SOUTH PACIFIC COMMISSION

FISHERIES NEWSLETTER

NUMBER 44
JANUARY - MARCH 1988

Contents

Original text : English

B.P. D5, NOUMEA CEDEX, New Caledonia - Telephone: 26.20.00 - Cable: SOUTHPACOM NOUMEA - Telex: 3139NM SOPACOM - Fax: (687) 26.38.18

SPC ACTIVITIES

DEEP SEA FISHERIES DEVELOPMENT PROJECT NOTES

Pago Pago - American Samoa

In response to reports by local fishermen that deep-bottom fish catches around Tutuila are in decline, and the fact that some fishermen now regularly venture up to 65 km offshore to fish outlying banks, the American Samoa Office of Marine and Wildlife Resources (OMWR) is actively seeking to encourage diversification of fishing effort. To this end the Government of American Samoa requested the assistance of SPC in developing effective techniques for capturing the large, deep-swimming tunas that are commonly associated with FADS. The Territory has four FADS in place around Tutuila.

In response, the DSFD Project's second visit to the Territory commenced on 3 February, under the supervision of Master Fisherman Archie Moana.

After familiarising himself with the local fishing scene and inspecting the FADS, Archie concentrated on surveying the availability of locally occurring baitfish, including flying fish, big-eye scad and mackerel tuna.

Developing effective means of capturing suitable local baitfish will be an important component of successful FAD fishing trials. Archie has already demonstrated that flying fish can be taken around Tutuila at night, using lights and scoop nets, and has also captured good numbers of big-eye scad around the FADS by jigging with small feather lures.

By mid-February Archie had rigged several vertical longlines from heavy monofilament nylon and on the first set a 20 kg albacore tuna *(Thunnus alalunga)* was taken. The attractiveness of the gear and bait was demonstrated soon after when large tuna broke both of the vertical longlines and carried them away. At the moment Archie is busy rigging heavier gear.

Palau - Republic of Belau

The Project's stay in Palau (*see SPC Fisheries Newsletter* # 43) continued in the new year with Master Fisherman Lindsay Chapman surveying deep-bottom fishing grounds along the western reefs. The areas fished included a submerged reef between Angaur and Peleliu islands, the reef-slope off the Ngemelis islands in the south-west, and the western reef-slope off Ngaraard State in the north.

Catches from these areas were only fair. Fishing was hampered by persistently strong and changeable currents and several mechanical failures of the fishing vessel. The best catches were taken in Peleliu State, 93.6 kg of bottom species being taken in 8 hours of fishing with three handreels at depth between 90 and 200 m. The most commonly taken species in this area was the gold-tailed jobfish *(Pristipomoides auricilla)*.

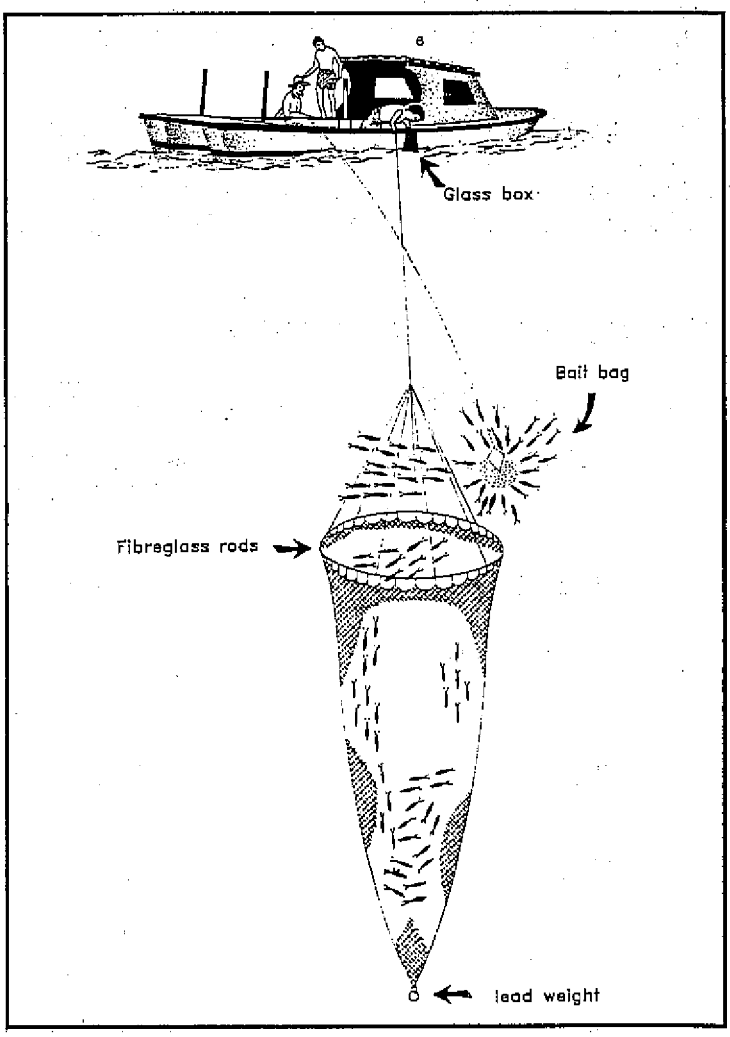
Lindsay is still awaiting the arrival of more powerful echo-sounding equipment, to be used in searching for new fishing grounds, and for permission from traditional leaders in the northern states to fish waters surveyed during the previous DSFD Project visit in 1983, in order to gather comparative catch data.

Yap - Federated States of Micronesia

Lindsay took time out from his Palau assignment to travel to Yap at the direction of SPC, in order to review recent developments in fisheries there, and to assess local needs for a proposed DSFD Project visit. While in Yap he inspected the new Yap Fishing Authority complex at Kolonia. His report of that visit begins on page 31 of this issue.

Tonga - Gear development sub-project

Master Fisherman Paul Mead, supervising the gear development sub-project in Vava'u, has recently been experimenting with the use of an Hawaiian-style hoop net in the hope of capturing mackerel scad, or 'opelu' *(Decapterus* spp.). These baitfishing trials were conducted with the co-operation of the FAO/UNDP Regional Fishery Support Programme, and with the participation of FAO/UNDP Fisheries Adviser, Bob Gillet, who had previously trialled this gear to good effect in Niue (see Gillet R., 1987. *Hawaiian-style* Decapterus *fishing trials in Niue.* Suva, Fiji. FAO/UNDP Regional Fishery Support Programme). The hoop net used had a circumference of 14 m, a fibreglass hoop at the mouth, six shroud lines and a hauling rope, and was used in conjunction with chumming from a weighted bag, as illustrated in the drawing below.



Hoop net arrangement and fishing technique
(from *Hawaiian-style* Decapterus *fishing trials in Niue*)

Although schools of opelu were observed on several occasions and responded to chumming, the fish were difficult to bunch together so that the net could be set to lift them from the water, and the trials were therefore not productive.

Paul also continued with the FAD monitoring and maintenance programme and recently deployed a shallow-water FAD in 82 m off Utungake — in an area where big-eye scad, or 'atule' *(Selar crumenophthalmus)* are regularly observed. Paul's aim, in both the hoop net trials and the shallow-water FAD deployment, is to develop effective techniques for gathering and capturing local baitfish in support of vertical longline fishing.

NEWS FROM IN AND AROUND THE REGION

FAO/UNDP SPONSORED PACIFIC ISLANDS FISHERIES CONSULTANCIES
(Source: R. Gillett - FAO/UNDP)

In the April-June 1986 issue of the *SPC Fisheries Newsletter*, consultancies sponsored by the FAO/UNDP Regional Fishery Support Programme were listed. The objective of the listing was to inform fishery workers of some of the specialised consultancy work being carried out in various countries. It was also hoped that other agencies and organisations would be encouraged to provide similar information.

In 1987, 35 consultancies and staff missions were carried out, either directly by FAO South Pacific fishery programmes or indirectly through regional organisations. The following table summarises this work. Reports of the regional missions are available from the FAO/UNDP office. Enquiries for country-specific reports should be made to the country concerned.

1. The FAO/UNDP Regional Fishery Support Programme

Area	Consultant/Staff	Work
Regional	Gulbrandsen/Savins	Comparative evaluation of artisanal Pacific Island fishing vessels
Regional	Vincent	Supervise refrigeration course
Regional	Wessel-Daae	Advise on export marketing and tuna by-product utilisation (funded in part by INFOFISH)
Regional	Crossland	Fisheries implications of seabed mapping (funded through FFA)
Regional	Medly	Identify appropriate analytical models for gauging economic impact of fishing fleets (funded through FFA)
Regional	Onorio	Advise USP on alternatives for future fisheries research and training (funded through FFA)
Regional	Fa'asili	Identify fisheries information needs (funded through FFA)

Cook Islands	Lewis	Review research activities, assist in developing resource profiles and management plans
FSM	Howell	Advise on fish handling and marketing
Kiribati	Gulbrandsen	Prepare plans for trolling skiff, modify plans for Kir canoes
Kiribati	Kida	Evaluate potential for local longlining (funded through FFA)
Marshall Islands	Vincent	Re-activate cold storage facilities
Marshall Islands	Evans	Advise on the structure and function of the Marshall Islands Maritime authority (funded through FFA)
Niue	Paulo/Gillett	*Decapterus* fishing trials using Hawaiian hoop net
Niue	Overa	Prepare plans for an enlarged Alia catamaran
Palau	Izumi	Compile fishery bibliography
Papua New Guinea	Savins	Assist in boatbuilding
Papua New Guinea	Gulbrandsen	Prepare plans for fishing canoes
Solomon islands	Stone	Advise on operation of pole/line fleet
Solomon islands	Vincent	Advise on pole/line refrigeration systems
Solomon islands	Gillett	Compile fishery bibliography
Solomon islands	Purcell	Instruct on the use of sail on fishing canoes
Solomon islands	Gulbrandsen	Prepare plans for fishing trimaran
Tokelau	Gillett	Trochus survey
Tonga	Munro	Evaluate research activities
Tonga	Izumi	Assist in Japanese Univ.research on seamounts
Tonga	Gulbrandsen	Modify plans for 8.8 metre fishing boat
Western Samoa	Gillett	Compile fishery bibliography
Vanuatu	Gillett	Compile fishery bibliography

2. The FAO/South Pacific Aquaculture Development Project

Area	Consultant/Staff	Work
Regional	Tikai	Participate in seaweed marketing study in the Philippines (in association with FFA)
Cook Islands	Kafuku and Ikenoue	Advise on feasibility of milkfish and mullet farming
Cook Islands	Stephenson	Study socio-economic aspects of proposed milkfish farming
Kiribati	Kafuku and Ikenoue	Formulate masterplan of aquaculture research and development especially concerning milkfish
Nauru	Kafuku and Ikenoue	Advise on feasibility of aquaculture potential and tilapia eradication
Tonga	Kafuku and Ikenoue	Formulate masterplan of aquaculture research and development
Tuvalu	Uan	Carry out seaweed farming trials

PACIFIC ISLANDS SEEK CHANGES IN JAPANESE FISHERIES POLICY

(Source: FFA/*Pacific Daily News/Marshall Islands Journal*)

The 16 member countries of the South Pacific Forum have been unsuccessful recently in their attempt to elicit from Japan a formal response to the proposal that negotiating procedures regarding Japanese fishing activities in the South Pacific be restructured.

The most important change sought by the group's Forum Fisheries Agency (FFA) is that Japan agree to negotiate fishing access agreements multilaterally, rather than with individual states as is the current practice.

The FFA says that some 600 Japanese vessels catch approximately 250 000 tonnes of fish annually in FFA member countries' waters, for which Japan pays about US$ 7 million (3%-3.5% of the total landed value), in the form of licensing fees, to countries with which it has agreements.

FFA members decided at a meeting held in Nauru in July, 1987 to invite Japan to conduct further fisheries negotiations multilaterally, with the aim of gaining negotiating power through the presentation of a united front. Revenues derived through agreements negotiated in this way would be shared by all FFA members, whether their waters were fished or not.

A further FFA meeting, held in Honiara, Solomon Islands in November 1987, expressed the members' disappointment that Japan had failed to respond formally to the invitation. However, an informal document by a senior Japanese fisheries adviser, which was presented at the meeting, outlined Japanese concerns at the difficulties Japan might encounter under a multilateral negotiating arrangement. This document was previously distributed to some members.

An FFA statement arising from the Honiara meeting said that the points raised in the Japanese paper were based on two major assumptions not shared by member countries:

1) The arrangement proposed would be the same in form and substance as the recently concluded multilateral fisheries treaty with the United States.

2) FFA member countries were seeking more aid from Japan.

'The meeting expressed deep disappointment that an informal view was distributed before any attempt was made to establish facts or enter into a meaningful dialogue which would be mutually beneficial to all who are involved,' the statement said.

'Japan has been fishing under bilateral arrangements with many FFA member countries, and in those circumstances has enjoyed longstanding ties with the region.'

The Honiara meeting concluded that fisheries resources are of vital importance to South Pacific countries, and that a constructive approach to their management through equitable treaties will serve as a firm and positive foundation for future relations.

KOSRAE OPENS FISH PROCESSING PLANT

(Source: Pacific Fisheries Development Foundation)

A US$ 250 000 small-scale fish processing plant commenced operation in Kosrae in February. The plant, the first of its kind to operate in the Federated States of Micronesia, will produce **namurabushi**, a popular food item in Japan. The product is essentially an alternative to canned tuna. Tuna loins and fillets are first steamed, then dried. After drying the product is vacuum-packed and distributed through supermarkets. A trial distribution of the product in Pohnpei indicates that consumers are very pleased with it. From the point of view of production, namurabushi is less expensive to produce than canned tuna, since the cost of the can is eliminated. Also, it is lighter and may be airfreighted effectively. The product has a shelf-life of about one month in a domestic refrigerator, but may also be frozen for up to four months.

The Kosrae plant is designed to produce around 1 000 kg of namurabushi daily. In order for the plant to break even it has to purchase skipjack for around US$ 0.88/kg. The current market price in Kosrae, however, is between US$ 1.43 and US$ 1.65/kg. If the Kosrae pole-and-line fishery supplied the plant with skipjack at US$ 0.88/kg it would make no profit on sales.

Nevertheless, the State Government supports the setting up of the facility since it may cut down on imports and provide jobs for local people. At the moment Marine Resource Division and Kosrae Island Fishing Cooperative Association (KIFCA) are negotiating a three-month service contract for KIFCA to run the facility on a trial basis.

PALAU'S UNWANTED GUESTS

(Source: *Pacific Daily News*)

A year after 26 Indonesian fishermen were convicted in Palau of poaching in the archipelago's waters, they are still awaiting repatriation.

Palau Government spokesman, Bonifacio Basilius, said recently that pleas to the Indonesian Government to come and get the men have gone unanswered.

The 26 were detected fishing near Tobi Island, in the far south of the group, and sentenced to either two years in gaol or deportation at the expense of the Indonesian Government. They were gaoled because Indonesia did nothing to bring them home. However, because Koror's prison was too small to hold the men, they were released into the care of the community, where, Basilius said, they have received a humane reception.

'They each have local sponsors,' said Basilius. 'They're staying in homes and being fed. They work for the families.' One of the fishermen died of natural causes after his arrest said Basilius, and a local policeman 'was kind enough to bury him in his family's burial plot.'

Basilius said a similar Tobi Island incident is in the making.

'I got a report from Tobi that 11 fishermen are there now and the police are deciding whether to go the 220 miles there to get them or what,' Basilius said. 'It takes two days and one night to get there.'

'I talked with the police and suggested that they ask the Tobi people to arrest the fishermen, but they said that the Indonesians outnumber the able-bodied Palauan men on the island.' He said 28 Palauans live on Tobi.

Palau has a common sea-border with Indonesia.

MOSTLY GOOD NEWS FOR AMERICAN SAMOA'S CANNERS
(Source: *Samoa News/Pacific Islands Monthly*)

Japanese and Taiwanese longliners began diverting from American Samoa in the wake of a 2.5 c/lb tax on landings of unprocessed fish by foreign vessels, imposed by the American Samoan Government in July 1987. Although the new tax was expected to yield some US$ 150 000 annually, by October some ten foreign vessels had begun landing their catches at PAFCO in Fiji or Tahiti in preference to Pago Pago.

Following a report prepared by the American Samoa Fisheries Council, which indicated that the decline in economic activity caused by the defection of the fishing vessels would offset revenue earnings from the new tax, the American Samoan Fono repealed the tax in September.

However, by year's end, both Star Kist and Samoa Packing reported that their canning tonnages were well up on 1986 figures. Star Kist packed more than 110 000 tons of tuna, compared to 100 000 tons in 1986, while Samoa Packing is reported to have packed more than 75 000 tons and taken on 200 extra workers during the year.

According to Star Kist's Manager for Tuna Processing, Ken Cordrey, the company's increased production could be attributed to higher employee productivity and the landing of generally larger fish, especially yellowfin tuna. On 12 August, 1987, Star Kist achieved a record production day when 560 tons of tuna were packed. 'We had been getting big fish over a period of weeks, and at the same time our training programmes were starting to take effect', Cordrey said. 'So we announced to our employees that we wanted to break the 500 ton mark and they really rallied. It was the first time in anyone's memory that the cleaning ladies demanded more and more fish to clean!'

The new year saw the arrival of about 10 US trolling boats, part of a reported fleet of 40 or more boats normally based on the US West Coast now venturing into the Pacific to fish the newly-discovered albacore grounds about 2 500 km east of New Zealand. The boats are privately-owned, but represented by the Western Fishboat Owners' Association (WFOA) of San Diego. The WFOA had recently negotiated contracts with several Pacific canneries to handle the fleet's albacore catch.

The trolling boats typically carry between 30 and 40 tons of fish compared to the large purse-seiners' capacity of 1 000 tons or more. The advantage for the small boats is that their trolling rigs enable them to take the high-value albacore which seiners find difficult to capture. The WFOA contract with canneries is reported to give them a guaranteed price of

US$ 1 600/ton for albacore over 5 kg and US$ 1 500/ton for smaller fish. Skipjack taken by the seiners has commanded prices well under US$ 1 000/ton over the past few years. Samoa Packing's General Manager, Gordon Sterling, expects that the troll catch will supplement the supply of albacore provided to American Samoa's canneries by the longline fishermen, but not replace it.

FISHERIES SCIENCE AND TECHNOLOGY

CAUSES OF MORTALITY OF THE PEARL OYSTER IN WESTERN AUSTRALIA

(Source: *Austasia Aquaculture*)

The Western Australian pearling industry is Australia's third most valuable fishing industry. Pearl production is based on the use of naturally grown oysters that are removed from collection grounds and then transported to lease sites where pearl formation is induced by artificial means.

During the 1970's and early 1980's, excessive mortality occurred in oysters that had been removed from their natural beds and transported to lease sites. These losses sometimes amounted to 80 per cent of those taken. High mortalities had two major effects on the industry. Firstly, there was a direct financial loss to operators and secondly, the industry was forced to remove more oysters than it would normally require. This placed an increasing pressure on the natural population of oysters.

During the years 1980-1984, David Pass and Michael Mannion of the School of Veterinary Science, Murdoch University, and Rand Dybdahl of the Western Australia Department of Fisheries undertook research to determine the causes of mortality in pearl oysters in northwest Western Australia.

The aims of the investigation were to determine the factors and the possible causes associated with the mortality. Most of the work was done with one company which was the largest producer of pearls at the time. The husbandry methods used by this company were as follows: oysters were collected off the Eighty Mile Beach south of Broome, by divers using hookah gear during neap tide periods from April to October. The shell surfaces were cleaned of fouling organisms, divided into three size categories and placed in wire baskets which were then stacked underwater in carrier tanks built into the hulls of transport ships.

Seawater was circulated through the tanks by a venturi system which piped water from the hull to the surface of the tanks when the ship was moving. Water drained from the tanks through holes in the bottom. Transportation from Eighty Mile Beach to the lease site, 700 km away to the south, took approximately 37 hours. At the lease site, the oysters were suspended in baskets below rafts. During this period of acclimatisation which, in most cases, was approximately one year, the oysters were raised, cleaned and the dead shell removed every three months.

The first step of the disease investigation was to define the disease within the animal. This was accomplished by pathological and microbiological examination of naturally diseased oysters and the findings were substantiated by experimental reproduction of the disease in the laboratory. Predisposing factors were determined by investigation of environmental factors, particularly water quality,and management practices.

This research revealed that there was not an excessive mortality of oysters in the natural environment. Mortality occurred at the lease sites and the incidence varied between neap tides and was greatest in the winter months. The rate of mortality also varied inversely with the size of the oyster, i.e. small oysters sickened at a greater rate than larger oysters.

Pathological and microbiological examination of many oysters revealed that they were suffering from an infectious non-contagious disease, i.e. it did not spread from oyster to oyster. In addition the depth at which oysters were held, as well as cleaning the shell, had no effect on the incidence of disease.

Microbiological examination showed that 75 per cent of oysters contained large numbers of the marine bacterium *Vibrio harveyi* in their haemolymph (blood). This organism, which is commonly found in fish faeces and on the external surface of shellfish, was shown in the laboratory to be able to produce disease in oysters that was similar to the disease seen in the field and it was concluded that this bacterium was involved in the mortality problem. Examination of the environmental parameters showed that the factor that was most strongly associated with oyster mortality was water temperature. The lower the water temperature, the higher the mortality.

Experimental reproduction of the disease proved that oysters were more susceptible to disease at the water temperatures that occurred in the winter months (18°C) off the northwest coast of Western Australia. Oysters are cold-blooded animals and their body defense mechanisms against invading microorganisms are decreased as the temperature drops towards the level of their normal range, or below it. Although 18°C is not cold for many species of oyster, it appears to be so for a warm-water oyster such as *Pinctada maxima*.

It was hypothesised that the most likely source of infection for oysters was in the carrier tanks during transportation from the collection grounds to the lease site. The water of the carrier tanks was examined for bacterial content and it was shown that there was a massive increase in bacterial content during the period of transportation. This occurred despite a flow-through water system. It appeared that although water was flowing into the tanks, it was probably bypassing many of the oysters held in baskets because the baskets acted as a physical barrier to the flow, allowing bacteria to build up in the slowly-moving water.

The results of this investigation indicated that the high mortality of pearl oyster in the northwest of Western Australia was associated with cold water temperatures, crowding of oysters during transport and inadequate water circulation in carrier tanks on transport ships. A major consequence of this was infection of oysters with marine *Vibro* species of bacteria, particularly *Vibro harveyi.*

As a consequence of this investigation, transport and management practices within the industry have been modified and the mortality rate of oysters has declined dramatically.

References: Dybdahl, R and Pass, D.A. (1985). *An investigation of mortality of the pearl oyster,* Pinctada maxima, *in Western Australia.* Report No.71 pp 1-78. Fisheries Department, Perth, Western Australia,

Pass, D.A., Dybdahl, R and Mannion, M.M.. (1987). Investigations into the causes of mortality of the pearl oyster, *Pinctada maxima* (Jamison), in Western Australia, *Aquaculture* 65, in press.

RUST NEVER SLEEPS, BUT ...
(Source: *Australian Fisheries*)

The ongoing battle against corrosion continues with the release of two new products in Australia: **Neutra Rust** TL corrosion inihibitor and **Neutra Rust 661** rust converter.

The products have been put on the market by a Melbourne company, No Rust Pty Ltd. According to the company these 'rust busters' are water-based rather than solvent-based and therefore easier to work with. In addition to being very efficient, they are also non-toxic, non-acidic, lead and zinc free, and non-flammable.

Neutra Rust TL (tank liner) is primarily intended as a chemical insulator or barrier between structural surfaces and liquid content. The paint comes in a range of colours and is claimed to be suitable for use on iron, cast iron, sheet, stainless steel, aged aluminium, and galvanised steel. It can also be used on cement and concrete and is resistant to spillage from most corrosive chemicals.

The second product, Neutra Rust 661, is claimed to chemically convert rust into a neutral compound which then insulates the metal against further oxidation.

No-Rust says that under normal conditions, a coat of Neutra-Rust 661 will dry in 30 minutes and can then be used as a premium for a wide range of paints, lacquers and other finishes.

The company says both products are particularly useful in the maintenance of fishing boats and gear. It says Neutra-Rust 661 is quicker, cheaper and less complicated than sandblasting, particularly above the waterline, and Neutra-Rust TL makes an excellent primer for anti-fouling paints.

More details from: No-Rust Pty Ltd, 6/97 Lewis Road, Knoxfield, Victoria 3180, Tel: (03) 222 1444, Fax: (03) 887 0230.

SHARKS - PUTTING THE BITE ON CANCER

(Source: *Australian Fisheries*)

Sharks may be considered by many to be an unlikely friend of man, but if a theory put forward by Swedish scientist Ingmar Joelsson, proves correct, sharks — or at least their liver oil — may prove to be our ally in the fight against cancer.

Professor Joelsson presented this idea at a recent research congress in Norway, based on the fact that sharks are believed to be the only living creatures which do not contract cancer.

Shark liver oil contains the substance alkysoksyl glycerol which strengthens the sharks' immune system, and some researchers believe it may have the same effect on humans.

Not only is the oil thought to be a possible anti-cancer agent, it has also had a beneficial effect in patients undergoing radiation treatment, according to the Norwegian Information Service.

It is also expected that the oil will soon be tested for possible remedial effects in the treatment of sunburn.

ABSTRACTS

Processing and Storage of Sashimi Tuna for Retailers and Wholesalers, published by NSW Fish Marketing Authority, Gipps St, Prymont, NSW, Australia. 10 pp.

In keeping with the growing appreciation outside Japan for raw tuna prepared in the **sashimi** and **sushi** style, and the growing awareness among fishermen of the potential rewards of capturing and marketing sashimi-grade tuna, the NSW Fish Marketing Authority has released this informative, illustrated guide to the proper preparation and storage of sashimi fish after purchase. Although written primarily for re-sellers and restauranteurs, the guide will be of interest to anyone who enjoys sashimi, and to fishermen seeking to promote the sale of sashimi-grade fish.

The booklet details the butchering, filleting, blocking and slicing techniques to produce traditional sashimi and the proper storage at each processing stage, as well as serving and portion advice, and even a recipe for sushi.

PRELIMINARY RESULTS OF A DEEP-BOTTOM FISHING TRIAL WITH 'Z' TRAPS IN VANUATU

by

Michel Blanc
ORSTOM
Pt. Vila
Vanuatu

SUMMARY

From March to June 1987, the Research Section of the Vanuatu Fisheries Department conducted deep fishing trials with traps on the outer-reef slope of north Efate.

Ninety-four 'Z' trap sets were made at depths between 50 m and 430 m.

The best catches were obtained in the second part of the trials on bottoms ranging from 100 m to 215 m, the cpue being 7.4 kg of fish per trap per set.

Two hundred and fifty-eight fish, totalling 393.5 kg, were caught. Most of the catches were of commercially valuable species: jobfish *(Pristipomoides* spp.), sea perches *(Lutjanus malabaricus),* breams (Pentapodidae) and groupers *(Epinephelus* spp.).

These trials also resulted in introduction to the market of a new species *(Conger* sp.). One hundred and fourteen nautilus *(Nautilus pompilius)* were also taken, usually at great depths.

This paper describes the fishing methods used, gives the major results obtained, and underlines the problems associated with the use of this new technique in Vanuatu.

INTRODUCTION

Trial fishing with deep traps was started in April 1987 by the Research Section of the Fisheries Department in Vila.

The project, funded by the French Embassy, was largely based on a similar trial carried out in 1985 in New Caledonia by a commercial fisherman.

Between April and June 1987, 94 trap sets were made.

The first results, recorded on the fishing forms shown in Appendix I, were analysed by the Research Section of the Fisheries Department.

FISHING GEAR AND METHODS

Gear

Boat

We used the *Etelis*, a 10 m launch with a 35 hp diesel engine and a crew of four men.

The hydraulic line hauler was powered from the main engine.

Traps

The traps used were 'Z' types with two openings. The frames, made of iron rods, 10 mm in diameter, were covered with galvanized wire netting, mesh size 50 x 25 mm. Trap measurements were 200 x 150 x 70 cm.

We started off with six traps, two of which were lost during the period of the trials.

Methods

Trap setting and recovery

Traps were moored individually, instead of in groups on the same mooring line, because the latter technique caused many traps to be lost in New Caledonia.

Each trap was attached to a polypropylene line 12 mm in diameter, the total length of which varied with depth and current strength (length of one roll of line = 110 m).

The top part of the line floated on the surface of the water attached to three buoys 10 metres apart: two small, hard, pressure-resistant buoys, and an inflated marker buoy at the end of the line (Figure 1).

Once the depth had been determined with an echo-sounder, the baited trap was let down and the line run out, the boat going ahead at 4-5 knots against the wind.

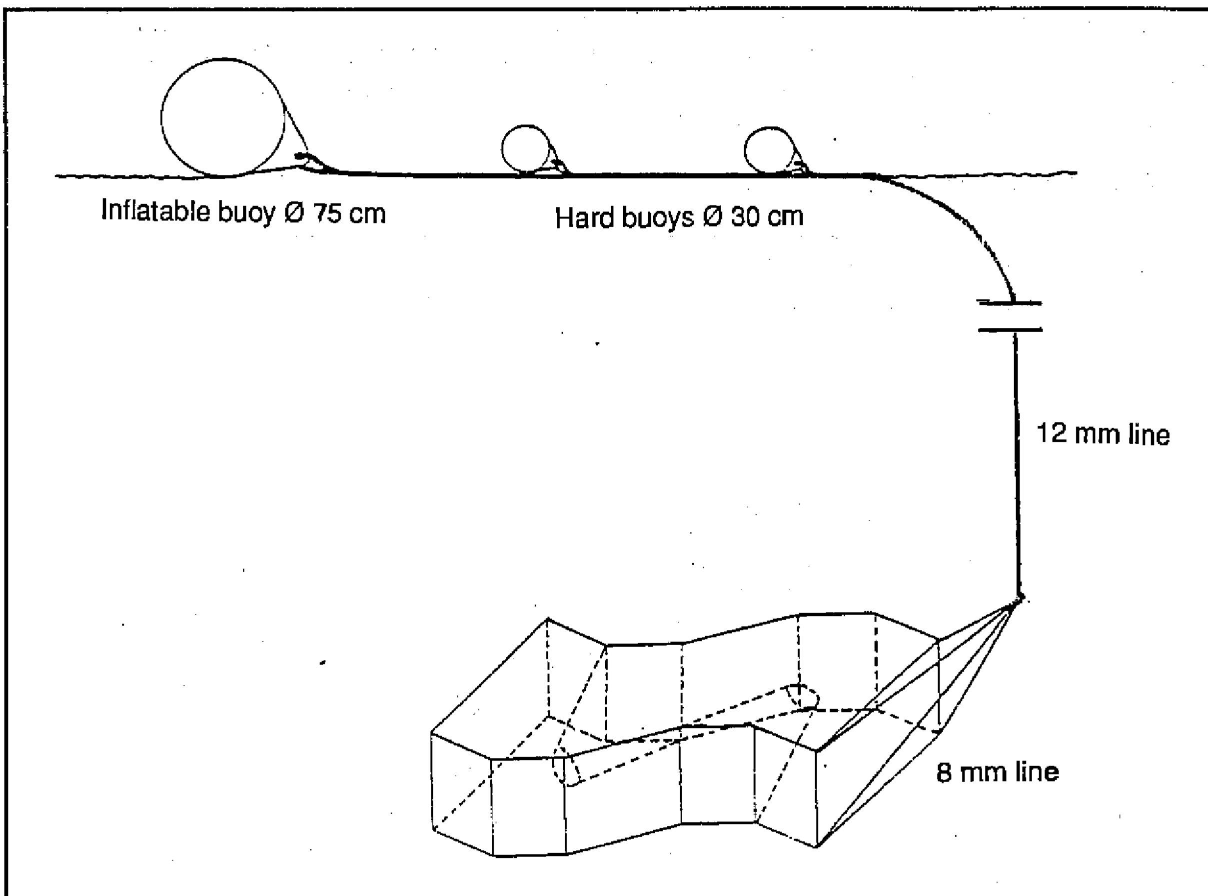


Figure 1. Trap and mooring arrangement

Since our traps were usually moored close to the shore, we had little trouble spotting the buoys. For recovery, the boat was moved towards the marker buoy with the wind or the current flow, the buoy was hooked and the slack of the line pulled in. The trap was then brought up, with one man at the wheel keeping the boat steady against the wind, another at the line hauler, and a third rolling up the line onto the after-deck. When the trap appeared, it was hoisted onto the gunwale and its contents emptied out. The trap was then rebaited and re-set, after the boat had been taken a little way further.

Bait used and set time

The main problem encountered in the course of our trials was obtaining a regular supply of good quality bait. At the rate of one kilogram per trap, the quantities needed are quite large. This is one of the drawbacks of the trap-fishing technique.

We were therefore compelled to use a wide variety of baitfish; fresh or frozen skipjack *(Katsuwonus pelamis)*, fresh or frozen yellowfin tuna *(Thunnus albacares)*, mackerel *(Selar* sp.), Spanish mackerel *(Euthynnus affinis)*, fresh sardines, saury imported from Japan *(Cololabis)*, guts of skipck and other tuna, and even canned fish in oil!

The best catches were obtained with fresh skipjack, which is generally regarded as the best bait. Yellowfin tuna, saury and canned fish (a bait that retains its attractive capacity for several days) also gave good results.

The bait was placed in a bag made of galvanized wire netting (mesh size 5 mm) hung in the middle of the trap; this kept the bait in good condition longer and made for far easier rebaiting.

We initially planned to make two sets per day per trap (one day-time set and one night-time set). The day-time sets were soon discontinued however, because the day-time catches were too small and the fishing grounds too remote (two return trips per day instead of one). Subsequently the minimum set time was 24 hours.

Fishing grounds

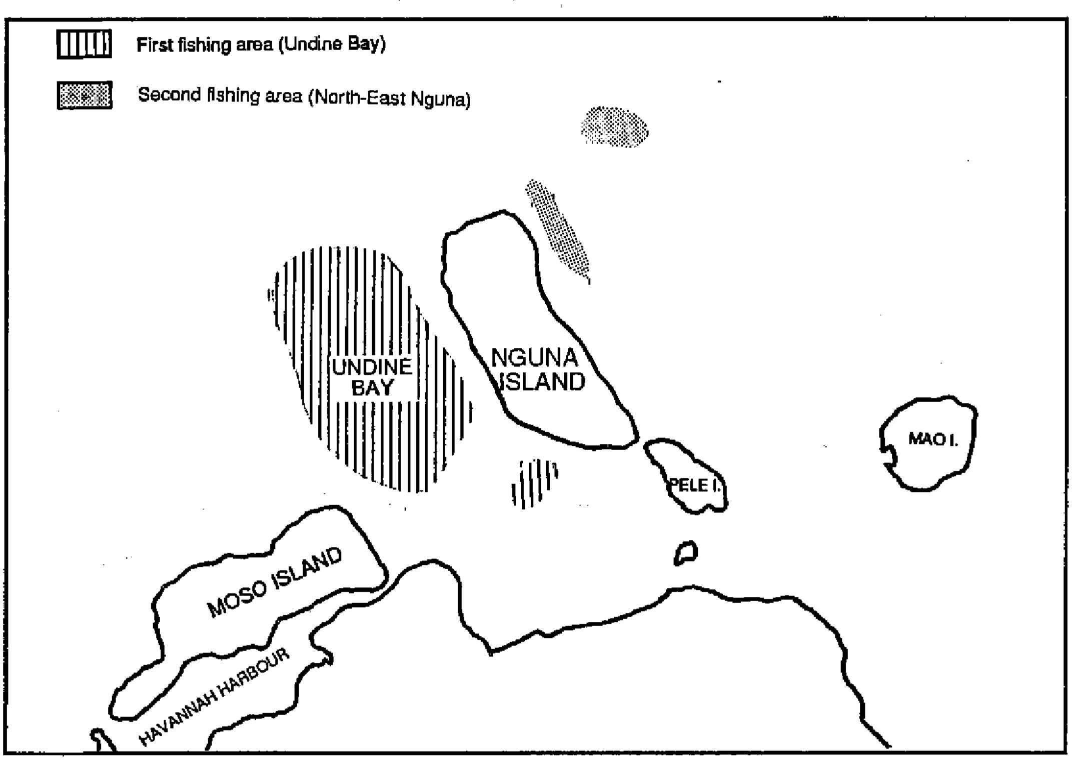


Figure 2. The fishing grounds

The fishing trials were held from 27 April to 19 June 1987 at Emoa, a fishing village in north Efate and the home port of the *Etelis* (see Fig.2).

At first our traps were set out in Undine Bay on bottoms between 50 and 430 m in depth. Seventy trap sets were made in this area.

The poor results obtained in Undine Bay led us to look for an area where fish were more abundant.

The second part of our trials was conducted off the north-east of Nguna Island, at depths ranging from 100 to 215 m. Twenty-four trap sets were made there.

RESULTS

Catch composition

Table 1 shows catches by species of commercial value, in numbers, live weight, percentage of total weight, and minimum and maximum depth of capture.

Two hundred and fifty-eight fish, totaling 393.5 kg, were captured in the period considered.

Species of high commercial value made up most of the catches: jobfish *(Pristipomoides* spp.) (20% of total weight), perches *(Lutjanus malabaricus)* (16.4%), breams *(*Pentapodides*)* (15%), groupers *(Epinephelus* spp.) (21.8%). The mean weight of these species ranged from 0.5 to 4.2 kg, which are useful sizes for the market.

Conger eels *(Conger* sp.) were captured at depths from 200 to 400 m and accounted for 16.3 per cent of the total catch. This species, new on the local market, has good quality white flesh suitable for smoking.

Selling price at the Natai Fish Market was Vatu 200/kg for fresh fish and Vatu 400/kg for smoked fish.

Table 1 does not show sharks, which formed a sizeable fraction of the total catch. Several unidentified species were also captured.

A number of very large specimens of *Lutjanus bohar* were fished in fairly shallow waters. They were thrown back because of their toxicity and therefore not taken into account.

Lastly, a few other species of no commercial value were captured: one *Beryx splendens* at a depth of 215 m, two *Anomalops* sp. at the same depth, two butterfly fish *(Heniochus acuminatus)* at 125 and 130 m.

Table 1. Species composition of catch

Species	Number	Live weight (kg)	Average weight (kg)	Percentage total weight	Depth range (m)
Etelis:					
Etelis carbunculus	4	12.6	3.2	3.2	285-430
Pristipomoides:					
Pristipomoides multidens	10	20.1	2.0	5.1	125-190
Pristipomoides flavippinis	53	37.6	0.7	9.6	110-215
Pristipomoides filamentosus	16	20.0	1.3	5.1	105-130
Total:	79	77.7	1.0	19.7	
Lutjanidae:					
Lutjanus malabaricus	41	64.6	1.6	16.4	105-180
Lutjanus rufolineatus	26	4.7	0.2	1.2	110-150
Aprion virescens	1	10.2	10.2	2.6	110-
Lethrinus miniatus	1	4.0	4.0	1.0	130-
Lethrinus chrysostomus	1	1.2	1.2	0.3	125-
Lethrinus variegatus	7	1.9	0.3	0.5	50-130
Total:	77	86.8	1.1	22.0	
Pentapodidae:					
Gymnocranius japonicus	7	11.0	1.6	2.8	110-180
Gymnocranius lethrinoides	2	3.7	1.9	0.9	120-
Gymnocranius rivulatus	15	22.2	1.5	5.6	130-150
Gnathodentex mossambicus	13	22.4	1.7	5.7	125-215
Total:	37	59.3	1.6	15.1	
Serranidae:					
Epinephelus morrhua	9	22.4	2.5	5.7	175-310
Epinephelus magniscuttis	7	29.2	4.2	7.4	220-350
Epinephelus septemfasciatus	7	18.4	2.6	4.7	220-350
Epinephelus chlorostigma	3	12.1	4.0	3.1	140-185
Epinephelus areolatus	3	1.4	0.5	0.4	130-140
Epinephelus maculatus	1	1.8	1.8	0.5	125-
Cephalopholis formosanus	1	0.3	0.3	0.1	125-
Total:	31	85.6	2.8	21.8	
Miscellaneous:					
Seriola rivoliana	1	2.8	2.8	0.7	125-
Priacanthus blochii	1	1.4	1.4	0.4	210-
Ostichthys japonicus	5	3.0	0.6	0.8	200-315
Parupeneus pleurospilos	2	0.2	0.1	0.1	125-
Total:	9	7.4	0.8	1.9	
TOTAL:	258	393.5	1.5	100.0	

Catch per unit of effort (cpue)

Tables 2 and 3 give cpue in kilos per trap per set, for the two trial areas.

Table 2. Catch per unit of effort at Undine Bay in 70 trap sets

Species	Live weight (kg)	Percentage of total weight	cpue (kg/trap/set)
Etelis carbunculus	12.6	5.8	0.2
Pristipomoides spp.	35.6	16.5	0.5
Lutjanus malabaricus	15.2	7.0	0.2
Gymnocranius spp.	19.1	8.8	0.3
Epinephelus spp.	67.1	31.1	1.0
Conger spp.	64.3	29.8	0.9
Other species	2.2	1.0	0.0
TOTAL:	**216.1**	**100.0**	**3.1**

Table 3. Catch per unit of effort at north-east of Nguna in 24 trap sets

Species	Live weight (kg)	Percentage of total weight	cpue (kg/trap/set)
Pristipomoides spp.	42.1	23.7	1.8
Lutjanus malabaricus	49.4	27.8	2.1
Gymnocranius spp.			
Gnathodentex mossambicus	40.2	22.7	1.7
Epinephelus spp.			
Other species	27.5	15.5	1.1
TOTAL:	**177.4**	**100.0**	**7.4**

Cpue values were low in Undine Bay; 3.1 kg of fish per trap per set, with congers accounting for 0.9 kg. These poor results are mainly due to over-fishing in this area since the establishment of the Emoa fishery.[1]

North-east of Nguna Island much better results were obtained, with 7.4 kg per trap per set. This area, where bottoms are from 100 to 215 m deep, is virtually unfished at present.

Jobfish *(Pristipomoides* spp.), perches *(Lutjanus malabaricus)* and breams *Pentapodus* spp. make up the major part of the captures.

Catches of nautilus

A hundred and fourteen nautilus *(Nautilus pompilius)* were captured in 94 trap sets.

Table 4 gives the cpue (number of nautilus per trap per set) in relation to depth. It was found that from 100 to 200 m, the optimum depth range for fish, nautilus were seldom caught (0.8 nautilus/trap/set).

[1] An exploratory survey was conducted with bottom-longlines around Efate (Grandperrin R., 1983). Good results were obtained in Undine Bay and on the leeward side of Nguna Island.

On the other hand below 300 m catch figures were higher (2.6 nautilus/trap/set).

Table 4. Nautilus captures in relation to depth

Depth (m)	Number of sets	Number of nautilus	cpue (number/trap/set)
0-100	5	0	0.0
100-200	48	40	0.8
200-300	20	19	1.0
>300	21	55	2.6
TOTAL:	94	114	1.2

Nautilus shells in good condition (about two-thirds of the total taken) were sold locally at prices ranging from 300 and 500 Vatu each (rough, uncleaned, unpolished shells).

DISCUSSION

Comparisons with trials in New Caledonia

From March to June, 1985, 1390 'Z' trap sets were made by a commercial fisherman on the outer reef-slope south-west of New Caledonia, at depths ranging from 90 to 140 m. Mean cpue was 8.9 kg. The Lutjanidae-Serranidae group accounted for 45 per cent of the total catch, with *Lutjanus amabilis* alone making up 31 per cent. In addition, 24 traps set at a depth of 400 m gave much higher catches of nautilus *(Nautilus macromphalus)* than those set at depths between 90 and 140 m (38 nautilus per trap per set, against 1.3 in the 90-140 m range).

Cpue for fish, in numbers and by species captured

Mean cpue in the second part of our fishing trials (7.4 kg/trap/set) was close to that obtained in New Caledonia (8.9 kg/trap/set).

When making comparisons it must, however, be borne in mind that our cpue in Vanuatu was only obtained from 24 trap sets.

As regards species captured in New Caledonia, *Lutjanus amabilis* accounted for 3 per cent of the total catch, whereas in Vanuatu *Lutjanus malabaricus* was the major species. *Pristipomoides* made up 20 per cent of the Vanuatu catches (with *P. flavipinnis* predominant) against 15 per cent in New Caledonia *(P. filamentosus* predominant).

Cpue for nautilus

The species captured were different: *Nautilus macromphalus* in New Caledonia, *Nautilus pompilius* in Vanuatu.

In New Caledonia the cpue for nautilus increased considerably with depth. It did not in Vanuatu (Table 4).

The New Caledonian figure of 38 nautilus per trap per day at a depth of 400 m suggests that the stock of nautilus is much larger than in Vanuatu, where only 2.6 nautilus per trap per day were taken at depths of more than 300 m.

Problems encountered

Bait

Our main problem was to obtain an adequate supply of good quality bait. At the rate of 1 kg per trap per day, we needed about 30 kg of bait per week.

Because we were unable to obtain sufficient quantities in Vanuatu we used only 1 kg of bait per trap, whereas in New Caledonia 2.5 kg per trap were used.[2]

Loss of traps

Of the six traps initially constructed, two were lost during the fishing trials.

The first was lost on the sea-mount located north-east of Nguna. Set at a depth of 215 m, it was never found again. The most plausible explanation is that the trap drifted away to the very deep bottoms as it was being let down. This area, where fish are very abundant, proved difficult to exploit because the accessible bottoms of the sea-mounts are very narrow and the currents in the area very strong.

The second trap was lost east off Nguna at a depth of 140 m. The only possible reasons are either that the marker buoy was stolen, or that the line was cut by the propeller of a passing boat.

Traps and lines were rarely caught up on the bottom and when this did happen we were always able to pull them free.

Choice of fishing grounds

Intensive trap-fishing can only be carried out near the boat's home-port.

In our case the choice was very limited as bottoms with really abundant fish stocks are rare around Efate. Good grounds at Forari and Eton on the east coast were too far from Vila or Emoa, as were the rich red snapper grounds at Cook's Reef west of the island of Emae. In addition the villagers of Emae are likely to object strongly to outsiders fishing in their waters.

The lack of extensive fishing grounds is a factor limiting deep bottom fishing development in Vanuatu.

Prospects

The Fisheries Department at present possesses four traps. Three more traps are being constructed at Vanuatu's National Institute of Technology.

Deep trap-fishing trials will only be resumed when the Fisheries Department has acquired a vessel suitable for this type of fishing.

The *Etelis,* which was a gift from a Canadian development agency, will henceforth be available only occasionally. The *Albacore,* a research vessel presented by Japan in 1987, does not lend itself to trap-fishing. Only the *Yasur* is suitable for use, but is too costly to operate.

---

[2] It must be noted that the c.p.u.e obtained in New Caledonia (i.e 8.9 kg/trap/set) works out to only 3.6 kg/trap/set per 1 kg of bait.

If and when the trials can be resumed, attention should be paid to the following points:

— Sufficient quantities of bait should be secured and stocked. Recently two FADS were moored off the coast of Efate and they should enable sufficient quantities of skipjack to be captured for a long period of trials. It would also be useful to compare the cpue obtained with different quantities of bait (1 kg or 2 kg of bait per trap per set).

— The efficiency of traps for fishing of red snappers (*Eteliss* spp.) should be tested. *Ad hoc* trials could be carried out with the *Etelis* when the boat goes out to Cook's Reef.

— Trapping trials in the 100 to 200 m depth range should be continued in order to determine cpue more accurately and to check the economic viability of this type of fishing.

— Attempts should be made to find a market for nautilus.

— Export of living nautilus for aquariums could be investigated, in addition to local sale of the shells.

CONCLUSIONS

The number of trap sets made during our trials was too small for final conclusions to be drawn, particularly regarding the economics of this type of fishing. The trials did, however, produce some promising results:

— The cpue obtained in the second part of our trials demonstrated the efficiency of 'Z' traps for capturing species in the upper depth range.

— These species are generally commercially valuable and of a size that is in demand on the local market.

— Capture of nautilus in the lower depth range can be a useful supplementary source of income.

— This new technique has one important advantage in that fishing gear can be left in the water for a very long time. Good catches were made in traps that were recovered two weeks after having been set out. As the bait loses its attracting capacity after a few hours, this result seems to prove the effectiveness of the straight entrances used (low rate of escape).

The constraints of this type of fishing are great:

— The initial outlay for gear is high; a trap with lines and buoys costs about Vatu 50 000.

— The vessel used must be large and fitted with expensive equipment (echo-sounder, line hauler ...).

— Large quantities of bait are required.

— There are few areas in Vanuatu where fish are very abundant, and their size is very limited.

Despite these handicaps, trapping of deep-bottom fish can be regarded as a promising technique for exploitation of Vanuatu's outer reef-slope resources.

Further trials of this technique would be useful to determine what type of boat, fishing methods, trap shape, etc., give best results, and to ascertain whether it is economically viable.

APPENDIX 1

TRAP FISHING

Form N°:

Date : Departure time : Return time :

Moon : Fishing area :

Number of traps : Total fish :

Number Nautilus :

Trap N°	1	2	3	4	5	6	7	8	9	10
Set / Recovery										
Time in water										
Location										
Depth										
Bait										
Number Nautilus										
Number fish										
Weight fish										

FISHING LOGSHEET USED DURING TRIALS

TUNA LONGLINERS PERFECT THEIR ART

by

Susan Pollack
(Reprinted from National Fisherman Magazine)

'We're always trying to build a better mousetrap,' says Capt. Wade Bailey, a pioneer and highliner in the Gulf of Mexico's burgeoning yellowfin tuna longline fishery.

One secret of Bailey's success is that he fishes a lot of gear — more than most tuna longliners on the Gulf or East coasts. He makes 52-mile sets from aboard his 65' Thompson trawler, the *Heavy Set*.

In the Gulf, longliners target yellowfin from April through November. During the winter, they fish for a combination of swordfish, yellowfin and a small allowable bycatch of prized bluefin tuna. (They are allowed to catch two bluefin per trip until a 115-ton quota is filled.)

Like most pelagic longliners, Bailey has switched from braided nylon line to monofilament. His mainline is 730 lb test and his leaders 400 lb test. According to longliners, monofilament is stronger, more durable, less bulky, and once you get the hang of it, easier to handle than nylon line. But most importantly it catches more fish. One possible reason is that it is less visible in the water, an asset when fishing for tuna, which are visual feeders.

When hauling back under strain, monofilment tends to stretch, rather than part. However, this can destroy a drum, which is why you need one that is both strong and well-engineered, according to Bailey, who has had success with Lindgren-Pitman drums. Recently, he purchased one of the largest ones the Pompano Beach, Fla., company makes. It holds up to 60 miles of monofilament mainline.

Bailey uses the same hooks for swordfish and tuna — 9/0 Mustads, pattern No.7698B. Though they're available from the factory with an offset bend, Bailey prefers to put in the offset himself. This saves money (10 cents per hook) but more importantly, it allows Bailey to get just the shape he wants in each hook. Mustad's own pre-offset hook features a pronounced offset and a straight shank. By contrast, Bailey puts only a slight offset in his hooks and bends the shank slightly.

This season, the *Heavy Set* has been landing between 7 000 and 10 000 lbs of yellowfin per trip. Generally, 40-55 per cent of the catch consists of top-grade yellowfins which fetch US$ 3 - US$ 5/lb, depending on the season, with prices strongest in the winter. Grade 1 yellowfins have a higher fat content and bright red flesh with high clarity. Prices for Grade 2 yellowfins range from US$ 2 - US$ 4/lb and for Grade 3 yellowfins, US$ 1 - US$ 3/lb.

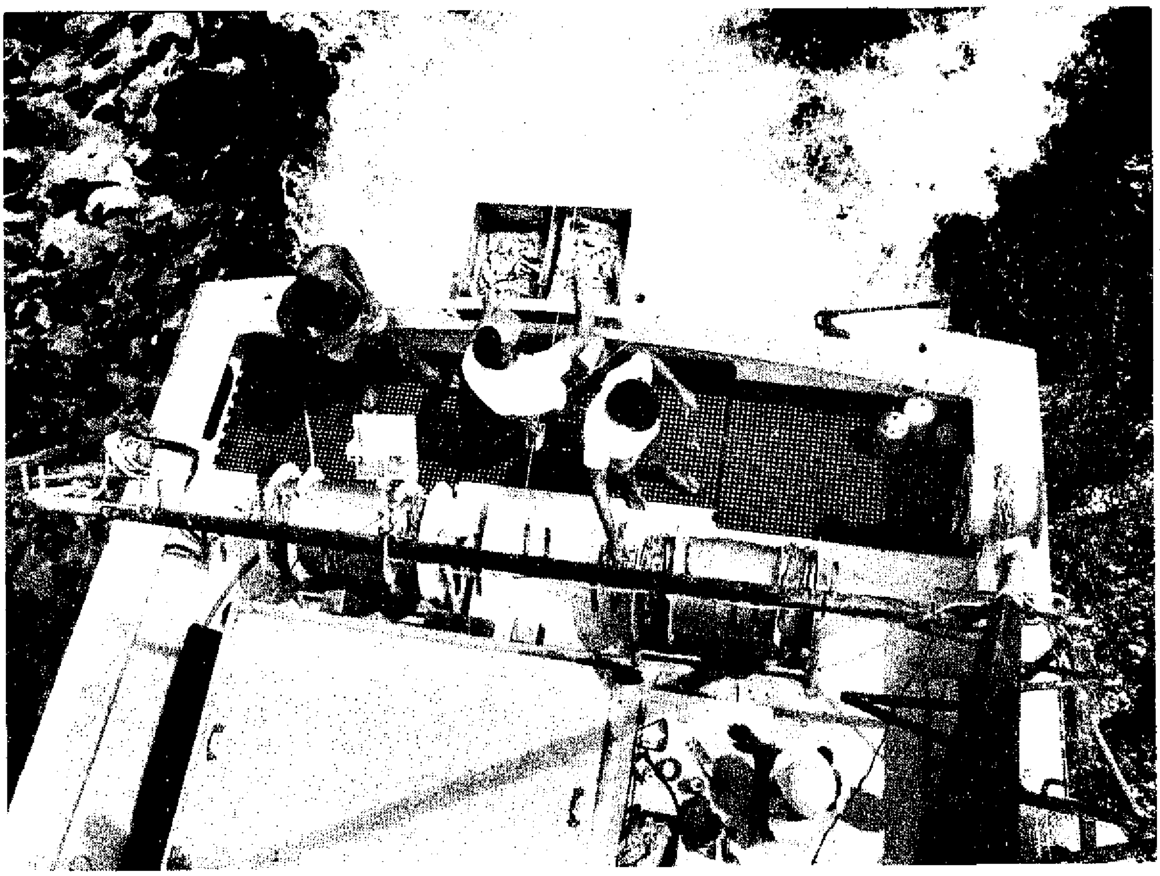
Bailey makes five sets per seven-to-eight day trip. He has been fishing a 24-to-30 hour steam from Venice, La., a major Gulf yellowfin port. Nearly a third of the Gulf's 100-boat yellowfin fleet works out of Venice, where Larry and Ki Pearcy of Venice Wholesale Seafood have set up a new facility that has attracted nearly a half dozen steady buyers.

Like their northern counterparts, Gulf tuna longliners look for edges — where warm water meets cold — except during the summer, when the entire Gulf is blanketed by surface temperatures in the 80s.

During a late May/early June trip, the *Heavy Set* ran its gear out 700 - 1 500 fathoms during an initial set. Bailey explained his strategy, 'We'll know a lot better what we have when we haul back. All we can do now is take an educated guess.' Finding the largest concentration of yellowfin around 1 000 fathoms, Bailey spent the rest of the trip fishing those grounds.

Working the Gear

How does the gear work? Bailey slows the *Heavy Set* to an idling speed signalling it is time to set. His four-man crew is at the stern. After putting over a radio transmitter-equipped buoy (or beeper), a high-flier and a poly ball, the men begin setting hooks. Mainline is run from a drum aft of the wheelhouse through a fairlead to another block at the stern.



The crew at work setting the longline

There, to port and starboard, crewmen Johnny McGuffie and Ron Parson operate two hydraulically powered gangion reels, or carts, each full of 20-to-25 fathom leaders. The men alternate passing hooks to Kenneth Aziz, who is seated on the centreline at the stern. Aziz reaches into a bait box on the transom and threads the hook through a Spanish sardine. Meanwhile, the man who passed him the hook has been powering the line off his cart and letting the wake of the boat take it astern.

When McGuffie or Parson reaches the end of a leader, he hands the snap to Aziz, who is still holding the baited hook. In one swift motion, Aziz pitches the hook overboard and snaps the leader onto the line. This procedure, says Bailey, has been worked out to prevent both gear foul ups and injuries to the crew.

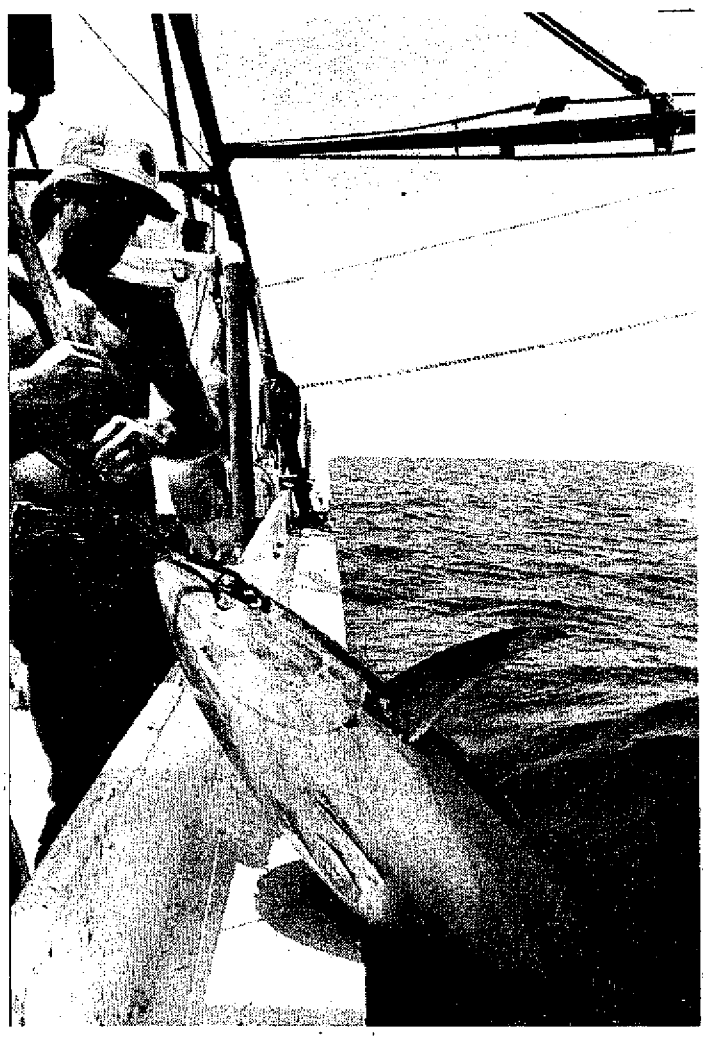
Rodney Braden sets buoys from another smaller, manually-run drum on the port quarter. After every five hooks, he sets a small polyurethane 'bullet' buoy to support the mainline at the desired depth. (The buoy lines, or ball drops, are each 10 fathoms long.)

When yellowfin fishing, the *Heavy Set* sets 1 200 hooks in all, with 90 hooks to a section. High-fliers mark the ends of each section. Every three and a half sections, the men set a radio beeper, which can help locate the gear via an automatic direction finder in the wheelhouse.

The set underway, Bailey guns the engine and runs at six to seven knots. Setting takes six to seven hours, and Bailey lets the gear soak another 10 to 12 hours before hauling back.

Hauling back is the reverse of setting out, except it can take a lot more time if the gear is heavy with fish. During haul-back, Bailey runs the boat and hauler from an outside steering station to starboard. The mainline is hauled up on the starboard rail through a block with a V-shaped sheave that prevents the mainline from chafing or twisting. The line is then run through a roller and back onto the drum via a levelwind.

Feeling a tug on the mainline, Bailey calls, 'Fish'. As the leader snakes up out of the water, a gloved crewman grabs it and begins to 'wire the fish' by hand. The other men stand by. As the yellowfin breaks the surface, the men gaff it and bring it to the side of the boat. Before it is hoisted aboard, Bailey shoots the fish in the head with a .22-calibre pistol. This is a common practice among Gulf tuna longliners. They say it prevents the flesh of the fish — and the crew — from being damaged by thrashing.



Gaffing a large yellowfin aboard

The men lift the fish onto a wooden V-shaped cleaning rack on deck. Aziz immediately saws off its head and pulls the entrails out. This done, he scrapes out dried blood, washes out the body cavity and places the fish on ice in the hold. The complete butchering and cleaning process takes only two to three minutes. Aziz works quickly to maintain quality.

On some boats, particularly in the north, monofilament line or steel wire is run down the spinal column to kill the fish and to deaden its nerves so it cools down quickly. This is particularly effective in reducing the core heat of large fish such as bluefins and bigeyes.

Once fishing gets underway, Bailey and his crew work around the clock. The men work 24-hour stretches hauling and immediately re-setting gear. The only break they get is while the gear is soaking. Then they grab some food and sleep.

In contrast to swordfish, which are night feeders, yellowfin will bite during the day. In fact, Bailey has found they bite best during the day, particularly at dawn and dusk.

Gulf longliners have found Spanish sardines, herring, menhaden and other oily fish to be the most effective for catching yellowfin. Moreover, these baits are a lot less expensive than squid, which they use to catch swordfish during the winter. Like their northern counterparts, they also use *cyalume* lights to catch swordfish.

Gulf fishermen work shallower water for swordfish than they do for tuna; they generally pursue the billfish in 150-500 fathoms. And since they fish for swordfish during the winter, when Gulf waters are cooler, they use longer leaders to get their baits down deeper. Bailey uses 30-40 fathom leaders when swordfishing. And he fishes less hooks — only 700-750 per set compared to the 1 200 he fishes for yellowfin. Since the winter fishery includes giant bluefins, he sets more buoys because these large fish tend to pull the lines down.

During the winter swordfish season, the gear soaks at night and is hauled at first light. The moon is far more critical to swordfishing than it is to yellowfin fishing. Bailey observes 'While yellowfin fishing peaks as the moon is building, it does not drop off enough the rest of the month to (warrant) staying at the dock,' he says.

What about costs? Bailey calculates it costs him about US$ 50 000 to rig his boat for tuna and swordfish fishing. This includes US$ 15 000 for 52 miles of mainline, US$ 10 000 for the mainline drum, US$ 60 00 for a pair of leader carts and another US$ 3 250 for the leaders themselves. Other expenses are US$ 1 275 for 300 bullet buoys, US$ 1 200 for high-fliers, US$ 5 000 for five beeper buoys, US$ 1 000 for hooks, UIS$ 850 for snaps and US$ 3 500 for the automatic direction finder. Another US$ 2 000 is invested in crimps and 'trinkets,' the brightly colored plastic skirts and sleeves used to attract tuna.

Bailey's average costs per summer yellowfin trip are US$ 4 000 to US$ 5 000. This is for food, fuel, ice, bait and gear. During the winter swordfishing season, his per-trip expenses double because of the costs of purchasing squid and *cyalume* lights.

Northeastern Innovations

Northeastern pelagic longliners use similar gear. But it is difficult to compare fishing methods because the habitats and fishing conditions in the Gulf and Northeast waters are so different. For one thing, northern waters are a lot cooler and temperatures more variable year-round. For another, those fishing from Cape Hatteras north to the US-Canadian border at Georges Bank have been targetting bigeye tuna and swordfish, rather than yellowfin, because the former bring the best money. Bigeyes fetch an average of US$ 5.50/lb, and they can be as high as US$ 6.50 - US$ 7.50 if they are in prime condition and have the high fat content desired by Japanese buyers. In early summer, ex-vessel swordfish prices were as high as US$ 5 - US$ 6/lb.

One thing is definite, however, monfilament is quickly replacing the old Yankee rope gear. Veteran pelagic longline Ted Malley of Scituate, Mass., says 'If I had it to do all over again, I would have switched to mono a few years sooner than I did.' Malley says he saw numerous demonstrations that show Yankee nylon rope gear can't hold a candle to monofilament when the two are being fished side by side. Malley had been using mono gangions, and had he not sold his boat this year, he says, he would have also switched to mono mainline.

But by far the greatest innovation northern pelagic longliners are making use of is the new line thrower. Barnegat Light, N.J., highliner Curt Blinsinger is one of the first tuna fishermen to successfully use this new piece of equipment. The captain of the 75 ft *Sara Ann*, Blinsinger purchased a US$ 3 400 line thrower, or shooter, from Lingren-Pitman this winter.

Fishing the 1 000-fathom bank off Cape Hatteras with the line thrower this spring, Blinsinger boated 10 000 lbs of prized bigeyes. During that same trip, boats fishing conventional gear alongside the *Sara Ann* were having difficulty catching anything.

Line throwers pull the mainline off the drum at a speed faster than the boat is moving, thereby creating sag in the line between the floats or ball drops. This allows a boat to get its line down deep and eliminates the need to have long ball drops and leaders.

A boat may lose or increase sag due to currents, but a skilled operator can compensate by setting the shooter faster or slower to loosen or tighten up the line, according to Peter Lindgren of Lindgren-Pitman.

Moreover, a boat can change the depth it is fishing by simply adjusting the speed of the shooter. With conventional methods, you have to shorten or lengthen your leaders. With the line shooter, the sag of the mainline is lengthened or shortened instead. As a result, not only can you fish a lot deeper, you can fish a range of depths. The leaders farthest from the floats fish deepest, while those nearest the floats fish the shallowest.

Says Blinsinger: 'Without a shooter, it's difficult to get much below 30 fathoms without cutting back the number of hooks you fish. And it takes a long time to haul back because you have to have such long leaders.' With 12-15 fathom leaders, Blinsinger has been able to fish relatively easily down to 40-50 fathoms.

In order to set the thrower, Blinsinger takes into account the speed of his boat and the amount of line between ball drops. Then he is able to calculate the depth he desires to set his gear and get the maximum sag between the balls. He is constantly fine-tuning this gear after determining which hooks and which depths are fishing most effectively.

Blinsinger fishes 30-35 miles of gear during the summer and about 20 during the shorter daylight hours of winter. In the Northeast, squid is the prime bait for both swordfish and tuna. However, because of the rising costs of squid, some longliners have switched back to mackerel or tried using herring, butterfish and even whiting to catch swordfish.

Blinsinger and others, including veteran Barnegat Light longliner Lou Puskas (who is now installing a line shooter aboard the 78 ft *Olympic Javelin*), hope the shooter will enable them to catch bigeyes in the dark of the moon. To date, longliners have only been able to catch bigeyes effectively one week out of the month — usually just before and after the full moon because that is when the fish come up closest to the surface to feed.

Bigeyes swim from the surface down to 200 fathoms. The goal is to be able to catch them throughout the month. But without a line thrower, a boat can't cover those depths, according to Blinsinger.

THE LONGBOAT ON THE LIBRARY VERANDAH

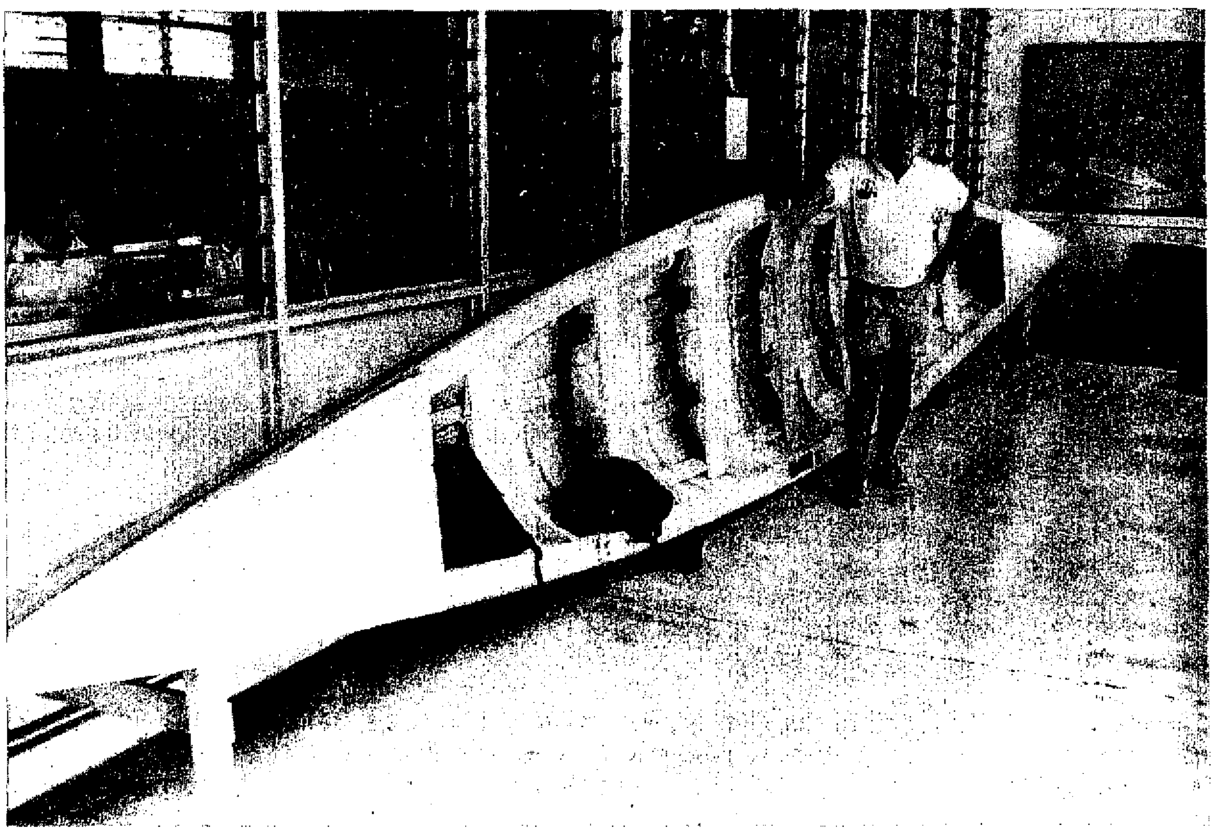
by

R. Powell
Rarotonga, Cook Islands

There is a popular fallacy that the longboat that sits on the verandah of the Rarotonga Library was built for the shore-based whaling which took place from the end of the last century until the last whale was caught about 1914.

The boats used for whaling were much larger and more heavily constructed than this boat. Seam batten construction along the lines of the pelagic whaling fleets was used in Rarotongan whale boats to give them more longitudinal strength, more than was needed in this light, specialised fishing boat.

The practice of using imported Kauri planking from New Zealand and cutting the framing from locally-grown timber, was the common method of construction until recent years. Copper fastening was also general practice.



The longboat on the library verandah

The frames of this boat were cut from the local timber known as *au* or yellow hibiscus (*Hibiscus tiliaceus*), which grows commonly along the shores of most Pacific islands and atolls. It is a tree which grows into natural bends and crooks, holds nails well and is very durable. Incidentally it must be one of the very few hardwoods which are a natural dark green when seasoned.

The preferred species of pelagic fish in the Pacific are tuna and tuna-like fish, which generally swim in the top 200 fathoms. Large snappers and snake mackerel, which reach an extreme of perhaps 200 lbs, are always caught at night. This boat was built to catch both day and night species.

One common factor of all the tropical Pacific islands is that they rise steeply from great depths. The average seabed between islands is around 2 000 fathoms or 12 000 feet deep. Atolls and islands rise up from this great depth at an angle which is often as steep as the mountains rising from the coastline. In many areas the drop is nearly vertical, so that any form of anchoring is impossible. This means that to keep over an area it is necessary to keep paddling or rowing steadily just to maintain station and keep fishing lines vertical. In a one-man canoe, in strong wind and with a rough sea, this is strenuous work. The long swell generated by the trade winds keeps any boat rising and falling. This means that a tight line is almost impossible to maintain.

When the longboat was built it was rowed with four or five oars, and the crew considered it no hardship to row right around Rarotonga in a night's fishing. Today outboard motors have been fitted to boats that can no longer be rowed. Perhaps some day, with the price of fuel going ever higher, men may once again look to the ways of the last generation with their easy-pulling boats.

At the time when Makea Nui Tinirau Ariki was an active fisherman, a day's fishing for *a'ai* (yellowfin tuna) might start well after sunrise. Word would spread around that the signs were right for the return of the *a'ai* and up to fifty canoes might be seen a mile or so off Avarua, most of them looking for baitfish such as *maroro* (flying fish), or *koperu* (big-eye scad). A dozen of these baitfish weighing close to 1/2 lb each would be enough, with perhaps a similar number to be chopped up for *paru* or ground bait. Each fisherman in turn would need 15 to 20 large basalt stones weighing between 5 and 7 lbs each. Some men would also take a number of large *au* leaves.

Fishing lines, formerly made by hand from a local fibre known as *oronga*, were the prized possession of the owner. Making such a line was generally a community effort and no one would think of losing such a line, whatever the risk of holding onto it.

When the canoes were paddling around the fishing area, the longboat would be launched from its thatched boatshed. Five or six strong master fishermen would row out to the ground, marked by well known cross-bearings ashore, with Makea at the steering oar.

The whole art of making a big catch depended on getting these rugged, independent fishermen, in their fleet of canoes, to work together under one leader. It was here that a man such as Makea played such and important role. He was perhaps the last of the great *ravakai* or fishing *taunga*, with the *mana*, or respect, of a community so dependent on the arts of the fisherman.

First he would take a look at the men assembled in their canoes. In fine weather there might be perhaps 50 canoes, yet as each rose and fell between the swells no more than ten or so might be visible at one time. A man not commonly seen on the fishing ground would perhaps be asked to pull over, and his gear inspected. Should it be an old line, long since stored in the thatch of a cook-house, or one too short or too weak to stand the strain of a big fish, a curt nod would send the offending man back ashore. Such a thing would never happen today. In those days fishing was a serious business in which only the elite, or recognised masters of the art, were allowed to participate.

The lines for yellowfin tuna were at least 120 fathoms long and were hand-wound into a large ball from which the line fed out from the centre. Two or three balls of line were needed when a large big-eye tuna or marlin was hooked and it was necessary to play and tire the fish before it could be killed.

Now the time having come to start fishing, the men would take a bait fish and pass a hook through it, each man favouring his own method, generally unique to a particular island.

Taking a large basalt stone in the left hand, the baited hook and leader would be laid on the stone. A handful of chopped *paru* would be placed over this and perhaps a large soft leaf to cover the lot. Then the line would be passed around the stone for about ten turns, the stone turned and another ten turns of line applied. With a quick flick of the wrist a loop of line was then formed and held in the teeth, then carefully tucked under the last few turns of line. So much depended on the tension of this slip knot; too loose and it would slip out long before the heavy stone had reached the chosen depth; a shade too tight and it would fail to slip when the chosen depth was reached. Lines were marked with coloured cotton at forty, sixty, eighty and one hundred fathoms. Between these marks, depths were measured by armspans. Quite often a school of tuna would be found below the 100 fathom level.

If fishing began well the leader would take charge and every canoe would watch for Makea's signal. Once a few fish were caught below the 100 fathom depth, he would signal and the next set would be released perhaps at 80 fathoms. If the school came up to feed at this level the signal would be made again and the set raised again. As long as the whole fleet worked together under one man's direction it was generally possible to bring the school of fish up to perhaps 40 fathoms. With plenty of *paru* the fish would continue to feed at this depth and it became quicker and easier to haul the fish, and big catches resulted.

Sad to say, today there are no more of the recognised fishing leaders who can keep a fleet working together. Once every man becomes a law unto himself there will be those who catch a few, and those who, not knowing at what depth the fish are feeding, will go down deeper. With the *paru* being released at all depths, catches naturally drop off.

Conditions of course varied a great deal with the weather. On very calm, glassy days when sound carried well across the water, men working in company shared a common experience and the humour is something that everyone remembers of such days.

When one man was lucky, each fish he caught was greeted with cheers and ribald mirth in the expectation that he would make a mistake and lose the next fish. Men whose luck was out and who had caught nothing were greeted with ample explanations as to why. The fun was endless.

As the wind freshened up the sounds soon became lost, and while any one man was hauling the next would try and estimate the depth at which he caught the fish. The former, in turn, would go through several ruses to confuse those he knew were counting his arm movements as he hauled.

Should the sea become rough, keeping station over the line and thence over the released *paru* became more difficult and it became impossible to stay over the ground by maintaining a sculling motion with a canoe paddle tucked under the left arm.

As the wind and sea increased it became necessary to wrap the line in a couple of turns around the right knee in such a way that on a strike the line would slip free. Many a man has wrapped the line too tight and a large fish has capsized the canoe and pulled the fisherman under before the line came free.

Handling a very large fish in a 14 foot outrigger canoe in a rough sea is something best learned from a tender age. As it became difficult to hold station it was usual to push any stones or fish forward in the canoe to depress the bow slightly. This allowed the canoe to point more easily into the wind. However, as the wind increased and the sea began to crest, it was very easy to have the outrigger either fly up or bury, causing a capsize.

If a large fish was hooked at this time, it was common for a nearby fisherman to haul his own line and paddle alongside the other canoe and hold the outrigger float to stop it capsizing.

Sometimes marlin were hooked that were far too big for any canoe to carry. It was then usual in Rarotonga for other fishermen to use their lines with a round bend hook and attempt to jag this into the marlin, watching their chance through a 'lookbox'. I once saw a marlin of 700-800 lbs brought ashore with four canoes all fast to it.

Anyone with an interest in offshore fishing around the tropical Pacific islands soon finds an incredible similarity between the fishing methods of Polynesians from the Tuamotu to the Hawaiian Islands — even to as far west, thousands of miles downwind, as the outlying atolls of Kapingamarangi and Nukuoro. One can only conclude that these techniques were perfected in some common homeland and carried with these nomads of the Pacific as they became separated.

In the days when Makea was a mighty man it was the custom to share food. Fish was not sold for money — even the man who was sent ashore with bad fishing gear would be sure to receive a part of the day's catch later.

A good fisherman had prestige and respect in the community. His financial status was unimportant. Even his fishing gear was regarded of such value that the community would assist with the more laborious tasks of preparing and maintaining it.

As more money became available and gear was bought and in turn had to be replaced with cash, so men became more money conscious and fish were sold. Today, with each man fishing on his own, seldom does the catch ever meet the demand.

When the Europeans first arrived in these islands, the population was estimated to be about ten thousand. They lived entirely on the produce of their land and their skills as fishermen. Now, with a population just about the same, over two million dollars is spent annually to purchase meat and fish from overseas.

The longboat is a relic of a past era; of a refined and highly specialised art that has all but disappeared. Wether those fishing arts will ever be seen again is doubtful. Nevertheless, I think that the knowledge of those days is worth preserving.

The author (right) with well-known Cook Islands fisherman Tekake Williams

FISHERIES DEVELOPMENT IN YAP

by

Lindsay B. Chapman
South Pacific Commission

Introduction and background

In mid-July 1984 the author first visited Yap to supervise a South Pacific Commission (SPC) Deep Sea Fisheries Development Project (DSFDP) visit, at the request of the Government of the Federated States of Micronesia (FSM). This project visit was to assess the potential for development of a deep water snapper fishery, as well as to construct, deploy, and conduct experimental fishing around, fish aggregation devices (FADS). The fisheries sector in Yap is the responsibility of two separate departments; Marine Resources (MRD) and Yap Fishing Authority (YFA). This visit project came under the control of YFA.

The YFA at that time had a new manager, Mr. Christer S. Friberg, who had been in the position for one year. The facilities consisted of a building which housed the office, a maintenance area, one 10 ton holding freezer (in very poor condition), and two small flake-ice machines which produced around 1 ton of ice per 24 hours. The vessels owned and run by YFA included two 30 GRT (Gross Registered Ton), confiscated, Taiwanese fibreglass longliners, one of which had engine trouble, and a 9 m diesel-powered, Yamaha fibreglass vessel which was given to YFA in 1980 under Japanese aid. The remains of several other 5-9 m boats that would never run again were also in evidence

In early March, 1988 the author was again assigned to Yap, to review the objectives and work plan for a newly-proposed DSFDP visit. YFA had just moved into its new US$ 4.5M complex. There were five YFA vessels fishing every day, and landing a high quality, iced catch for export to buyers in Guam and Hawaii. The FAD project was still operating, one FAD having been on station for three and a half years. A small boatyard, manufacturing fibreglass dinghies, was well established.

It was these developments in fisheries over the past three and a half years that prompted the writing of this article.

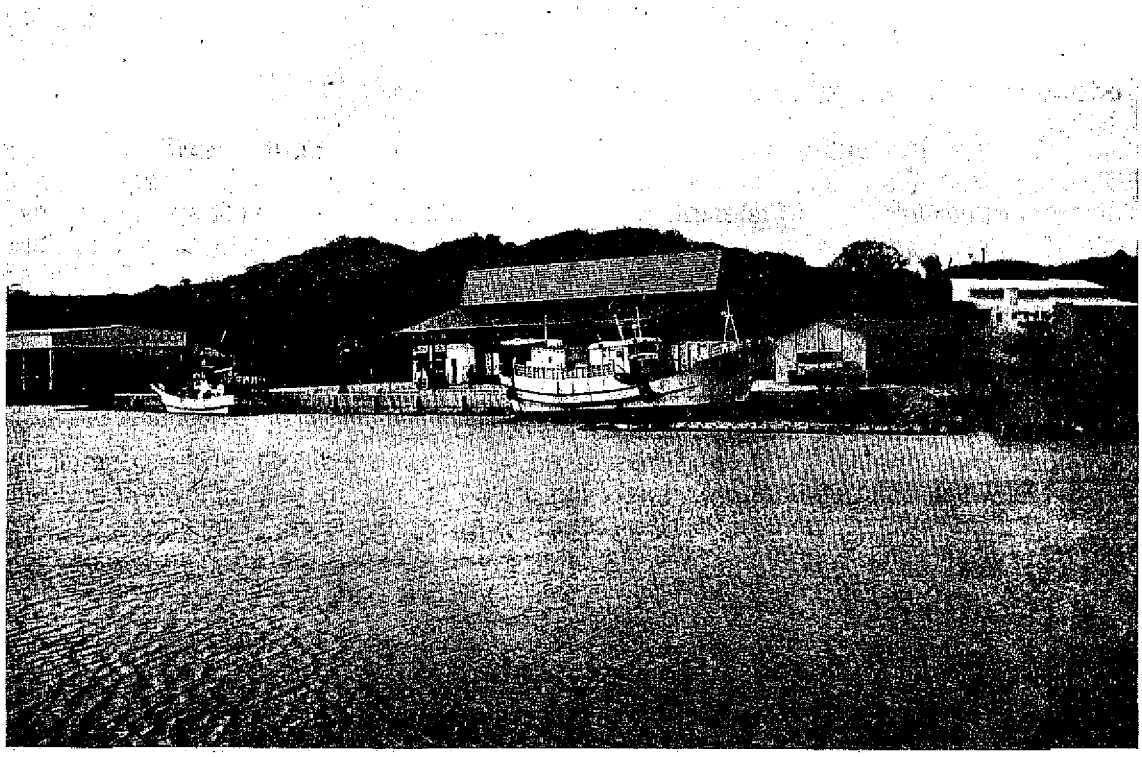
New facility

YFA moved into its new complex during February, 1988. The facility was funded under a Japanese aid package. It is obvious that careful planning and much thought went into the project at the early stages as each structure appears very functional and well-suited to its designed purposes.

The complex has a new 80 m concrete wharf frontage, with a 4 m depth of water at low tide; 20 m of the wharf is stepped to allow small craft to come alongside at any tide. Diesel fuel and fresh water outlets are located on the wharf for servicing fishing vessels. At one end of the wharf is a 13 m-wide, small-craft, concrete launching ramp of moderate slope. Next to the launching ramp is a 4-rail, multiple-carriage slipway, which is rated to pull out vessels up to 20 m in length, 6 m wide and weighing up to 30 t. During trials, a deadweight of 54 t was pulled by the winch gear with no apparent trouble. This would indicate that heavier vessels could be pulled out. The main factor limiting the slipway is that at half-tide, only vessels with a draft of 3 m or less can use it.

The main building, which is located in the middle of the wharf, approximately 20 m back from the water, houses the office, freezers and chillers, ice machines and processing area.

The office complex is located at one end of the building. Six staff work in this area; the manager, assistant manager, accountant, administrative officer, administrative assistant and a receptionist/typist. The office equipment includes 3 Apple II computers, and Telex and Fax machines, as well as typewriters and a photocopier. The computers are used for all accounting, and for data recording of catch and effort records. Even the weekly calculation of wages for all YFA's skippers and crews is handled by the computers.



Yap fisheries facility

The processing area, freezers, chillers and blast freezer, are located in the central area of the main building, with easy access to the wharf area, as well as access to the office. The layout of the processing area is very effective, with a 20 t chillroom operating at –2°C on one side, and two 5 t holding freezers operating at -26°C on the opposite side. At the far end of the area is an air blast, quick-freeze unit, which operates at -36°C and can freeze 250 kg of product every 24 hours. The processing area is well drained down the centre and has stainless steel tables and sinks. Fish are unloaded from vessels into large, wheeled plastic bins, which can hold approximately 500 kg of fish and brine. The fish in brine are then wheeled into the processing area where each fish is weighed. Export fish are individually tagged with their weight before being iced-down in the chillroom, to await packing four hours before flight time. Other fish are either processed and snap-frozen or held on ice to be sold wholesale to local retail outlets.

The remainder of the main building is taken up with ice production. A 50 t capacity block-ice storage chiller, which opperates at -5°C, is located next to the three block-ice machines. Each machine produces 50 x 50 kg blocks every 24 hours and has 10 compartments with five moulds per compartment. An overhead electric crane is used to pull one compartment (five moulds) and these are placed in a fresh water trough for several minutes to release the ice. From the trough the moulds are lifted to a rack and tipped so that the ice slides out and down a ramp to the entrance to the storage chiller, where the ice is stacked. The five moulds are then lifted by the crane, to a filling reservoir with five outlets, and all the moulds are refilled at one time before being placed back in the compartment. The ice set-up is designed so that only two people are required for its operation; one to work the crane and the other to stack the ice in the storage chiller. This process takes about eight minutes per compartment.

Next to the storage chiller door is an electric block-ice crusher and blower. Ice is taken from the chiller, slid onto a hoist platform and lifted to the top of the crusher, where it automatically falls in and is crushed. The crushed ice is gravity fed into the top of the 150 mm blower unit, which blows the crushed ice wherever needed, through a 150 mm reinforced flexible plastic hose. The hose can be moved from the processing area to the ice-hold of a vessel tied at the wharf. The capacity of the crusher/blower unit is 20 t of crushed ice per hour.

Packing fish for export

A second building, situated next to the slipway, houses the workshop, fishing gear retail store, outboard sales and service centre, and storage area. The workshop area is extremely well fitted out, with a hand-operated hydraulic press, drill press, testing equipment for both diesel and outboard engines, electric and oxy-welding equipment and a cleaning area to wash engine parts. There are several workbenches with vices, and a large selection of hand tools, including specialty tools for working on Yanmar diesel and Yamaha outboard engines. Three small portable generating plants allow power tools to be used on the slipway. Woodworking tools, such as a bench circular saw and timber thicknesser, are located in a different part of the workshop.

At the roadway side of the building is the gear store. This store sells new Yamaha outboard engines, spare parts for both Yamaha and Yanmar engines (those models sold or owned by YFA), and a large range of fishing gear. The storage area can also be used as a boat repair area and is large enough to house three 10 m vessels, side by side, so that maintenance can be carried out under shelter. At present this area also stores all FAD materials.

A third building which will be a storage shed for the use of YFA fishermen, is almost completed. The shed will be divided into separate lock-up areas, so that each boat skipper will have an area in which to store his vessel's gear. The remainder of this shed will be used for general storage.

Fishing vessels and fishing activities

At present YFA has 5 of its own vessels supplying iced fish to the complex. These are:

a) *F.V.Mgerger* — a 9 m, Yamaha fibreglass vessel powered by an AA30F diesel inboard engine, with a conventional propellor/shaft drive. This vessel has a top speed of 7.5 knots and has been in operation since 1980. Equipment includes trolling booms, two hydraulic dropline reels and two modified Samoan-type handreels.

b) *F.V.Taguw*, *F.V.Garngab* and *F.V.Dabar* — 8 m, Yamaha fibreglass vessels powered by Yanmar DE28-ZN diesel inboard engines connected to SZ160 stern-drives. These vessels have top speeds of 25 knots. Two have been in operation since early 1986, the third since early 1987. Each is equipped with trolling booms and three modified Samoan-type handreels.

c) *F.V.Mailap* — a 16 m, Yamaha fibreglass vessel powered by an AA52F diesel inboard engine, with a conventional propeller/shaft drive. This vessel has a top speed of 15 knots and has been in operation since mid-1987. It is fully equipped for pole-and-line tuna fishing; although this gear is not used at present. Equipment includes trolling booms, four hydraulic dropline reels and one electric dropline reel.

All the vessels are equipped with large ice-storage holds. The 16 m vessel also has a deck-mounted brine tank. Light handlines are also carried on all vessels for shallow water fishing. The four smaller vessels fish around Yap proper, the FADS anchored off Yap, and a shallow bank approximately 20 miles north of Yap. The 16 m vessel fishes grounds further away, such as Ngulu reef and Sunken Shoals near Ulithi atoll, as well as around Yap proper.

Payment for all skippers and crews on YFA vessels is based on the individual vessel's catch. This means that no wages or retainers are paid to fishing staff. Payment is usually based on half the catch, the other half being retained by YFA to cover all running, ice, and maintenance costs. The sharing of this payment depends upon the number of people on the vessel, with the skipper getting a higher percentage than crew members.

Three main fishing techniques are used by YFA vessels: trolling, droplining (both shallow and deep water), and mid-water fishing (ika shibi and drop stone). Catches taken during the months January 1987 and January 1988 are summarized in Table 1. A total of 36 795 fish was taken for a round weight of 85 627.7 kg. The majority of this was high quality, of export standard — although not all of this fish was exported due to a shortage of cargo space on the three flights per week out of Yap.

The total catch of fish for 1987 was worth US$ 150 000, with more than US$ 100 000, of this coming from export earnings. Prices obtained for export fish varied according to species, size and market demand. Most export fish was sold to Hawaiian Fish Distributors in Hawaii and the remainder to markets in Guam and Saipan.

TABLE 1. Catches for YFA vessels

Month/Year	Trolling catch		Dropline and mid-water catch	
	Number	Weight	Number	Weight (kg)
January 87	200	1326.6	1521	7493.6
February 87	136	733.2	2176	6280.5
March 87	750	3325.1	2534	4682.8
April 87	818	2986.4	3911	1801.8
May 87	737	2014.0	4490	2673.0
June 87	95	306.0	1846	1480.1
July 87	68	417.9	2116	3525.2
August 87	253	852.2	1800	8252.0
September 87	239	1103.4	2505	4848.5
October 87	1017	1504.3	2095	5216.0
November 87	1180	4220.5	2385	3298.0
December 87	436	2459.2	1266	6162.5
January 88	1503	6329.0	718	2335.9
TOTALS	**7432**	**27577.8**	**29363**	**58049.9**

FAD programme

YFA's FAD programme started in 1984, when materials for 15 complete systems were delivered. These materials were purchased by the Yap Community Action Programme (YAPCAP) with funds obtained from the Pacific Fisheries Development Foundation (PFDF). The author supervised the construction and deployment of the first five systems and trained YFA staff in these procedures. The design used for construction was the recommended SPC design, as illustrated in *SPC Handbook No. 24*. After the departure of the author in March 1985, YAPCAP supervised the project. In early 1987 YFA took charge.

To date, 13 FADS have been deployed in Yap state, with three still on station. The first FAD deployed has survived the longest. Others have had much shorter life spans, one not lasting even a month. It was noted in a report from YFA to the funding body, PFDF, that human error accounted for some losses between early 1985 to 1987. FADS were deployed with the polypropylene rope to the surface, instead of the nylon rope. Table 2 summarises FAD deployments to date.

These devices have greatly increased catches of pelagic species in Yap. Prior to their introduction, trolling activities were confined to the reef or the occasional school of tuna spotted near the coast. Now, vessels regularly go straight to the FADS and spend the majority of fishing time there. When weather conditions are too rough to conduct deep-bottom fishing, the YFA vessels concentrate on trolling, especially around the FADS. The YFA is now hoping to utilise these devices further by introducing new fishing techniques such as vertical longlining and drop stone/palu-ahi fishing. It is hoped that further interest and fishing effort will prove these systems a commercially viable proposition.

TABLE 2. FADS deployed in Yap State 1984 to 1988

Number	Location	Depth (Fathoms)	Distance from Reef	Deployed	Lost
1	Tomil	600	4.5 miles	Aug/84	On Station
2	Delipebinaw	700	2.0 miles	Sep/84	Nov/84
3	Map (west)	650	2.5 miles	Sep/84	Dec/84
4	Gilman	600	7.0 miles	Sep/84	Oct/86
5	Map (north)	650	2.5 miles	Feb/85	Aug/85
6	Ulithi	600	*	Mar/85	Apr/85
7	Rumung	600	2.5 miles	Apr/85	Aug/85
8	Ulithi	600	*	May/85	*
9	Fais	600	2.0 miles	May/85	Jul/85
10	Satawal	600	*	Jan/86	*
11	Rumung	*	*	Aug/86	Aug/86
12	Gilman	600	7.0 miles	Jan/87	On Station
13	Rumung	700	4.0 miles	Oct/87	On Station

* (not available)

Fibreglass boat building project

In March 1985, the Yap Department of Resources and Development acquired the services of a United Nations Volunteer, Mr S.U. Kaluarachchi from Sri Lanka, to set up a fibreglass construction project. This was a two-year project. At the end of that time the project was running well, and the volunteer was given a government contract for a further two years. The first six months of this project, to September 1985, were spent in writing up a work plan, locating overseas suppliers for materials, ordering these materials and waiting for their arrival. The first work undertaken was to repair many damaged fibreglass dinghies from Yap proper, as well as several from the outer islands. Interest was also shown in fibreglass water catchment/storage tanks; to date more than 50 have been constructed.

In October 1986 the first new boat mould was completed. This was for a 5.5 m dinghy with moulded fibreglass decks, built-in live bait tanks, and a built-in ice box.

This complete unit, without outboard, sold for US$ 2 350. Only five of these vessels have been constructed to date, the cost apparently being too expensive for the local people.

In November, 1987 the second new boat mould was completed. This was for a 4.5 m dinghy — supplied as a basic craft with no extras. This vessel proved much more popular on the local market and, in the first four months, six of these craft were completed and sold. Orders have been taken for a further 16 of these craft, which indicates the popularity of this vessel. The selling price of this boat, without outboard, is US$ 1 250 — much more within the price range of the local people.

On 1 March, 1988 the fibreglass project was handed over to private enterprise. Mr. Kaluarachchi will stay on as manager for one year. In that time it is hoped that a third new boat mould will be completed, for a 5 m craft in which the public has shown interest. In addition, a fibreglass version of a traditional Satawalese canoe has been constructed. If this canoe proves acceptable to the Satawalese, and orders are placed, then a mould will be constructed to fulfil these orders.

To date the fibreglass project has proved very successful. It has constructed more than 50 water tanks, and has repaired more than 60 small craft, as well as building the new craft mentioned above. With orders outstanding for the 4.5 m craft, as well as public interest in a new 5 m craft, future success seems assured.

Other areas of fisheries-related development

Three additional projects are underway which are related to the development of fisheries in Yap. These are:

Colonia marina

At present construction is underway on a US$ 700 000 marina, designed to berth 70 small craft and yachts. The complex will include a seafood restaurant and a dive shop.

West harbour development

Work has been underway for several years on this project. The aim is to dredge a channel from the shore to a natural reef passage to create a boat harbour. The dredging is about half-completed, with a launching ramp and a boat shelter fully-completed.

Reef and channel markers

A programme to mark all reef passages and waterways around Yap proper was initiated during 1986. The object of this programme is to improve navigation for small craft, particularly during night hours.

The fisheries sector in Yap is the largest and fastest growing area of the Government's overall development for the State. If the present rate of expansion can be maintained, with the same high quality of production, then the Yap fishing industry can look forward to prosperous years ahead.