18 in 1986. However, the total transshipment landings (by weight) increased by 81% over the same period.

Skipjack tuna constituted 70% of landings, with the rest being yellowfin and bigeye tuna. Length-frequency data from more than 17 000 skipjack tuna, 11 000 yellowfin tuna, and 1 200 bigeye tuna were graphed on a quarterly basis for 1985.

Yamasaki, who is stationed in Pago Pago, collected the catch data with the assistance of the local Office of Marine and Wildlife Resources. The data were compiled by Honda and other colleagues in Honolulu. The report is being edited and will be released as a Southwest Fisheries Center Administrative Report.

REGIONAL TRAINING COURSES IN COASTAL FISHERIES DEVELOPMENT IN PNG
(Source: UPNG)

1987 saw the successful completion of two regional training courses jointly sponsored by Papua New Guinea and Japan. The third course was carried out in February 1987. The fourth ran from 22 November to 13 December and accommodated a total of 20 participants from American Samoa (2), Cook Islands (1), Kiribati (1), Marshall Islands (1), Palau (1), Papua New Guinea (9), Solomon Islands (1), Tonga (1), Western Samoa (1) and Yap (2). The course content will be unchanged, covering the theory and application of all types of fishing nets, lines and traps applicable to conditions in the South Pacific region. Extensive practical work is carried out both on shore and on numerous fishing trips aboard the training vessel *Scomber*.

For further information, please contact: Dr Tim T. Kan, Head of Department, Department of Fisheries, University of Papua New Guinea. The UPNG telex number is NE 22366.

KOSRAE GIANT CLAM CULTURE SITE EVALUATED
(Source: MMDC)

Mr Gerald Heslinga, Manager of the Micronesian Mariculture Demonstration Centre (MMDC) in Palau, spent five days in Kosrae in June meeting with state officials and evaluating possible sites for the proposed FSM Giant Clam Hatchery. Near-term plans for the development of the hatchery include training personnel, expanding the present ocean nursery near Yen Ashr Island, building a critical mass of broodstock, requesting secondment of a UN biologist to the project, and soliciting hatchery equipment from Japan Goods and Services grants.

The most accessible and extensive areas for giant clam mariculture in Kosrae are shallow subtidal and intertidal fringing reef flats, which in many parts of the island extend nearly a kilometre from shore. An important objective of the next 12 months will be to conduct nursery trials on these shallow flats to determine their suitability for clam cultivation. Judging from the number of fossil *Tridacna gigas* and *Hippopus hippopus* in recent sediments on Kosrae these clam species were formerly abundant on the reef flats. Today *T. gigas* is extinct and *H. hippopus* is either extinct or extremely rare, most probably as a result of human predation.

FIRST TROCHUS AIRFREIGHTED TO TUVALU
(Source: *Tuvalu Echoes*/UNDP)

A first shipment of 200 live trochus (*Trochus niloticus*) was landed at Funafuti, Tuvalu in September under the sponsorship of the FAO/UNDP South Pacific Regional Fisheries Support Programme (SPRFSP) (see *SPC Fisheries Newsletter* #40). The collection and freighting of the trochus was supervised by SPRFSP Fisheries Development Adviser Bob Gillett.

It was reported that 180 of the molluscs survived the journey in viable condition and that these were released along the ocean reef at north Funafuti. Further transfers to Funafuti by commercial air services are planned and it is hoped that the New Zealand Air Force will later co-operate with transfers to Nukufetau and Nukulaelae.

PNG FISH POSTER
(Source: *Australian Fisheries*)

An identification poster for commonly caught fish of Papua New Guinea has been released by the Papua New Guinea Government's Department of Fisheries and Marine Resources.

The poster, which features fish commonly caught by local fishermen in waters close to coral reefs, contains 72 colour photographs of fish species in family groups. Each fish is labelled with its scientific name together with an estimate of its maximum attainable size. In addition provision has been made beneath each photograph for fishermen to add the local name by which they know the fish. This is an important feature in PNG and other Pacific Island nations where even neighbouring communities may have quite different names for the same species.

The poster was designed to assist with the collection of catch information from fishermen who operate near coral reefs and land their catches at government-run fisheries stations. The PNG Fisheries Division has embarked on a survey of the national reef-associated resources harvest and it is expected that the poster will assist in the training of fisheries station staff to recognise the major groups of fishes and thus be able to make estimates of the contribution of each group to the total catch. The project is not limited to fin-fish but includes invertebrates such as beche-de-mer, trochus, green snail, blacklip and goldlip pearlshell.

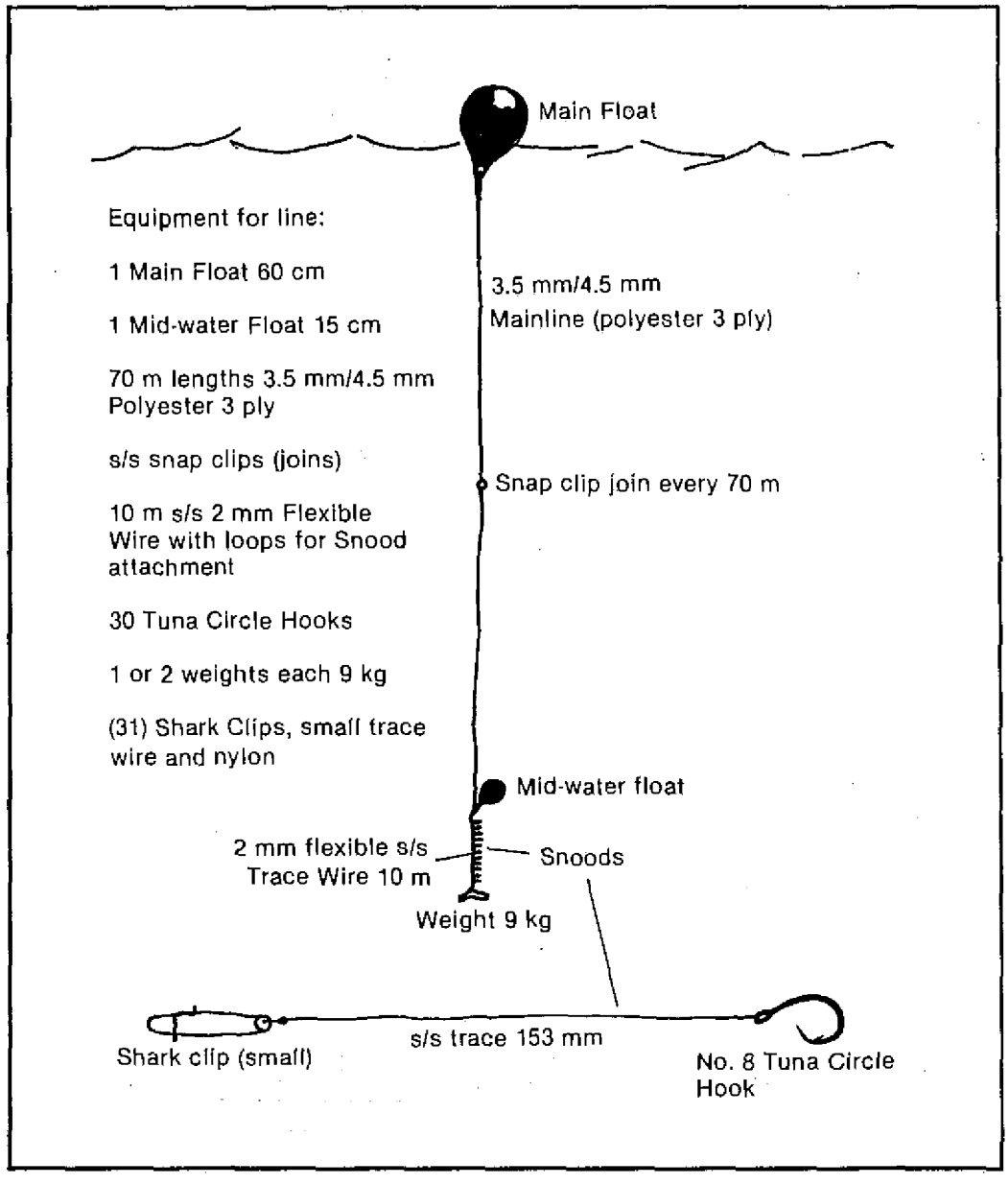
The posters are available from the First Assistant Secretary, Department of Fisheries and Marine Resources, P.O. Box 417, Konedobu, Papua New Guinea, at a cost of PNG K 5.00.

FISHERIES SCIENCE AND TECHNOLOGY

DEEP BOTTOM FISHING SURVEY IN QUEENSLAND

(Source: *Australian Fisheries*)

A survey investigating the potential of an alternative fishery for small trawlers working off Queensland's north coast was conducted earlier this year by Queensland fisherman Richard Greenwood using his vessel *Louisianne*. The aim was to examine the feasibility of establishing a dropline fishery, particularly in the outer reef area of Townsville. The initial task was to locate suitable fishing grounds and anchorages in the area, and then to target on suitable fish species, for example jobfish and king snapper, in water depths of 180 m or deeper. Early results were disappointing for a number of reasons, but mainly because of interruptions caused by almost continuously rough weather.



An example of the rig used for the droplining trials

The fishing gear was made by the vessel's owner with advice from the Australian Fisheries Service. It consisted of 800 m of 3.5 mm and 4.5 mm mainline (polyester 3-ply cord) on both winch drums, with each line joined every 70 m by a stainless steel snap hook to allow the attachment of mid-water buoys. Each line also had a 10 m stainless steel trace with swaged loops for the attachment of snoods. The snoods consisted of short lengths of stainless steel trace, small shark clips and No 8 Mustad tuna circle hooks (see diagram). Floats used included 60 cm orange top floats and 15 cm plastic net buoys as mid-water floats. Weights were pieces of angle iron each weighing about 9 kg.

Most of the bait used consisted of trawled trash fish and included butterfly bream (known locally as pinkies), goatfish, squid and cuttlefish. Very small fish were used whole but larger ones and the squid and cuttlefish were cut into pieces before being attached to the hooks. Tuna circle hooks were used because of their ability to hold fish for considerable periods of time. However they were found difficult to bait, particularly with small whole fish. One suggestion that was made was to salt the fish bait overnight to toughen the flesh.

Sounding surveys over much of the area chosen for the trials proved discouraging as much of the ground deeper than 100 m was found to be clear continental shelf slope with little or no noticeable rough ground. Some droplining was attempted during this early survey but no fish were caught. To evaluate the effectiveness of the fishing gear it was decided to seek shallower shoal bottoms in depths of about 70 m. Once again no major fish concentrations were noted, but fish were caught in small, uncommercial quantities.

It was here that one of the advantages of the rig being used was demonstrated. Some fouling of the mainline on rough ground occurred, but the bottom-rigged weight (angle-iron) easily broke away each time allowing the mainline to be retrieved intact, complete with any fish hooked. Although some sharks were noted in water depths of less than 70 m, they did not attack the line; this situation could change if more fish were hooked.

Another observation of interest was that although the droplining was carried out during a period of spring tides, no noticeable current was observed. In water less than 80 m deep a single 9 kg angle-iron weight on each dropline was effective, and, at depths greater than 80 m, two weights were more than adequate. Only once was the gear recovered fouled, after the weight had broken away and a small shark, which was thought to have tangled the line in its struggles, had been hauled.

A total of only 32 fish representing 11 different species were caught. These were:

Chinaman fish (*Symphorus nematophorus*) which is poisonous (2);
Tusk fish (*Choerodon cephalotes*) (1);
Sweetlip (*Lethrinus fletus*) (2);
Spangled emperor (*Lethrinus nebulosus*) (5);
Red emperor (*Lutjanus sebae*) (4);
Green jobfish (*Aprion virescens*) (1);
Rosy jobfish (*Aprion microlepis*) (4);
Coral rock-cod (*Epinephelus corallicola*) (3);
Coral trout (*Plectropoma maculatium*) (7);
Trevally-bludger (*Carangoides gymnostethus*) (2);
Little blue shark (*Scolodien palasorrah*) (1).

In summary, catches to date from the project have been poor but this has been mostly attributed to unseasonal bad weather and the effort involved in locating suitable fishing grounds. Despite the poor catches the dropline method of fishing has been demonstrated as suitable for this region, particularly in depths of more than 50 m.

The tuna circle hooks used in the survey proved ideal for holding fish but some problems were experienced in baiting operations. It was also found that the number of hooks used on each line could be reduced, as hooks higher than 5 m off the bottom were consistently

untouched. Although the aim of the project was to examine whether droplining was a feasible alternative, or adjunct, to trawling in this area, it was found that it was not practical to mix the two activities within the same trip because of the time needed to change from trawling to droplining, and also because of the distances between the respective grounds.

Further survey work will be carried out in the future, at a time when weather conditions are more suitable.

TRIALS WITH NEW TECHNIQUE FOR TAGGING DEEP-WATER FISH :

(Source: *Catch*)

A new technique to tag deep-water fish was tested in New Zealand earlier this year by Peter Horn and Brendon Massey, two scientists with the New Zealand Ministry of Agriculture and Fisheries. The technique uses detachable hooks and tags on set lines, with weak traces that will break once the hook is set and the fish struggles.

The trials aimed to refine the technique in preparation for an extensive survey planned for later this year to investigate the movement of bluenose and alfonsino. At that time it is hoped to fish with detachable hooks on several major grounds and to tag over 2 000 fish.

Tagging deep-water fish at the surface produces many problems. The fish experience drastic and often fatal changes in water temperature, light intensity, and particularly, pressure. The over-inflated swimbladder and everted stomach of a landed fish are a clear indication of the change in pressure, and are often associated with serious internal injuries. Even species with open swimbladders, such as alfonsino, which may still be very lively when brought to the surface, appear to suffer a fatal shock in the short time taken to land, measure, tag and return them to the water. A method that enables the tagging of deep-water fish without removing them from their habitat is clearly of value.

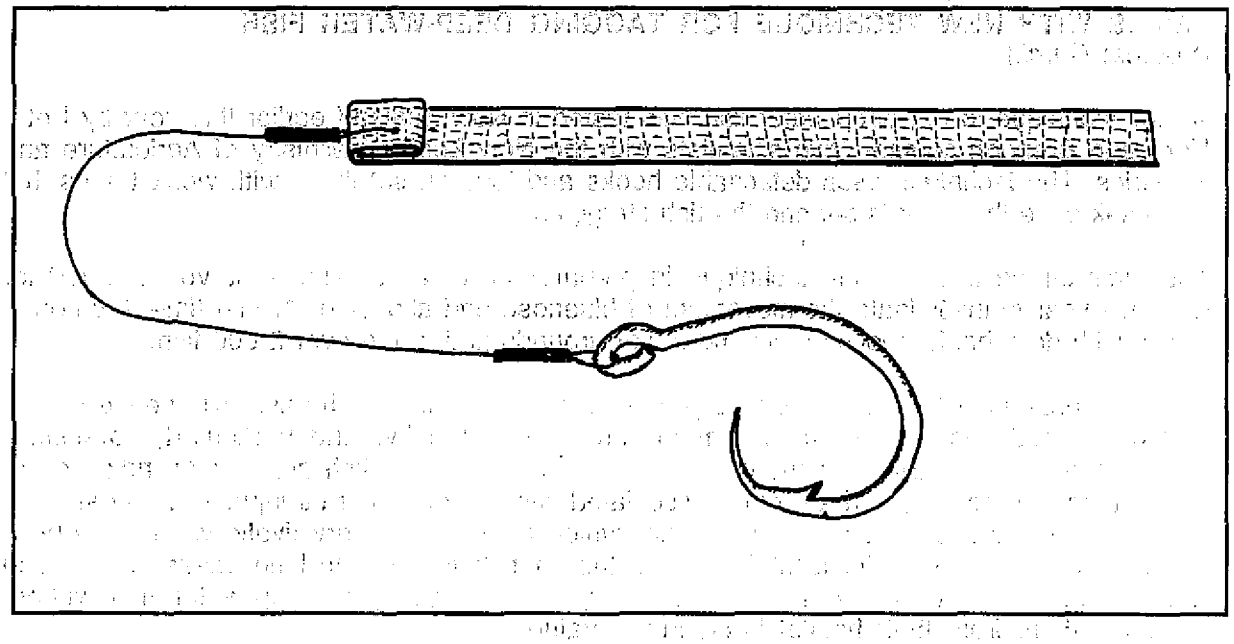
Tags on detachable hooks were experimented with in a study of tilefish on the east coast of the USA in 1979. About two per cent of the tags were later recovered by commercial fishermen. In the study just completed, different hook types, tag designs, and breakable trace strengths were all tested to determine the best possible gear combination to use for tagging bluenose and alfonsino. The tags used in the pilot study were unlabelled PVC streamers (85 mm long, 6 mm wide) attached to hooks with a length of stainless steel wire. In future surveys, commercially-made tags of a somewhat similar design, but labelled and numbered, will be used.

Large J-shaped hooks are usually used in the commercial fishery for bluenose. However, for this work it was considered desirable to use the smallest hook possible so as not to hinder feeding by tagged fish. Four hook types were fished simultaneously to compare their catching efficiencies (the proportion of fish caught to hook baited). A total of 597 fish (498 bluenose, 60 alfonsino, 39 of other species) were caught, and catching efficiencies are compared in the table below.

Hook type	Catching efficiency		
	All fish	Length<60 cm	Length>60 cm
Mustad O'Shaughnessy No 7/0	0.32	0.16	0.16
Mustad Beak No 6/0	0.32	0.20	0.12
Mustad Tuna circle No 9	0.45	0.32	0.13
Tainawa size 17	0.24	0.17	0.07

The tuna circle hook was clearly the most efficient of the four tested, particularly for fish shorter than 60 cm. For larger fish, the O'Shaughnessy hook appeared to be marginally more effective.

In designing the tag, the researchers aimed to select a tag that was highly visible against bluenose and alfonsino, yet had a minimal effect on the efficiency of the gear. Yellow and green tags were compared. The effect on fishing success of having the tags 10 cm or 20 cm from the hooks was also investigated.



Hook and tag used in the trial, life size

The four tag types were fished simultaneously with an experimental control (i.e, hooks without tags), and the fishing efficiencies were again compared. Results are shown in the table below.

Tag type	Catching efficiency
Control	0.21
Yellow, 10 cm wire	0.18
Yellow, 20 cm wire	0.17
Green, 10 cm wire	0.17
Green, 20 cm wire	0.17

The tags appeared to have little effect on fishing success, and no tag design was clearly superior. It was resolved in future to use yellow tags on a 10 cm wire. Yellow was considered to be generally more visible than green and the shorter wire less likely to tangle or impede the movement of small fish.

Tagged hooks were attached to snoods with 2.3 or 4 kg breaking strain nylon and fished with a control line of full strength gear. The results given by the different strength lines are shown below.

Trace strength	% broken	Fish retained Blue nose	Other species
Full strength	1.9	64	15
4 Kg	17.4	0	4
3 Kg	23.1	0	4
2 Kg	28.2	0	3

The catch on the control gear was 64 bluenose, 6 lucifer dogfish, 5 sea perch, 2 rubyfish, and 2 spiny dogfish. Unfortunately, no alfonsino were caught. Many hooks were detached from the breakable traces although some small fish (sea perch and lucifer dogfish) were retained on this gear. Clearly, even small bluenose have no difficulty breaking the 4 kg trace. Further work is required to determine the strongest nylon that alfonsino are able to break.

This technique could be particularly useful to study the movements of fish that can be targetted by line fishing (e.g bluenose, groper, ling). However, species only occasionally caught by line, like alfonsino, could also be studied using this method.

HAWAIIAN BOTTOM FISH MANAGEMENT

(Source : NMFS)

The fishery management plan (FMP) for bottom fish, which was implemented by the Western Pacific Regional Fishery Management Council in 1986, requires that an annual review of the bottom fishery be completed by the monitoring team, which is made up of a panel of scientists familiar with the fishery and appointed by the Council. This annual review is based on the team's consideration of a series of sections submitted by various agencies, including the NMFS Honolulu Laboratory, the Western Pacific Program Office of the Southwest Region, the Hawaii Department of Aquatic Resources, the Office of Marine and Wildlife Resources in American Samoa, and the Department of Fish and Game in Guam.

For the section of the review on the biological status of the bottom fishery, Fishery Biologist Stephen Ralston and Research Assistant Kurt E. Kawamoto have completed an Administrative Report (Southwest Fisheries Center Administrative Report H-87-7) entitled *An assessment and description of the status of bottom fish stocks in Hawaii.* The analysis was based upon data collected from 1984 to 1986 at the Honolulu wholesale fish market. The information obtained represents nearly full coverage of the fishery and includes size structure.

Six species comprise the preponderance of bottom fish landings in Hawaii: **opakapaka** (*Pristimopoides filamentosus*), **onaga** (*Etelis coruscans*), **ehu** (*E. carbunculus*), **uku** (*Aprion virescens*), **hapuupuu** (*Epinephelus quernus*), and **butaguchi** (*Pseudocaranx dentex*). The first four are snappers, and the last two are a grouper and a jack, respectively. Catch statistics indicate the importance of **opakapaka** in the deep-sea handline fishery although landings of **opakapaka** from the Northwestern Hawaiian Islands (NWHI) have declined 16.5 per cent over the last 3 years. Fishermen are now beginning to target on **onaga** in place of **opakapaka** in this area and catches of **ehu**, **hapuupuu**, and **butaguchi** in the NWHI have risen as well. In contrast, bottom fish landings in the main Hawaiian Islands (MHI) have remained exceptionally stable.

Size structured yield-per-recruit analyses demonstrate that the MHI fisheries for **opakapa**, **ehu**, and **uku** are moderately to severely growth-overfished. These species may benefit from minimum size restrictions. By comparison, an increased harvest of **onaga** in the MHI is suggested, whereas the fishery for **hapuupuu** appears close to optimal.

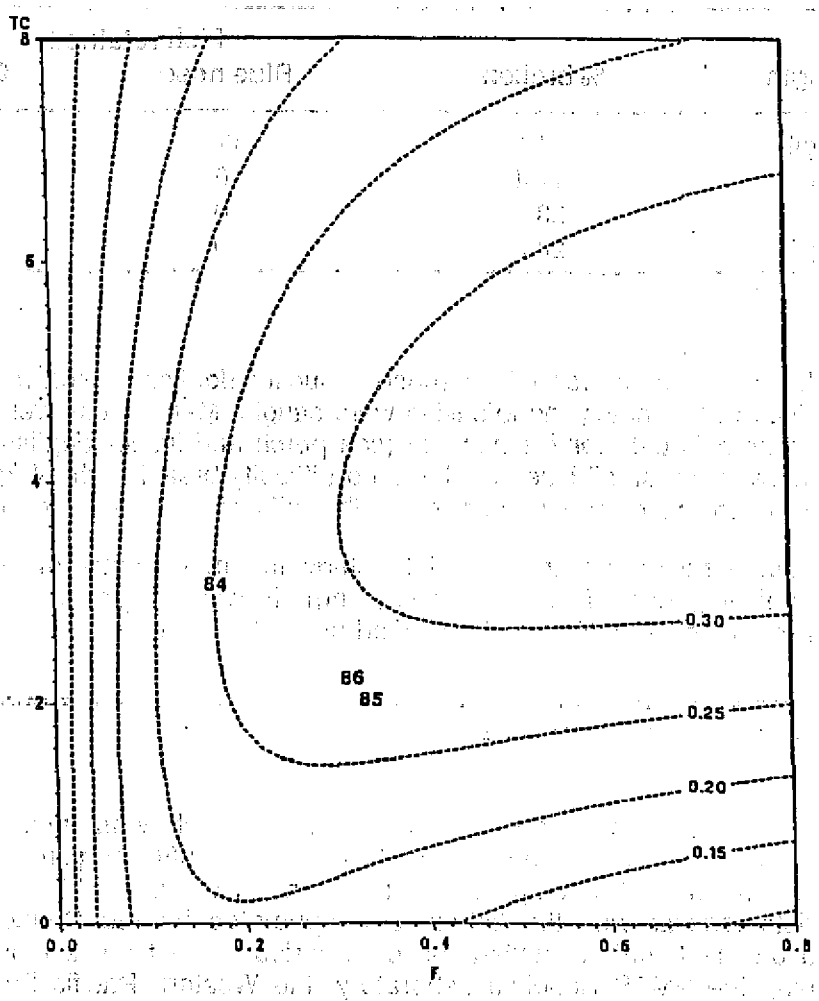


Figure 3: Yield-per-recruit analysis for opakapaka caught in the main Hawaiian Islands. The unit of "F" is per year and the unit of "TC" is years. Contoured isopleths represent the locus of points corresponding to equal yield per recruit (kilograms). The estimated positions of the fishery during the years 1984, 1985, and 1986 are plotted.

In the NWHI, there is no evidence of growth-overfishing for any of the five species analysed (**opakapaka, onaga, ehu, hapuupuu**, and **butaguchi**). This is probably due to the fishery being in a state of disequilibrium, the result of increasing fishing effort (a 30 per cent increase from 1984 to 1986) and major changes in fishing grounds. In 1986 the fishery for bottom fish in the NWHI shifted almost 300 nautical miles to the northwest as more distant stocks were increasingly exploited.

Current harvest levels of these fishes in the MHI are believed to be near maximum sustainable yield (MSY), although much better information about the recreational and the commercial catch that is unaccounted for is necessary before a more accurate assessment can be made. In the NWHI, landings presently exceed the best available estimate of MSY as bottom fish stocks are being 'fished up'.

The information generated by the study was taken into account when members of the Western Pacific Regional Fishery Management Council met in Honolulu from 4 to 5 June to discuss a limited entry proposal for the NHWI bottom fishery; the proposal was approved unanimously. Developed by Council staff and consultants with substantial technical input from Honolulu Laboratory staff, the proposal creates a closed zone in the upper reaches of the NWHI where only permitted vessels can fish, and an open zone in the lower reaches where all vessels except permitted vessels can fish.

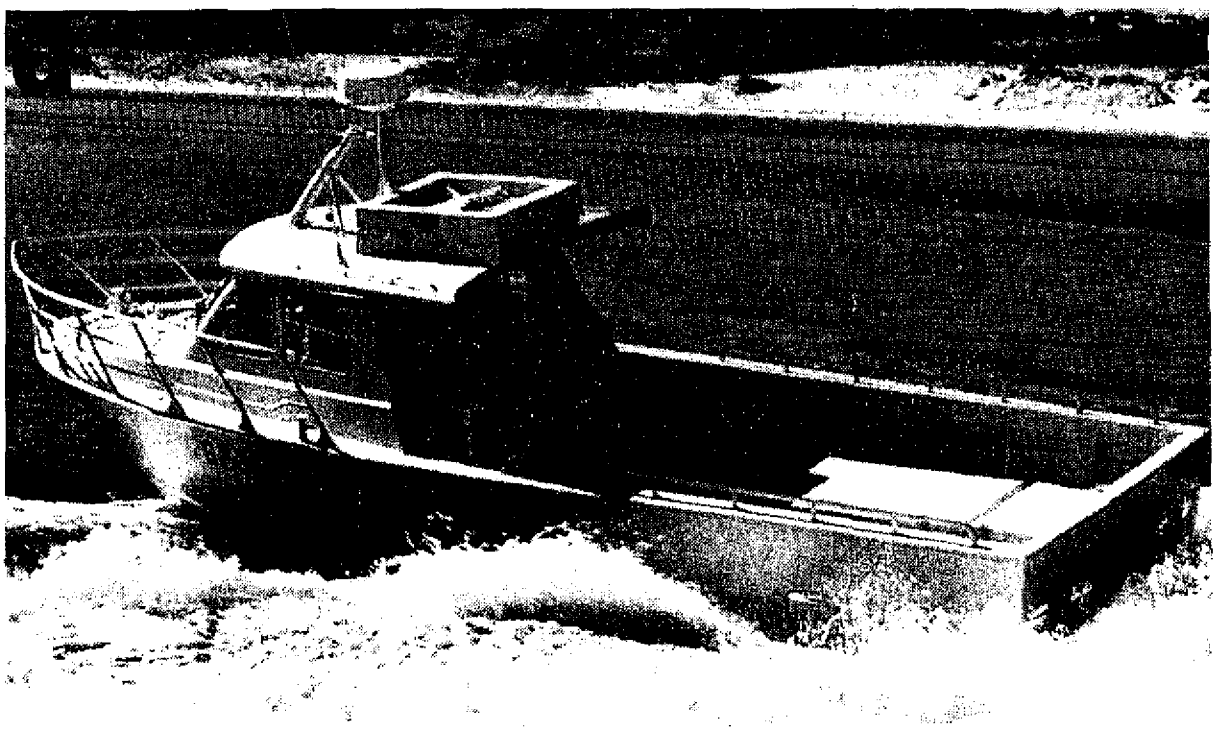
The Council also voted to recommend against issue of a permit to a drift gill-net fisherman who had applied to the Southwest Region for an experimental permit to fish his gear in the southern regions of the Hawaii extended economic zone (EEZ). The Pelagic Fisheries FMP bans all gill-net fishing in the EEZ except by special permit. Public testimony against the permit was considerable, ranging from environmentalist concerns for the potential impact of the gear on marine mammals and seabirds, through sports fishing concerns about the impact of the gear on blue marlin, to commercial fishing operators worried about gear conflict and entanglements.

AUSTRALIA EXPORTS JET BOATS

(Source: *Fishing News International*)

Jet powered fishing vessels are being sold by a West Australian boatbuilder to New Zealand, the country which pioneered and brought them to a high stage of development. They were originally used to run the rapids in New Zealand's fast flowing rivers, being later adapted for use by Australia's commercial fishermen. The jet boats' speed and shallow draft allows them to manoeuvre over reefs and shallows where conventionally-powered craft cannot venture.

Jet power has been well established in West Australia's Abrolhos rock lobster fishery for many years and now its offshore fishing potential is being recognised by commercial operations around both Australia and New Zealand.



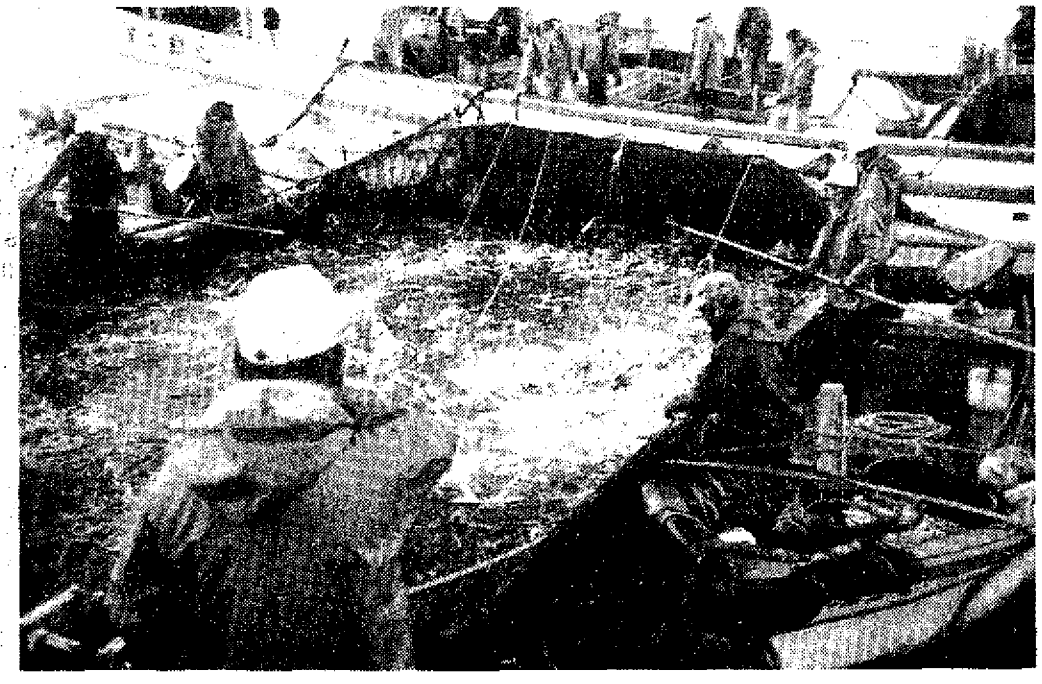
Jet power enables the 10 m *Mistic* to turn in her own length and to stop sharply.

JAPANESE SET NET FISHERY IS A GROWING INDUSTRY

(Source: *Fishing News International*)

It was 5.25 am as the 20 m long *Buri Maru No. 1* set out in the pre-dawn darkness with her smaller, 30 t capacity sister vessel to harvest two large set nets anchored some 4 km off the coast of Japan. After an hour had elapsed our sister vessel left the grounds to return to port full of harvested skipper, horse mackerel, sardines, puffer, filefish and other species, while we followed on, also with full holds, an hour later.

The fishermen's two hours of labour that morning yielded 50 t of fish valued at about 1.7 million yen (US$ 10 500). Mr Motoyshi, Executive Director of the Kamogawa Fishermen's Co-operative in the Chiba prefecture, explained that most of the morning harvests at that time were composed of low-value species, and that with the yellowtail season income would increase still further.

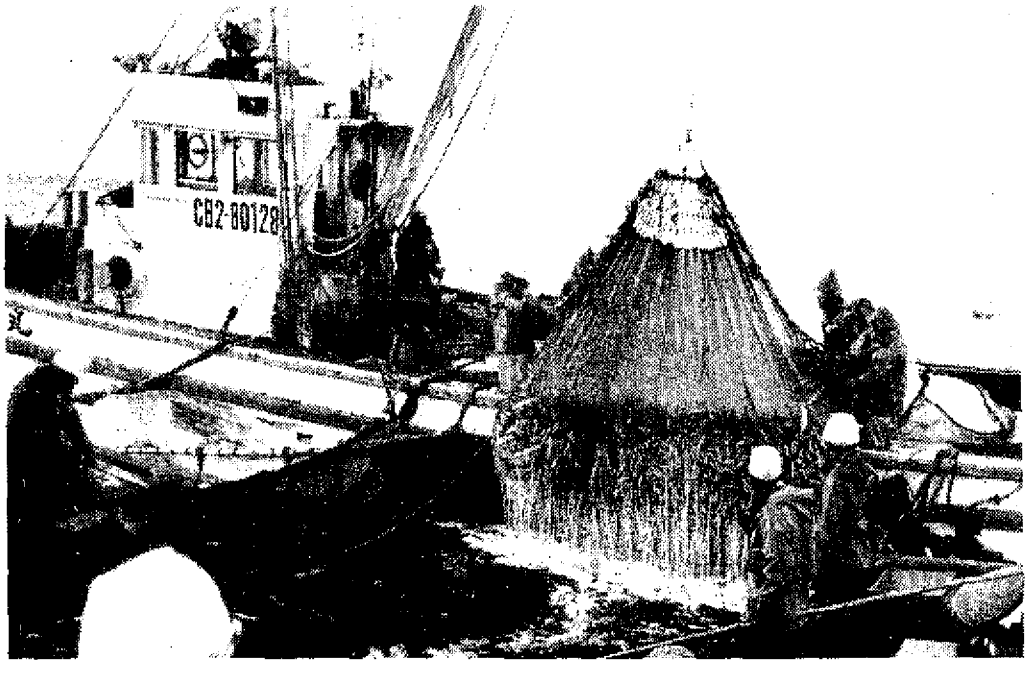


A set net is narrowed up to harvest fish from the last compartment. Kamogawa Fishermen's Co-operative's set nets are 480 m long by 50 m deep, and 400 m long by 35 m deep.

Set net fishing in Japan is effective because of its low operational costs and the fact that the fish caught and delivered to market are fresher and of better quality than those harvested by any other fishing method, including gillnetting. Although pound or set netting has a several hundred year history in Japan, the introduction of stronger synthetic twines and other improvements over the last 15 years has resulted in this fishing method spreading nationwide. There are now said to be around 5 000 set net fish traps deployed around the coast of Japan.

The set net fishery has become a significant market for Japan's manufacturers of fishing nets, but if nets are set without good knowledge of the fishes' migration routes and behaviour, and knowledge of tidal streams, including their power and violence in a typhoon, the investment will be wasted.

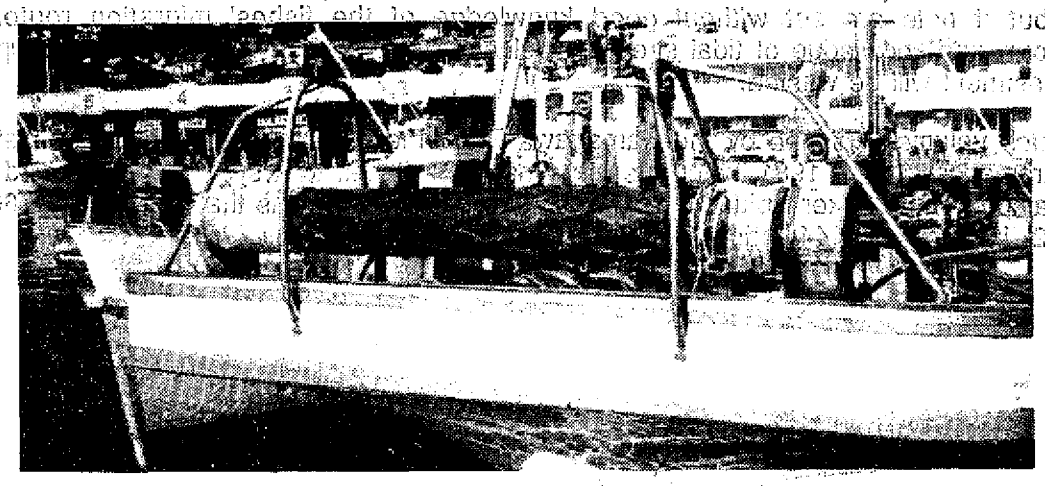
The catch volume achieved by the Kamogawa Fishermens' Co-operative from set nets has risen dramatically since 1981, when the organisation switched to a system devised and made by a Japanese net maker Hokuriku Seimo Co Ltd. From 2 705 tons that year and 2 560 tons in 1982, it rose to 5 044 tons in 1985.



Fish being scooped up from the set net with a brailer

Mr Motoyoshi is said to be well satisfied with the nets supplied by Hokuriku Seimo, despite the substantial initial investment of 300 million yen. Results have been better than he expected and the new set nets paid for themselves in a few years. The Co-operative's present gross annual income of several hundred million yen (over US$ 3 million) is much more than that achieved before 1981.

Hokuriku Seimo - known as 'Hokumo' for short - has become Japan's top set net maker, having supplied more than half of the country's set nets in current operation. Hokumo carries out continuous studies in an attempt to harvest more fish with less running costs. The firm has field laboratories and is able to test and check its set net systems under real conditions instead of basing its designs on desk calculations and former experiences only.



A special Japanese-designed vessel for deploying set nets

Set net fishing is presently the only buoyant fishery sector in Japan. Hukumo says it is confident of its ability to develop its set net systems successfully in any fishing area worldwide.

Further information from; Hokuriko Seimo Co Ltd, 8-4 Sumiyoshi-cho, Shinjuku-ku, Tokyo, Japan.

ABSTRACTS

SURVEY OF POTENTIALLY IMPORTANT ECONOMIC SEAWEEDS IN YAP LAGOON, MICRONESIA, by Roy T. Tsuda, Stephen G. Nelson, Valerie J. Paul and Katheryn L. van Altstyne, 1987. 16 pp.

A survey of potentially important economic seaweeds in Yap Lagoon, Micronesia, conducted from 23-28 November, 1986, revealed the abundance of two species of *Gracilaria* inhabiting the nearshore seagrass beds. *Gracilaria salicornia* and *Gracilaria* sp. were abundant on both the west and southeast coasts. Laboratory analyses of the agar found in these two species showed low yields from less than 1% to 10% (without NaOH pretreatment) and low gel strengths of less than 160 g cm. There is, however, a potential of marketing *Gracilaria* spp as a fresh vegetable in Guam, if farming in the seagrass beds or ponds can be developed.

Contact address: Marine Laboratory, University of Guam, Mangilao, Guam 96923.

STATIC FISHING AROUND FISH AGGREGATING DEVICES (FADS) AND OFFSHORE BANKS IN AMERICAN SAMOA

by

Michael Crook
Leilani Enterprises, Inc
Pago Pago, American Samoa

This work was carried out as part of Pacific Fisheries Development Foundation Project No 44a.

Experimental static handline fishing around FADs was first attempted in American Samoa in 1978-9 by Pat Brian who was associated with the first generation of FADs to be deployed here. No formal reports or records were made describing the gear, techniques or catch, but word-of-mouth reports indicate that this work was mildly successful. The most recent generation of FADs was deployed in late 1984 following a period of over a year where there were no buoys at all. During this period trolling had become nearly unprofitable due to rising fuel costs and the increasing scarcity of fish, often attributed to the influx of tuna superseiners to this area. Now the buoys have brought the fish but trolling can still be uneconomical when the fish are either not feeding on the surface or not biting on artificial lures, which is often the case in very calm weather or during mid-day hours. The purpose of this programme was to investigate the feasibility of static fishing for the pelagic species usually caught by trolling around FADs and offshore banks e.g. yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*), skipjack (*Katsuwonus pelamis*), wahoo (*Acanthocybium solandri*) and dolphin fish (*Coryphaena hippurus*).

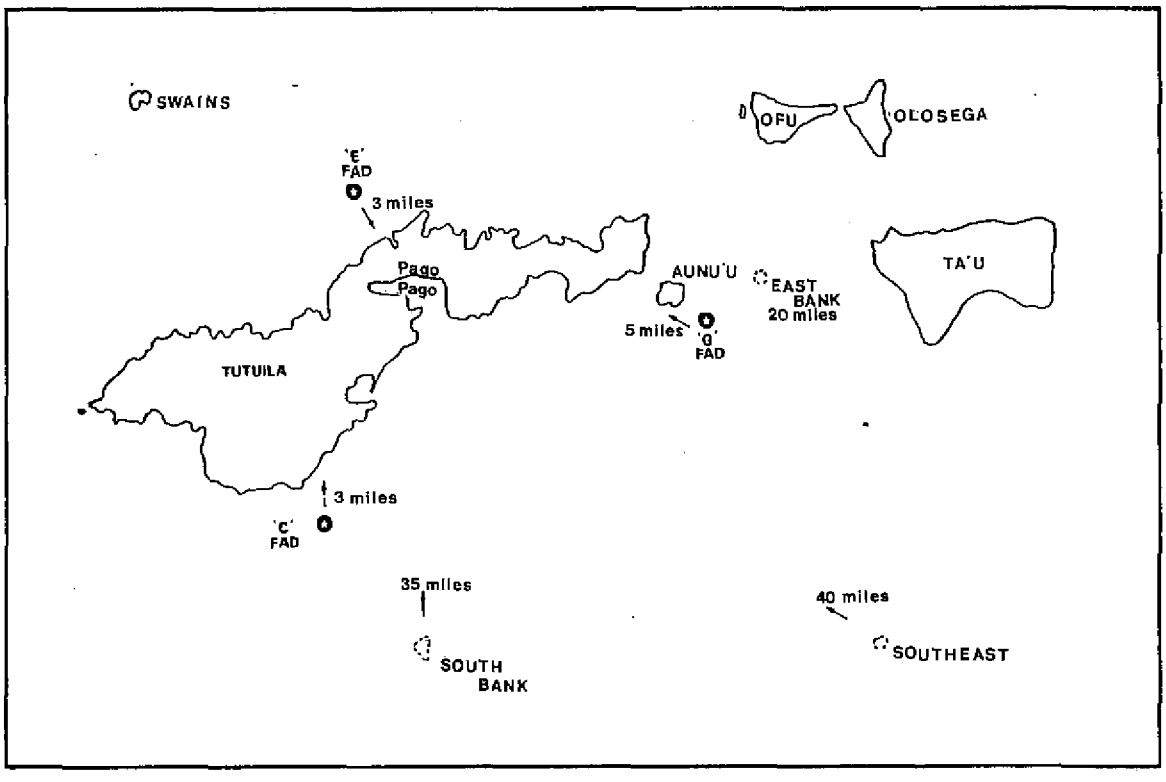


Figure 1: Tutuila Island, American Samoa, showing FAD position and areas fished

Methods and materials

The sixteen trips made between December 1984 and April 1985 were aboard the 40 ft. diesel powered *Leilani* and were made irrespective of moon phase or time of day. The initial trips were mainly to FAD C and also to G and E (Figure 1) and were unsuccessful. These buoys had only recently been deployed at this time and there was no evidence of fish on the surface or marks on the recording fathometer (echo sounder). By early February a school of small yellowfin tuna moved in on FAD C and soon thereafter both C and G had resident tuna schools in their respective areas.

Hawaiian fisherman Mr Alika Cooper was contracted to assist us with the static fishing and the gear he brought with him was for a technique known in Hawaii as 'palu ahi'. Chumming is essential for static hook and line types of fishing and the advantage of the palu ahi gear is that it lets the fishermen chum at the precise depth he wants to present his bait.

The entire handline gear consisted of 100 fathoms of braided dacron line of approximately 300 lb breaking strength. This line was marked by tying in swivels every 10 fathoms for the first 50 fathoms and stored in a large bucket or basket. The carefully marked lines allow different lines to be fished at the same depths once the fish are located. Mr Cooper indicated that all lines were to be always set at the same depth so that the chumming effect would be cumulative rather than dispersed over differing depths.

Terminal gear consists of a flattened lead weight of 1.5-3 lb. tied to a swivel. The line connecting the weight to the swivel has one corner of a 10 in square of heavy cloth lashed to it (Figure 2). The main line is passed through the swivel and tied to a final swivel, and another swivel is tied to the end, to which the monofilament leader is attached. This allows the lead and 'handkerchief' to slide freely along the mainline. In this way, a hooked fish which suddenly takes off again once near the boat will not pull the lead back with it. This avoids possible injury to the fisherman, damage to the vessel or the breaking of the line. All leaders were of monofilament, either 250 lb or 400 lb breaking strength depending on the size of the fish. Monofilament saves time when sharks are hooked (as they usually bite through the monofilament). Leader length was usually set at 2 fathoms. Hooks used were either BKN #34 to #40 or Mustad tuna circle hooks #6 - #3. When smaller fish such as rainbow runner (*Elegatis bipinnulata*) were the primary catch, leaders as light as 150 lb with a #26 BKN hook were used.

Use of the gear is as follows:

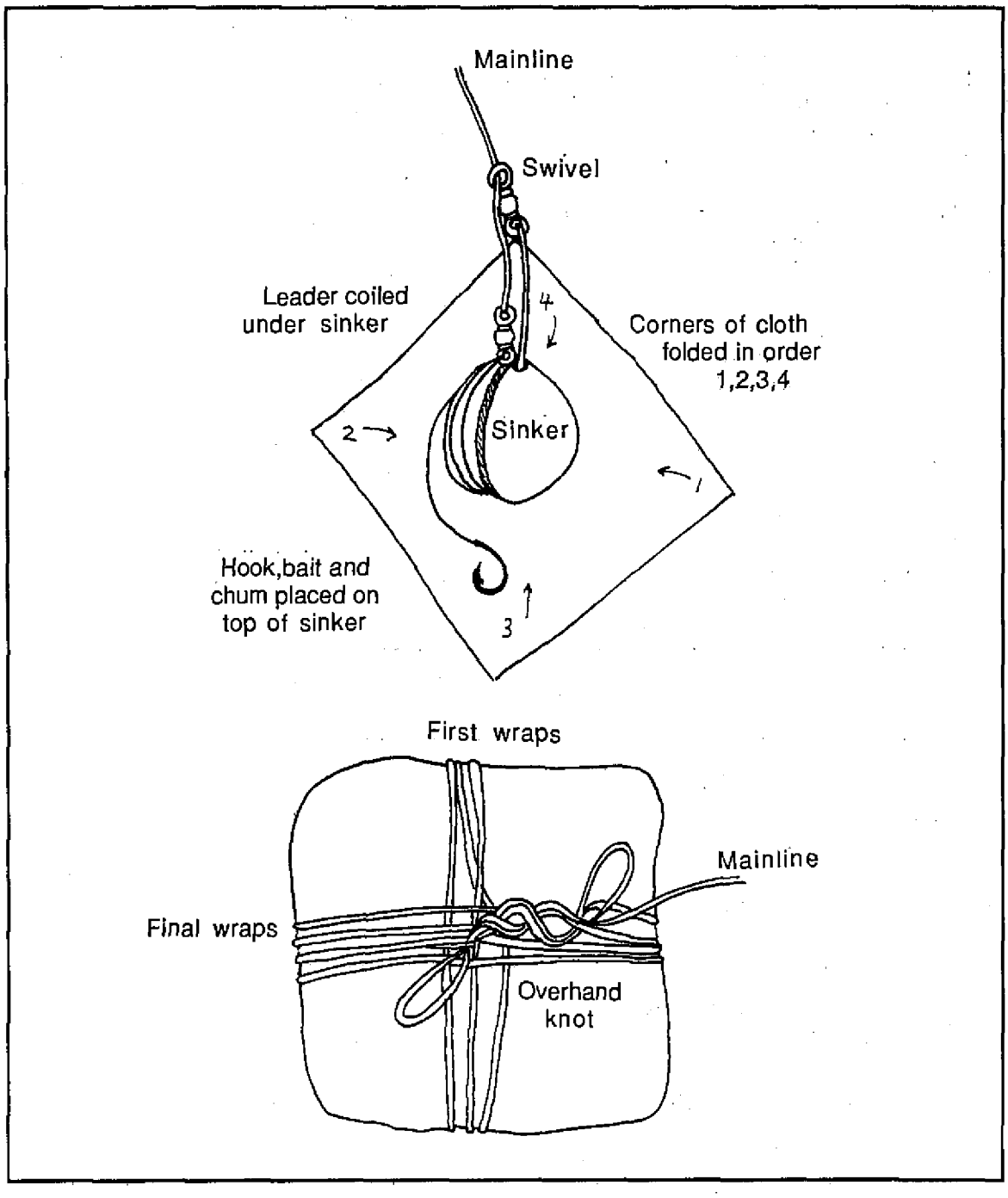
a) With the 'handkerchief' spread on a flat surface, coil the leader and place it in the centre, then put the lead on top.

b) Place a handful of chum (chopped skipjack, squid, etc.) on top of the lead.

c) Fold the corners over the chum with the connected corner being last.

d) Wrap the mainline around the bundle 3 times, then turn the bundle 90° and wrap 3 more times at right angles to the first wraps. On the third wrap loop the line around the index finger and go back 3 wraps in the opposite direction.

e) Do a double overhand knot with the index finger loop and the main line.



Palu ahi gear arrangement

The bundle is then dropped overboard and *must* fall freely until the desired depth is reached (by counting swivels). A sharp pull at this time will cause the knot to slip, unravelling the bundle and dispersing both the chum and the baited hook.

The gear for night fishing is somewhat different than that just described. Chumming was not recommended for night use by Mr Cooper. Instead a waterproofed 25-50 watt light was lowered 1-2 fathoms below the boat to attract squid and other baitfish, which were supposed in turn to attract larger fish. The flat lead and handkerchief were replaced with a 'banana' sinker made from a 12 in length of copper tubing (1/2 in diameter) filled with lead, with a length of 400 lb wire running through it with heavy stainless swivels at both ends. The banana shape of the sinkers is to keep them from rolling on the deck.

Baitfish most often attracted to the light were 'akule' (*Selar crumenopthalmus*). These were easily caught on standard akule gear, which comprised about 10 fathoms of 25 lb monofilament wound on a small reel with a 2 oz. sinker tied to the end, and rigged with 3 to 6 akule flies on branch loops spaced at 8 in to 12 in intervals, starting at 8 in above the weight. Hooked live, through the back, these fish are considered prime bait for the large tunas. Other baits used were skipjack tuna, frozen squid and Japanese longline bait (saury).

An additional surface line consisting of a 6-10 ft leader (250 lb) buoyed by a small float and attached to 1/4 in polypropylene cord, was allowed to drift 50 or more yards from the boat then tied off with 50 lb monofilament which would break away when the main line was struck.

For the FAD trips, the boat was tied directly to the FAD if the fish were observed to be staying close to it near the surface or if the fathometer marked them close to it at depth. A sea-anchor was deployed if they were located farther off. When a fish was hooked and boated it was immediately killed by a blow to the head and then bled, by tearing loose the gills if small (under 25 lb), or by an incision between the pectoral fin and lateral line if larger.

Results and discussion

Information and data concerning fishing dates, locations fished, fishing depths, bait used etc. are given in the table.

Trip date	Location	Bait	Depths fished Fathoms (m)	Time	Species Caught/ Weight
1/22/85	C FAD	Skipjack Sama	20-30 fathoms	0800-1500	6 Yellowfin -120 lbs
1/23	C FAD	Skipjack Sama Live trevally	40 (77) 40 (77) 10 (18)	1700-1900 1700-1900 1900-0700	2 Sharks 2 sharks 1 Shark 1 Yellowfin - 20 lbs
1/29	Rose Atoll	Skipjack	40-50 (72-90)	0700-1000	4 Yellowfin- 12-23 lbs 2 Dogtooth Tuna- 20 &85 lbs
2/7	C FAD	Skipjack	40 (72)	1630-1900	2 Sharks 2 Yellowfin - 35 & 46 lbs
		Live akule	10 (18)	1900-0100	No catch recorded
2/15	C FAD	Skipjack	40 (72)	0800-1500	2 Sharks 2 Yellowfin - 37 & 42 lbs
2/24	East Bank	Skipjack	40 (72)	1400-1900	1 Dogtooth Tuna - 155 lbs 1 Shark
			10 (18)	1900-0000	2 Sharks
3/5&6	South-east Bank	Skipjack Frozen squid	20-40 (36-72) 20-40 (36-72)		7 Shark 7 sharks
3/21	South-east Bank	Skipjack	30-40 (36-72) 10 (18)	1500-1900 1900-0100	5 Yellowfin - 110 lbs 2 Rainbow Runners - 6 lbs 1 Shark
4/8	South-east Bank	Skipjack &	10-30 (18-54) 10 (18)	1400-1900 1900-2300	12 Rainbow Runners - 80 lbs 5 Triggerfish - 9 lbs 1 Shark
4/21	South Bank	Akule	30 (54)	0800-1800	5 Yellowfin - 12 lbs 3 Dogtooth Tuna - 59 lbs 2 Sharks
4/25	C FAD	Akule	30 (54)	1200-1700	3 Rainbow Runners - 35 lbs 2 Yellowfin - 20 lbs
5/1	C FAD	Akule	10-40 (18-72)	1000-1400	1 Skipjack- 6 lbs

The first basic conclusion that can be drawn from the data is that this type of fishing was only slightly successful here as catch per trip rarely exceeded 200 lb. A major problem whether fishing at the FADs or off the banks is that of sharks. The extent of this problem is not always reflected in the data because sharks lost by biting through leaders are not counted. Sharks quickly learn to associate the presence of boats with a free meal; large amounts of chum in the water increase the problem many times over. It was our repeated experience to begin fishing and strike a couple of fish, only to have sharks move into the area, disperse the fish and ruin the fishing. With the market value of shark being nearly zero, as well as the market value of tuna falling due to the number of boats trolling the FADs, it is not feasible to embark on a shark extermination programme unless many boats are participating. The problem here is that most of the boats fishing the FADs are trolling and are not troubled by sharks, since they are continually moving around the area striking their fish at different spots, and of course not chumming. When sharks are a problem while trolling, they can be dealt with quickly and cheaply by using a disposable 1 gallon plastic container with a wire leader and hook, several of which can be tossed overboard when sharks are taking hooked fish on the surface.

However, the main problem with developing a static fishery further is the market potential of the catch. At this time trolling boats are landing a surplus of yellowfin and skipjack tuna. In the past months average wholesale/retail prices for yellowfin have dropped from US$ 1.50 per pound to US$ 0.90-1.00/lb. With a limited retail market (mainly due to large amounts of 'black market' fish coming from the local tuna canneries and only one restaurant that buys fresh sashimi quality tuna) there is little room for this fishery to expand. Early in the programme we were hopeful of being able to export fresh tuna to the United Fishing Agency (UFA) auction block in Hawaii, as some of us have been successfully doing with bottom fish for nearly three years now. The problem here has been that UFA reps have strongly advised us to set 60 lb as a minimum size for fish we export; smaller fish will have a lower oil/fat content in their flesh and thus bring a low price. Another problem with exporting tuna is the problem of 'burning', a discolouration and loss of texture in the meat of some tuna caused by metabolic body heat generated during capture, resulting in a very low market value. At present we have no way of testing a fish for 'burn' until it is quartered for sale on the auction block.

With these considerations in mind we shifted the emphasis of our static fishing to offshore banks where tuna, wahoo and other species are frequently seen in the areas we normally bottom fish. We found that setting our palu ahi lines at 10-40 fathoms while we bottom fished for snapper in 100-150 fathoms was productive in two ways. Firstly, it enhanced our bottom catch with a variety of miscellaneous fish, including some not usually caught around the FADs, such as rainbow runner and dogtooth tuna (*Gymnosarda unicolor*). Secondly, the lines serve as 'alarms' for the presence of sharks under the boat, before we start losing valuable bottom fish to them.

The data also indicate that night-time fishing efforts were unsuccessful. It was finally concluded that the fish were leaving the vicinity of the FAD at night. On three of the trips fish were either caught or observed near the FAD in the evening, while subsequent fishing at night brought only sharks, with no marks being recorded on the fathometer. Large schools of akule came to the light on these occasions and made excellent live bait, yet brought no strikes other than sharks. Efforts to locate schools on the fathometer in the vicinity of the FAD were also unsuccessful.

Conclusions

Although the trials of the palu-ahi method of fishing for tuna and other species indicates that it can be more productive or economical than trolling, it should not be concluded that this is always the way to approach fishing the FADs. This is evidenced by our final trip where 2 hours of trolling around FAD C produced nearly 350 lb of dolphinfish and yellowfin while the 3.5 hrs of static fishing produced one 5 lb skipjack. Along with the problems discussed previously, especially that of marketing, I feel that at present in American Samoa palu ahi fishing around the FADs is a useful but limited alternative to trolling, and one which can also enhance bottomfish catches while anchored on offshore banks.

A FIBREGLASS VERSION OF THE KIR-2 SAILING CANOE

by

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In recent years the 7.3 m KIR-2 plywood sailing canoe (Figure 1) designed by O. Gulbrandsen and constructed under the supervision of M. Savins in Tarawa has become popular in several Pacific Island countries.

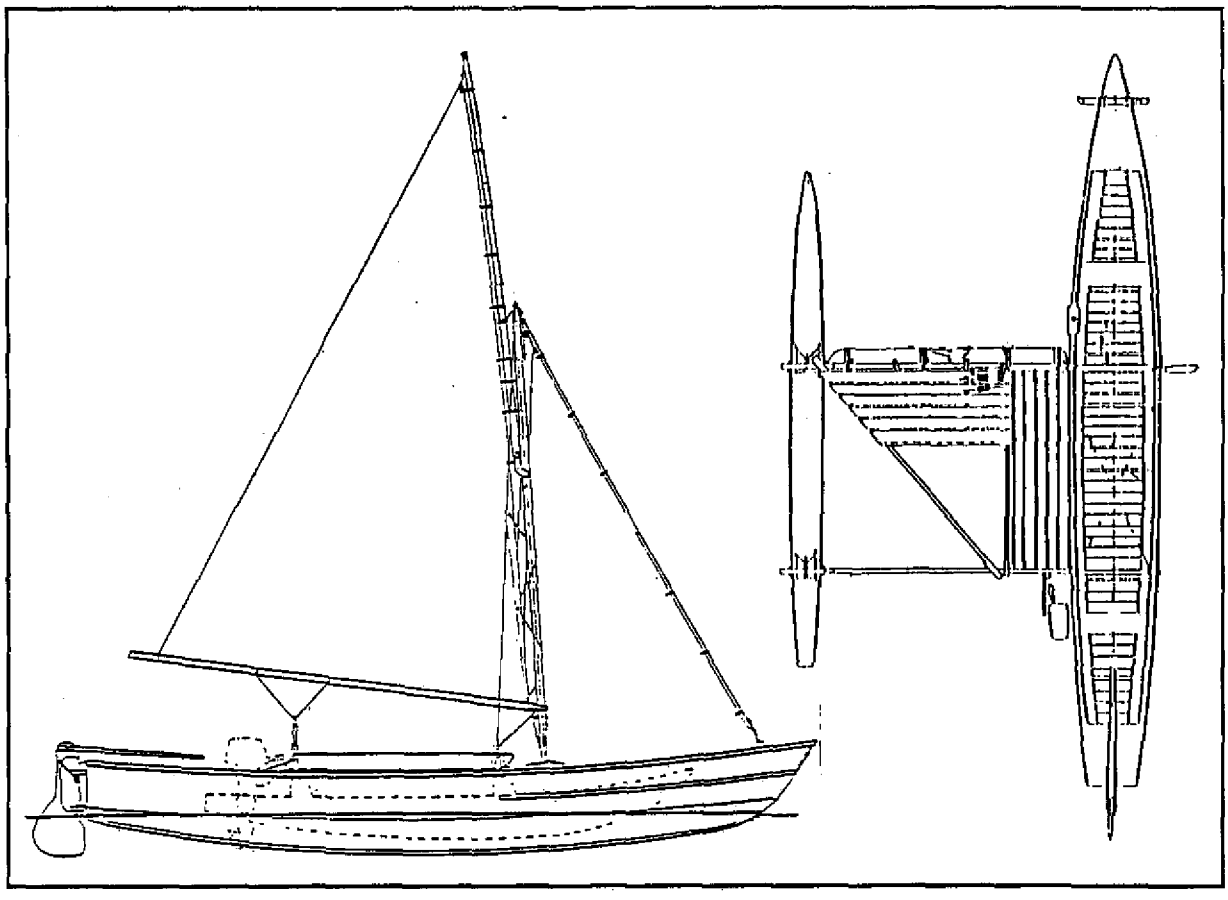

Figure 1: The KIR-2 sailing canoe

I decided to obtain one for my personal use in order to be able to speak with conviction about the positive and negative aspects of the design. Living in Suva, a location with several boatbuilding firms, I thought it would be easy to find someone to build the plywood canoe. It wasn't. Suva's leading builder of wooden boats quoted a price over four times the Tarawa cost and smaller builders were not interested in the job. Finally, one firm agreed to undertake the project but kept it on the 'back burner' for over five months.

At the beginning, the plan was to build a KIR-2 canoe which would, as closely as possible, resemble the craft presently in use in Tarawa and elsewhere. The offer by a reliable local fibreglass shop to build the boat out of fibreglass caused me to reconsider the original plan. Why not try a new material which, in some Pacific Island situations, may be more appropriate than plywood?

To start the construction, a wooden jig (temporary frame) was constructed (Figure 2) and sheets of 6 mm Divinycell foam were stapled to it (Figure 3). Seams between the foam sheets were filled (Figure 4) and faired. Over this surface (eventually to become the outside of the hull) three layers of fibreglass cloth (300 g and 450 g chopped strand mat, 330 g woven cloth) were laid. The structure was then removed from the jig, turned over and glassed on the inside (two layers of 300 g chopped strand mat, and one layer of 450 g roving). Departures from the original plywood design included a completely sealed stern section and floor area, reinforcement of the hull in the area of the outrigger support attachments, extension of the foredeck further aft, and the use of a fibreglassed solid foam outrigger float. The canoe's standing rigging was as specified in the original plans. With the exception of the mainsheet, all running rigging was either longline cord or braided fishing line.

The cost of the first fibreglass KIR-2 was considerably increased by the necessity to construct a jig, but this could be re-used in the future. Tradewinds Marine Ltd (Box 3084, Lami, Fiji) estimates that the cost of a subsequent canoe (completely rigged, with sails, without outboard engine) would be approximately US$ 4 000. Alternatively, the company would be willing to produce just the main hull and outrigger float for about US$ 2 700.

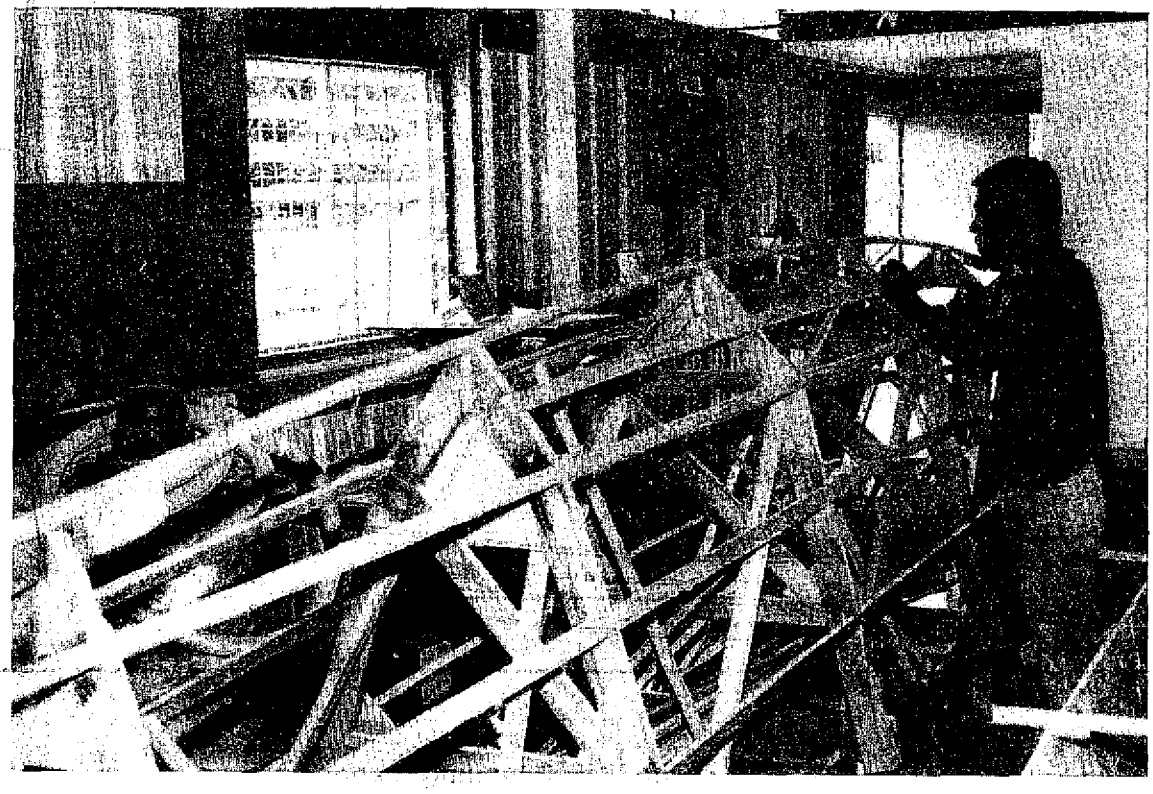

Figure 2 : The wooden jig

Figure 3: Stapling Divinycell foam to the jig

Figure 4: Filling the seams

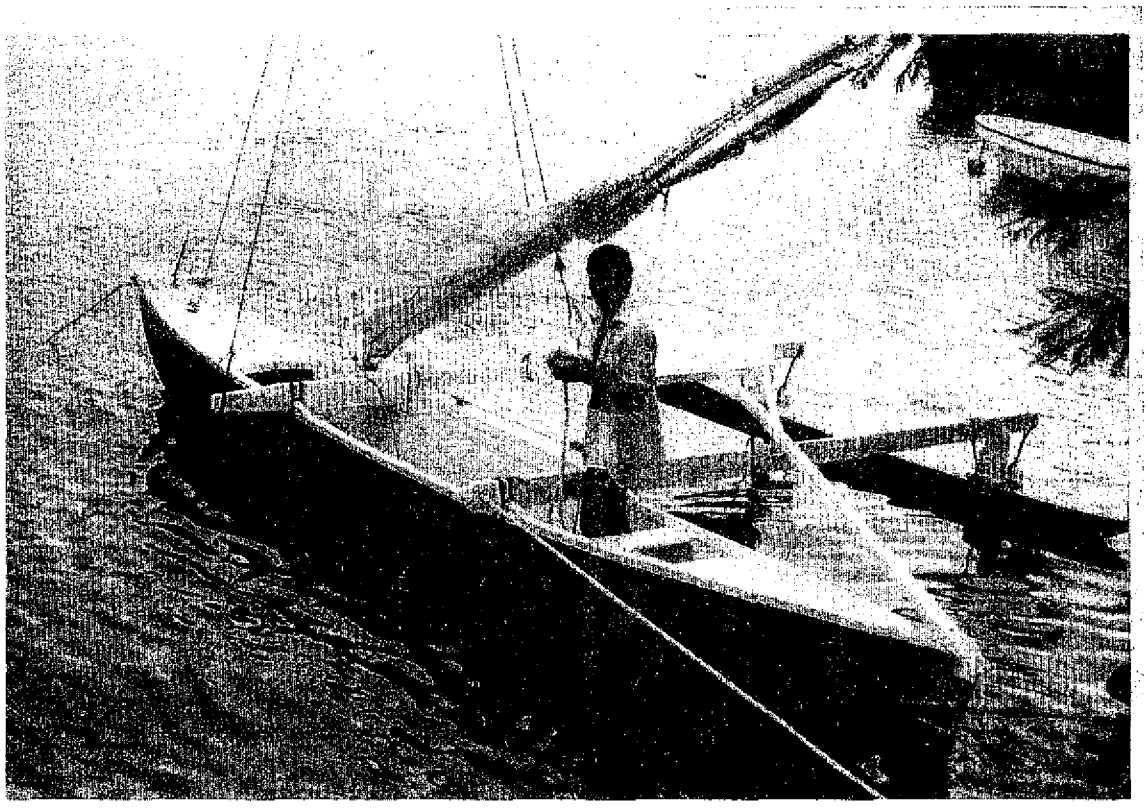

Figure 5: The finished fibreglass KIR-2

The finished product (Figure 5) was launched in September. Judging from the level at which it floats in the water, the main hull of the fibreglass canoe is somewhat lighter than its wooden counterpart. The glassed outrigger float behaves about the same. The relative sailing performance of the two canoes remains to be tested. However, due to its weight advantage, I suspect the glass version will prove to be faster.

My first serious trials of the canoe took place on 23 December, 1986 when a friend and I departed the Tradewinds Anchorage near Suva on a 5 day trip over the long Christmas weekend to Savu Savu on Vanua Levu in the north. The trip was to consist of a series of five 20-mile segments: Suva-Toberua, Toberua-Levuka, Levuka-Makogai, Makogai-Namena, and Namena-Savusavu.

I had been sceptical of the value of reefing such a small sail. My first lesson on the trip was to learn how wrong I was. With a wind of about 18 knots, it was difficult to beat to weather even inside the lagoon. The next day, in stronger winds and choppier conditions, a double-reefed main made a 4.3 mile beat to weather easier, drier and faster. We entered the Rewa river and motored for the next three hours. A newly-constructed bridge necessitated pulling down the mast. We were able to take it down and put it up again in less than five minutes.

As much as possible, we motor-sailed in the river, but it is doubtful if the sails increased the speed much, due to the winding nature of the river course. At about 17.30 hours we popped out of the river and spotted Toberua Island. The Island was reached after an hour of sailing on the starboard tack (outrigger to leeward). I suspect that the canoe makes less leeway on a port tack.

We arrived at the Island, and had a 'Toberua cocktail' and dinner courtesy of the resort Manager, Mike Dennis. Both Mike and the manager of Namena Island Resort are interested in the purchase of KIR-2 type canoes for the use of their hotel guests. We were offered accommodation ashore, but I declined as I wanted to see how it would be to sleep on the canoe. The platform was great to sleep on until the rain started. On future trips I will drag the canoe up on the beach, drape a canvas tarpaulin over the outrigger platform, and sleep on the sand between the main hull and outrigger float.

When we woke in the morning, the wind had increased considerably to about 25 knots. We took some of the hotel staff out for a sail. I was surprised at how the canoe handled considering all the weight. With five people, outboard, fuel, and lots of gear, I estimate there was the equivalent of seven men. On the port tack the boat was noticeably slower, but the extra weight in the main hull on the starboard tack resulted in a better performance than with just two people. Our plan was to reach Levuka on this day, but the depression hanging around the north was upgraded to cyclone 'Rajah'. Winds of up to 60 knots were forecast for nearby Taveuni Island. We quickly decided to return to Suva.

Motoring through the Rewa River was uneventful. When we came out into Laucala Bay, the wind was blowing approximately 30 knots. At this point I decided to push the canoe to the limit as I would much rather something failed in this sandy, near-shore area than hopelessly offshore. I should stress that these were probably more extreme conditions than a fishermen would ever subject his canoe to.

We shook out both reefs in the main and took off with the wind slightly aft of the beam on a port tack (outrigger to weather). The gaff was whipping around, but I recalled Oyvind Gulbrandsen a few days earlier saying not to worry about breaking it. As the fetch of the wind increased, the gaff was really doing a 'wet noodle' act. I soon became painfully aware that it would be very difficult if not impossible to reef the sail in these full-battle conditions - do it before departure or not at all.

With the wind and about 3 ft of following wind chop, the canoe was really scooting along - easily the fastest I have ever gone under sail. The outrigger beams, which I originally felt were the weakest component of the canoe, were not working that badly despite the roller-coaster action of surfing down the backs of waves and crashing into the troughs. At this point I was most worried about the rudder-tiller connection. Extreme weather helm alternated with slight lee helm and made for considerable pressure on the aft end of the tiller. On one especially spectacular slough to weather I was really concerned that I was going to actually break the tiller off. I promised myself that I would beef up this component upon return to Suva. I have since decided to fabricate a 'U'-shaped fitting which will extend down one side of the tiller, across the aft end, and back up the other side.

The other main area of concern was the amount of water coming on board. Waves hit the port side of the main hull forward of the mast and sometimes dumped as much as 20 gallons in the section just aft of the deck. The bow section of my canoe has been modified to extend decking much further aft than the original design. However, I feel that it is still in need of modification. My second promise to myself on return to Suva was to correct this situation. I feel the best remedy would be to have a heavy canvas cover made so that it could be tightly stretched and lashed to cover the area from the outrigger beam forward to the breakwater on the bow decking. This would not be entirely watertight, but would keep out most of the water.

I timed the dash across Laucala Bay precisely. From the mouth of the Rewa to the seaward end of the USP breakwater is 4.3 nautical miles. We covered the distance in 22 minutes for an average speed of 11.7 knots. It should be noted that this average includes 3 periods of luffing to bail out accumulated water.

In summary, the performance of the canoe in such full-battle conditions was pleasing. I now have a fair deal of confidence in the seaworthiness of the craft.

EEL FISHING - PILOT PROJECT IN SOLOMON ISLANDS

by

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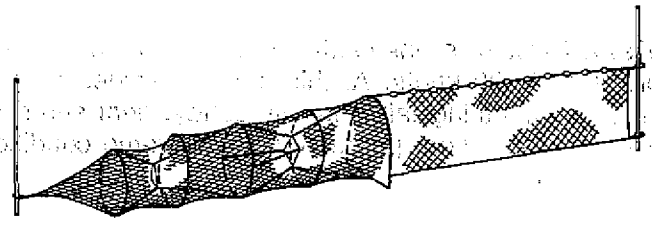
River fisheries have not attained much importance in Solomon Islands. Freshwater prawns (*Macrobrachium* spp.) are caught for sale in a few streams near the capital, Honiara. Elsewhere there is only sporadic subsistence fishing, spear and hook-and-line being the main methods.



A typical fyke net design

In March 1986, a villager from a hamlet in North East Guadalcanal approached the Fisheries Department for assistance in exploiting the eel resources of a small creek on his land. A preliminary trial of eel fyke nets carried out by Fisheries staff seemed promising. One fyke net was therefore left with the villagers, on condition that they recorded their catches. These exceeded expectations: in 21 overnight sets during the period April-June (the end of the rainy season), a mean catch rate of 25 kg per night was obtained. The eels were predominantly *Anguilla bicolor*, with a few specimens of *Anguilla obscura*. The mean individual weight was 0.7 kg.

The holding pond

Later in the year, small creeks in the swamp forest became unfishable due to low water levels. Fyke nets were then used in the larger, fast-flowing rivers. These trials proved less productive, but yielded the larger species *Anguilla marmorata*.

Enquiries in Honiara revealed a demand for freshwater eels from several restaurants and a food processor (for smoking). One problem was that the road from the fishing area fords two large rivers. After rain, when the best catches can be expected, these rivers are impassable. It was therefore necessary to make a holding pond near the village. An earth-walled pond lined with 200 micron polythene sheet,and measuring 6 m by 2 m was constructed. It is filled by hand pump from a shallow well, and the water level can be controlled by an L-shaped drain pipe. The pond has proved satisfactory for holding up to 75 kg of eels for several days. These can be transported live to Honiara in wet copra sacks.

Villagers display their eel catch

The pilot project has stimulated considerable interest among villagers in the surrounding area. An imported fyke net costs SI$ 170 (but nets could probably be made up more cheaply in the Solomon Islands). With eels fetching SI$ 2/kg for the fisherman, this capital outlay can obviously be recovered in a matter of days.

Future development is likely to be limited by the size of the market, although outlets such as direct sales to the public have yet to be investigated. At the very least, the technique can be expected to increase the supply of fish protein for inland villages which do not have access to the country's marine resources.