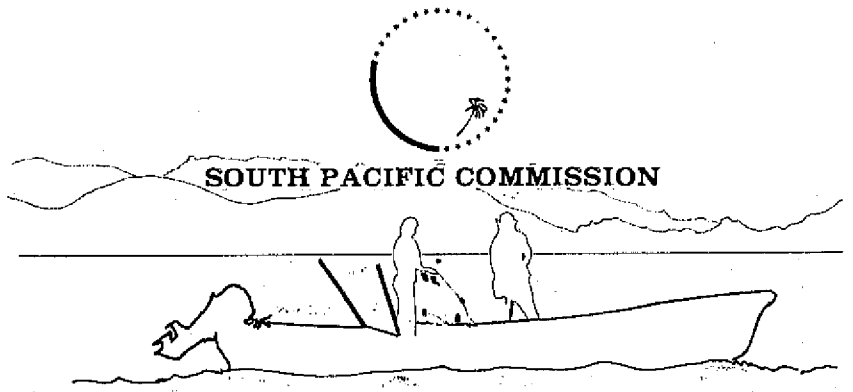

FISHERIES NEWSLETTER

NUMBER 47
OCTOBER — DECEMBER 1988

Contents

Original text: English

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SPC ACTIVITIES

DEEP SEA FISHERIES DEVELOPMENT PROJECT NOTES

Truk — Federated States of Micronesia

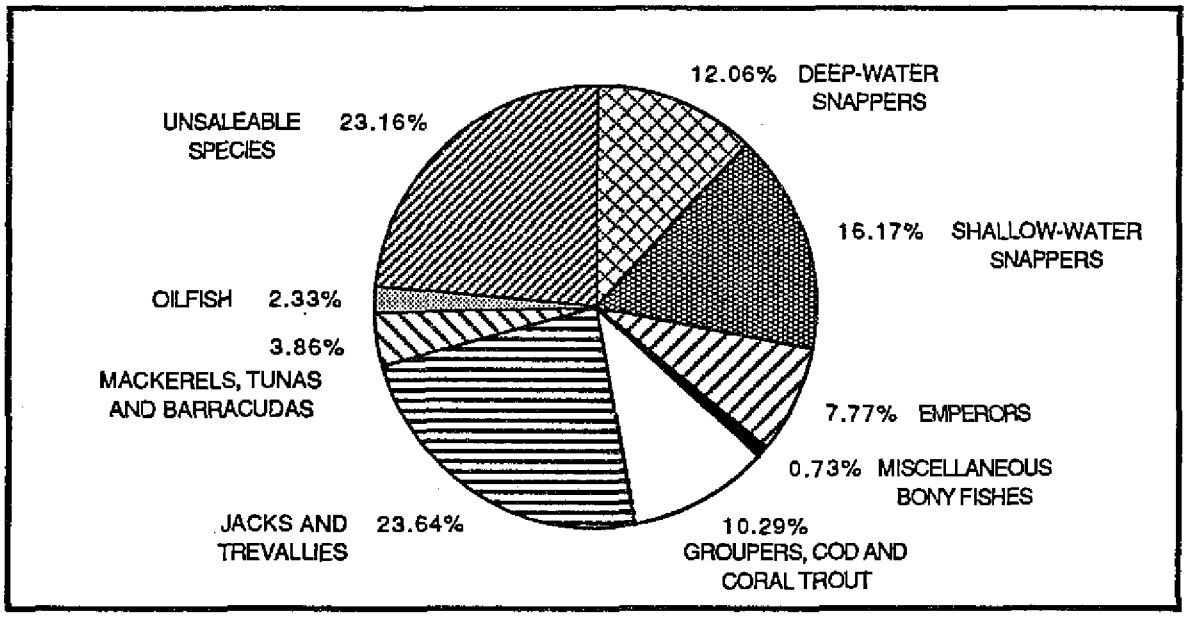
SPC Masterfisherman Lindsay Chapman completed a five-month assignment to Truk State, Federated States of Micronesia, in the third week of October (see *SPC Fisheries Newsletter* # 46), having conducted twenty-nine fishing trips along the outer reef slopes of Truk lagoon and four at Ruo Island in the Hall Group.

The major fishing activity was deep-bottom droplining with baited, multiple-hook terminal rigs which were lowered and hauled using FAO/Western Samoa-design wooden handreels; the aims being to survey the extent of deep-bottom fishing grounds, to assess their potential productivity, and to train local fishermen in the use of effective gear and techniques with which to take advantage of exploitable deep-bottom resources.

The Project's total landings amounted to 2,354 fish, with a combined weight of 5,155 kg, of which a little more than 76 per cent was of saleable species. Preliminary evaluation of catch records indicates catch rates of 3.8 kg per reel hour around Truk lagoon and 5.2 kg per reel hour on little-exploited grounds at Ruo Island. The unsaleable portion of landings mostly comprised sharks, which, Lindsay reports, were regularly responsible for significant losses of prime bottom fish and gear.

A report of this visit is presently in preparation. It will provide an assessment of the potential productivity of the areas surveyed and include recommendations to assist development and management of the deep-bottom resource.

The graph below represents the species composition of the deep-bottom handreel catch. Fish have been grouped on the basis of species taxonomy, habitat association, and recognisable concurrence in catches.



Species composition of the deep-bottom catch from Truk and Ruo

Territory of Wallis and Futuna

Consultant Masterfisherman to the Deep Sea Fisheries Development Project (DSFDP), Pale Taumaia, was assigned to the Territory of Wallis and Futuna for six months from August 1988, following a request by the Territorial Administration for assistance in promoting diversification in local fishing effort, particularly to provide training in deep-bottom droplining along the outer reef slopes.

Pale was selected to undertake this work due to his previous experience in the Territory and, not least, his ability to communicate with local fishermen in a Polynesian *lingua franca*.

From the outset the training programme was organised at community level, in consultation with the Service de l'économie rurale and the council of traditional leaders, *Te Kau Aliki*. It was decided that Pale would work successively with fishermen from each of the three districts on Wallis, beginning with 16 fishermen in Hahake District. Shore-side gear rigging and discussion sessions were held first and then training at sea commenced.

By the time Pale began working with fishermen from the next district, Mua, interest and enthusiasm had grown to the extent that 50 fishermen enlisted in the programme. In addition, at the suggestion of community leaders concerned that the youth of Wallis should be made better aware of the opportunities for useful employment offered by fishing, a meeting was held with local education authorities, who agreed to release secondary school students to participate in the training programme, both ashore and at sea. From then on, two or three senior students were regularly included as crew on fishing trips.

By the end of December Pale had commenced work in Hihifo District, with 52 fishermen scheduled to join training trips, and a request from the Administration that his visit be extended if possible. The Project is due to transfer to Futuna, some 120 nm south-west, in January, 1989.

Saipan — Commonwealth of the Northern Mariana Islands

A boom in tourism in the Northern Mariana Islands, which last year saw some 194,000 visitor arrivals (75 per cent from Japan), has created an unprecedented demand for fresh, premium quality fish, particularly the deep-water snappers and other bottom fish which the restaurant and hotel trade likes to feature — a demand which the local troll-based fishery can't supply. Some local dealers have recently turned to importing bottom fish from neighbouring states; the largest fish market in Saipan has recently been importing around 1,000 kg of fresh fish a week from Palau and Truk.

This situation is of concern to the Northern Marianas Division of Fish and Wildlife, which believes that the Commonwealth may well have exploitable stocks of the sought-after bottom fish but that local fishermen have not devised effective means of capturing them. As a result, a request was made to the DSFDP for the assignment of a Masterfisherman who would survey the extent and productivity of local deep-bottom grounds and demonstrate effective fishing techniques to local fishermen.

SPC Masterfisherman Paxton Wellington was assigned to this programme, arriving in Saipan in September. Unfortunately Paxton has experienced considerable difficulties in fulfilling the assigned work programme, including the breakdown of fishing craft, a reluctance on the part of local fishermen to diversify from their favoured troll fishery, and the onset of particularly bad weather.

During fishing surveys conducted so far, Paxton reports, deep-bottom grounds close to Saipan have not been very productive, but there are indications that offshore banks and shoals may give better results. He is presently hoping for a break in the rough weather to fish these areas more extensively.

INSHORE FISHERIES RESEARCH PROJECT

Beche-de-mer Resource Survey, Vanua Levu, Fiji

Beche-de-mer, a dried seafood product derived from sea cucumbers (holothurians), has been an export product of Fiji for at least 200 years, and probably much longer. The product is non-perishable and the fishery is one of the few income-earning activities based on marine products that rural producers can participate in without the need for refrigeration and other infrastructural facilities.

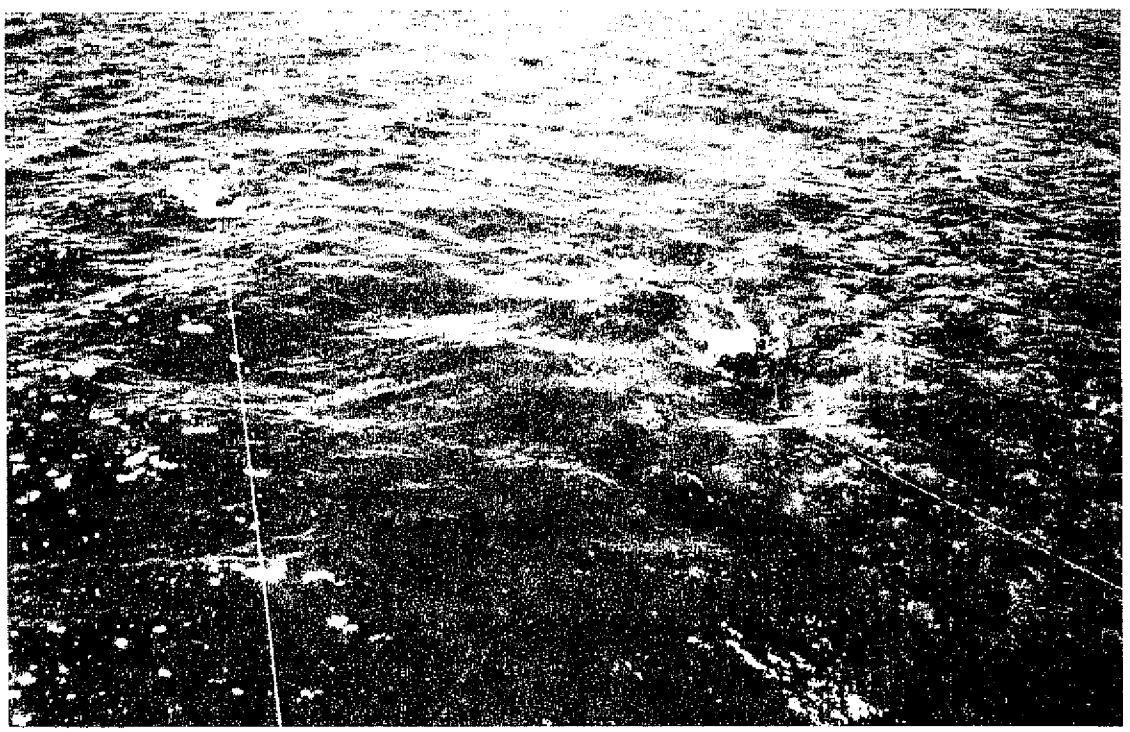
Fijian counterpart officers Manasa Tumuri and Apisai Sesewa search for beche-de-mer juveniles at low tide.

Fiji's beche-de-mer fishery has undergone a boom recently because the South-East Asian import market has begun to accept traditionally low-value sea cucumbers. Fijian beche-de-mer production rose from some 32 t (dried weight) in 1982 to over 600 t in 1987. This is equivalent to 6,000 t wet weight, which exceeds the combined weight of all other Fijian seafood production, including the catch of the industrial tuna fishing company. Ninety-five per cent of the harvest consisted of a single species, *Actinopyga miliaris,* which had not been previously exploited to any great extent.

The growth in the fishery led to concerns on the part of the Fiji Fisheries Division (FD) as to the sustainability of harvests at this level. As a result, the SPC Inshore Fisheries Research Project (IFRP) was requested to provide assistance for a survey aimed at establishing basic biological and fishery information on this unstudied species.

The survey took place during five weeks in November/ December 1988, and involved the IFRP Senior Scientist, a counterpart from Papua New Guinea, six Fijian Fisheries Officers, and the eight man crew of the FD Research vessel *Tui-ni-Wasabula*. One week was spent collecting harvesting and export statistics from beche-de-mer traders in Suva and Labasa, after which two weeks' field survey work was carried out in the northern lagoon of Vanua Levu, one of two main harvesting areas. The *Tui-ni-Wasabula* was used as a mother ship, while actual surveying was done using three smaller boats and four pairs of divers. As well as collecting baseline information on the abundance, habitat preference and population structure of *A. miliaris*, it was possible to compare several different survey methods and define the most useful combination for future, long-term monitoring work.

As a result of the survey, it was possible to recommend management approaches for this fishery. The main recommendation, the establishment of a seafood exporters association in which beche-de-mer exporters are obliged to participate in order to obtain export licenses, was implemented before the end of 1988. Follow-up work and further monitoring was also recommended but due to the departure of key FD personnel this has not so far been instituted. Beche-de-mer samples were despatched to overseas specialists for verification of their taxonomic identity, and in the meantime an incomplete draft report of the survey was forwarded to FD, and to outside reviewers, shortly after the survey completion. Report finalisation will be completed as soon as the results of the taxonomic examinations are received.



Manta-towing, one of the methods used in the Fiji beche-de-mer survey.

NEWS FROM IN AND AROUND THE REGION

COCONUTS CRABS THREATENED IN VANUATU
(Source: *Pacific Sunrise*)

The coconut crab of Vanuatu is one of the nation's most important natural resources, providing tourists with a much sought after delicacy, and income to the country of A$ 0.5 million every year. However, according to Dr Fletcher, an Australian scientist who has spent three years in Vanuatu, the supply of coconut crabs is being threatened by over-exploitation.

Coconut crab is featured on the menus of many of Vanuatu's restaurants and hotels and is considered to be a major attraction for tourists. Captured crabs are force-fed at restaurants and their stomachs yield an extremely palatable meal, while a paté-like substance can be extracted from the abdomen, which is used as a food reserve when the crab sheds its shell.

'Fight for life'

Coconut crabs weigh about 4 kg when fully grown. Thirty years ago they could be found in abundance throughout the islands of Vanuatu, but these days they are only found in large numbers in a few of the northern islands. Last year, up to a tonne of crabs was being shipped each week from Vanuatu's northern Torres Islands to the capital, Port-Vila.

The Banks/Torres Local Government Council recently expressed concern that the crab population was being rapidly depleted by the level of exploitation and requested an investigation by the Fisheries Department. The Department immediately imposed a three-month ban on the sale of crabs from these islands while control measures were developed.

Dr Fletcher was involved in the investigation programme, which was funded by the Australian Centre of International Agricultural Research. However, he says the control measures have only been partially successful. 'The coconut crab's future is by no means guaranteed. What is required is co-operation from the people who actually collect the crabs. It is in their own interest

to maintain a healthy population of crabs. In these remote northern islands, the sale of coconut crabs is virtually their only form of income.'

The breeding cycle of the crab does not permit successful farming on a large scale and the industry can only be preserved if the crabs are allowed to breed successfully in their natural environment. Since the crabs take approximatively 15 years to mature, it is essential that adequate controls and careful management be instituted if the crab meat industry is to survive.

SOLOMON ISLANDS REVIEW FISHERY STATISTICS ACTIVITIES

(Source: Solomon Islands Ministry of Natural Resources)

In August/September 1988, the Solomon Islands Fisheries Division commissioned a review of its fisheries statistics programme, in order to identify strengths and weaknesses in the present system of data collection, improve coverage (especially in the subsistence and artisanal sectors) and define the main present and potential users of and uses for the data generated. The review, funded by the FAO/UNDP Regional Fisheries Support Programme, was carried out by an Australian consultant, John Cook.

The review notes that fishery statistics in Solomon Islands focus on three separate areas: tuna catch and effort data, based on logsheets from fishing vessels; data on the activities of fisheries centres in each of Solomon Islands' provinces; and data on fish trade, including exports.

The review considers that the present system for analysing tuna catch and effort data operates satisfactorily. Minor improvements could be made in the data processing area through the streamlining of data entry and the elimination of duplication in recording bait fish catches. The practice of returning summary data to the fisheries companies should be resumed and discussions initiated to define whether further analyses of the database material would be helpful to them.

Collection of data on the activities of the provincial fisheries centres was reviewed, and the report suggests that this be discussed in detail at the next Solomon Islands fisheries officers' annual meeting. As a bare minimum, a system of monthly reporting from provincial fisheries centres should be reinstated.

Data on Solomon Islands fish trading are provided to the Fisheries Division by the Statistics Office, and changes planned by the Statistics Office for the classification of goods and the computerisation of trade statistics should allow the Fisheries Division to rely on this data in future, and therefore to cease conducting analysis itself. The present system of collecting export data from marine produce exporters by Fisheries Division should be discontinued, as it creates unnecessary work for the people providing the data as well as duplicating the work of the statistics office.

The planned conduct of a national agricultural survey in 1990 represents a unique opportunity to collect baseline data on village fisheries. The inclusion of the fisheries sector and participation of the Fisheries Division in the survey have been agreed to in principle by the participating organisations. Details of the survey have yet to be finalised, but it is expected that it will be a random stratified interview and product-weighing sample survey, based on clusters of households. Prior to the survey, the Fisheries Division will have to undertake a range of preparatory activities, including the definition of fishing regions and the development of survey and species classification systems. This is presently under way.

Once the field survey has been completed, a monitoring programme, comprising regular return visits to a sub-sample of villages to conduct fish-weighing surveys, will be needed. The information generated will enable fisheries department to monitor trends within the fishing industry in the light of predicted seasonal and inter-year variations in the landings of fish and marine products. Catch and effort data will be supplemented by biological information, especially length frequency data, initially from fish sold through Honiara fish market or caught

in fishing competitions. Once the system is operating smoothly and analytical capacity is established, it will be extended to provincial centres.

FADS: NEW FISH LURE
(Source: *Fiji Times*)

The Fisheries Division of the Ministry of Primary Industries, Fiji and the Institute of Marine Resources (IMR) at the University of the South Pacific (USP) have deployed fish aggregating devices around Fiji waters as part of research into new fishing methods.

The devices, commonly known as FADs, have been designed to attract fish into the area near where the FADs have been deployed.

Mr Hugh Walton of USP said that the project has been beneficial to the IMR and the Fisheries Division, training students in the University's Diploma in Tropical Fisheries Course and providing a fishing zone for fishermen. He said although IMR felt they had done a good job, feedback from fishermen would be useful. Mr Walton would appreciate information from them on the number and size of fish they catch, because they are catching about F$300 worth of fish per day around some of the FADs.

During 1988, the Fisheries Division and the Institute of Marine Resources have worked together to build and deploy the FADs. The IMR has provided a vessel while the Fisheries Division provided hardware and equipment necessary for the FAD construction.

Fishermen can pick up catch forms from the Fisheries Division or the IMR. The forms will help to determine how successful the FAD programme has been.

DRINKING FISH BLOOD TO SURVIVE
(Source: *Marshall Islands Journal*)

Two Kiribati islanders survived 32 days adrift in a small boat by catching fish and drinking fish blood. Iaria Maurerere, 32 years old, and Sera Toaea, 28 years old, were picked up by a South Korean cargo ship after drifting 1,500 miles.

The pair's ordeal began when they took three men on a six hour trip to a neighbouring island. They set off from Tarawa in a 28-foot fibreglass open boat with an outboard motor. The motor broke down on the return trip and they could not repair it.

The men had only a basket of taro, some coconuts and drinking water. They ran out of food after nine days and water after eighteen days. To protect themselves from the sun, they fashioned a shelter using interior floor boards and trolling line.

The two passed their time fishing, sleeping and swimming. They ate the fish raw and recalled reading about others surviving the sea by sucking blood from the tails of fish.

YOUNG WOMEN'S INVOLVEMENT IN FIJI FISHERIES
(Source: *Fiji Times*)

Fishing often appears to be a male-dominated activity. However, though many fishing projects for youth are dominated by males, one must also realise the important role young women play in building up Fijian fisheries industry. Taking an active part in many agricultural activities, as well as seeing to their daily chores, young women have also contributed greatly towards increasing family incomes by engaging in fishing activities.

Harvesting of molluscs and crustaceans (freshwater and marine clams, prawns and lobsters) is one of the outstanding examples of their involvement. Freshwater clams are almost exclusively harvested by women. Although most of these women are mature, they are always assisted by many youth workers from the villages.

Whilst the majority engage in the harvesting of *kai*, others get involved in activities more usually carried out by male youths. These include: catching of salt-water bivalves; trap-fishing for mangrove crabs; and netting or spear-fishing for prawns and other marine resources.

In addition, much of the processing, marketing and other on-shore work of the fishing community is done by women — smoking of fish, mending of nets, extraction of trochus meat, cleaning, smoking and grading beche-de-mer for sale, and, last, but not least, patiently sitting in markets to sell the catch.

Many women's fishing groups have a large number of members who are in the youth age group. These include:

— The **Toga Women's Fishing Group** in Rewa, which comprises three villages — Navatuyaba, Muana and Vunisei. There are some 30 members, of whom 15 are young people. The group specialises in harvesting of freshwater mussels (*kai*), catching some 30 tonnes (valued at F$20,000) per year. The Toga and Rewa river *kai* are sold in the Suva, Nausori and Davuilevu *kai* -selling centres by these women, and the market has been extended to the islands of Lomaiviti. The people of Koro are among the biggest consumers and an important market for the group, and *kai* are also sold to middlemen, who usually turn up at the villages every week. Harvesting of freshwater *kai* requires no sophisticated equipment. The women spend most of their time staying in shallow water diving for *kai*. One day's catch usually fetches more than F$20 in the market.

— A **women's fishing group in Urone**, Vanuabalavu, which altogether has 18 members, of whom 10 are young women. Net fishing is their main activity, while some non-fish sea-food (lobsters and octopus) are also caught by using traditional trap methods. Seashells are harvested by these women and sold to markets in the Suva area. The group has now acquired a punt to increase its fishing activity. One of the youth members who attended the Rural Fisheries Training Programme for women organised by the Fisheries Division at Lami is currently sharing her knowledge and teaching the other members of the group maintenance of the outboard engine and other basic engineering. The group is also actively involved in community work, making charcoal stoves for the village women and contributing cash to the Church.

Other than the fishing ventures carried out by women belonging to youth groups, there are many women who are now involved in the fish processing industry. The Pacific Fishing Co. Ltd. alone employs some 500 women, of whom the majority are young. The seaweed industry has also attracted many women; some are starting seaweed farming as a possible income-generating venture. Seaweed farming is a simple operation, but requires constant attention and sound management techniques for greater returns. Women's involvement in small scale fisheries also appears likely to continue to grow. The recent introduction of a training programme by the Fisheries Division has had a positive effect and has not only led women to continue with small-scale fishing but has encouraged them to fish on a larger scale. The three-week training programme, organised by the Division and funded by FAO/UNDP, provides fisherwomen with knowledge on the use of various fishing gears, law enforcement, fish preservation, handling and marketing, seaweed farming, and other fisheries-related activities.

So far four training programmes have been organised, each of three weeks duration, in the years 1986, 1987 and 1988. Follow-up training was organised during 1987 for participants

from 1986 and more follow-up programmes are planned for the future.The number of women trained so far totals 39, the majority of them young. By the end of 1987, the fisheries sector had an estimated subsistence involvement of 20,000 people, of whom the majority were women. Most of this involvement was in harvesting molluscs and crustaceans.The second largest employment for women has been in the industrial sector (PAFCO, other fish processors such as button factories and beche-de-mer processors, seaweed farming and shell collection).

SEA CUCUMBER STUDY

(Source: *Marshall Islands Journal*)

Federal funds have been approved to study sea cucumber fishery development in Micronesia and the feasibility of a dry dock vessel support facility, according to a release from the Department of Commerce.

The proposals were submitted to the Pacific Fisheries Development Foundation, a non-profit fisheries organisation, and approved by the National Marine Fisheries Service with funding of US$ 73,076, according to the release.

The sea cucumber study will include a population survey, the development of mariculture, natural products research and preparation and marketing technology.

PRIVATE FARM UNDER PRODUCTION IN GUAM

(Source: *Pacific Daily News*)

Fresh-water shrimp are a delicacy that Jose Champaco can't seem to grow enough of in his shrimp pond in Merizo, Guam. The pond, originally owned by his neighbour Jose Baza, was recently taken over by Champaco and Manuel Ungoco. Champaco is assisted by Ungoco's son Ben in working the pond.

Fresh water is pumped into the pond from a spring used by the families since before World War II, according to Champaco.

A pump-house will supply spring water to three other ponds that have been dug, although two of them leak and will have to be rebuilt.

The biggest problem is getting enough young shrimp from the University of Guam's College of Agriculture, according to Champaco. Nevertheless this arrangement is much better than his previous practice of bringing the shrimp from Hawaii, at which time he typically lost about 25 per cent of the shrimp during shipping.

Champaco stocks the pond with about 18,000 shrimps 'seeds', about an inch long. The shrimp grow to the best-tasting size after four to five months on Guam and would take about seven months in Hawaii to reach the same state, since Guam's climate is better for aquaculture. Shrimp seed costs about US$ 30.00 per 1,000, with a 10 per cent mortality rate. The shrimps sell for US$ 7.00 per pound, with 17 of the four-month-old shrimps or 16 of the five-month-old shrimps per pound.

BIG FISH INCOME FOR MARSHALLS

(Source: *Guam Business News*)

According to Marshall Islands Government fisheries statistics, the island chain earned more than US$ 900,000 last year from its fishing treaty with Japan. It was the third year in a row that the Republic had made more than US$ 900,000 from the treaty, which went into effect in 1984.

Large yellowfin tuna and bigeye tuna, both used by the Japanese primarily for sashimi, make up 95 per cent of the catch of more than 4,000 metric tons per year.

The benefits of a Pacific-wide tuna treaty signed with the United States in 1988 are also starting to flow to the Marshall Islands and other countries.

In December 1988, the Marshalls were granted US$ 54,000 to renovate their dilapidated fishing co-operative, including addition of a flake ice machine.

Steve Muller, director of the Marshall Islands Maritime Resources Authority, said that the flake ice has assisted local markets in displaying fish for sale and keeping the catch fresh.

The grant, from the Forum Fisheries Agency, was one of the first to be made from the U.S. Treaty proceeds for small-scale fisheries projects in the region. The United States pays the agency US$ 10 million a year to allow U.S. tuna vessels access to the region. The US$ 10 million includes a special US$ 1 million fund provided by the U.S. Agency for International Development to assist fisheries projects. Each island bids for the funds in a competitive selection process.

A small percentage of the remaining US$ 9 million is divided equally among all 16 Pacific member nations. This brings an additional US$ 98,000 to the Marshall Islands, regardless of whether or not American fishermen catch fish within the Marshalls' 200-mile zone.

GIANT CLAM BUSINESS IS GOOD

(Source: *The National Union*)

The development of the first commercial giant clam farm in the world holds promise for establishing a whole new industry in the South Pacific, especially in some of the smaller countries with extensive shallow lagoons, according to a company in Australia.

The company, based in Cairns, has expressed interest in duplicating its farming techniques in some of the Forum Island countries.

The *Pacific Sunrise* newsletter of Sydney said that there was an increased commitment to developing new industries in the Pacific Island countries. A survey on the world market for clam meat revealed that there was quite a substantial market — in fact, over 100,000 tons of meat per year, most of it in minced meat form. Therefore as a commercial development there is certainly potential not only to create employment, but also to earn export income.

Interestingly, one of the side effects of the farming is the release of spat to local reefs. This resource could be successfully utilised so that the local fisheries departments would obtain spat from the farm and develop a programme of placing the juvenile animals back on the depleted reefs, said *Pacific Sunrise*.

A tremendous amount of preliminary work has been carried out on the biological aspects of raising the clams commercially and the design of equipment. An example is the Micronesian Mariculture Demonstration Centre in Palau, which has a programme of training people from island countries and then delivering spat to them for replenishing reefs. This operation is being duplicated in other Pacific Island countries.

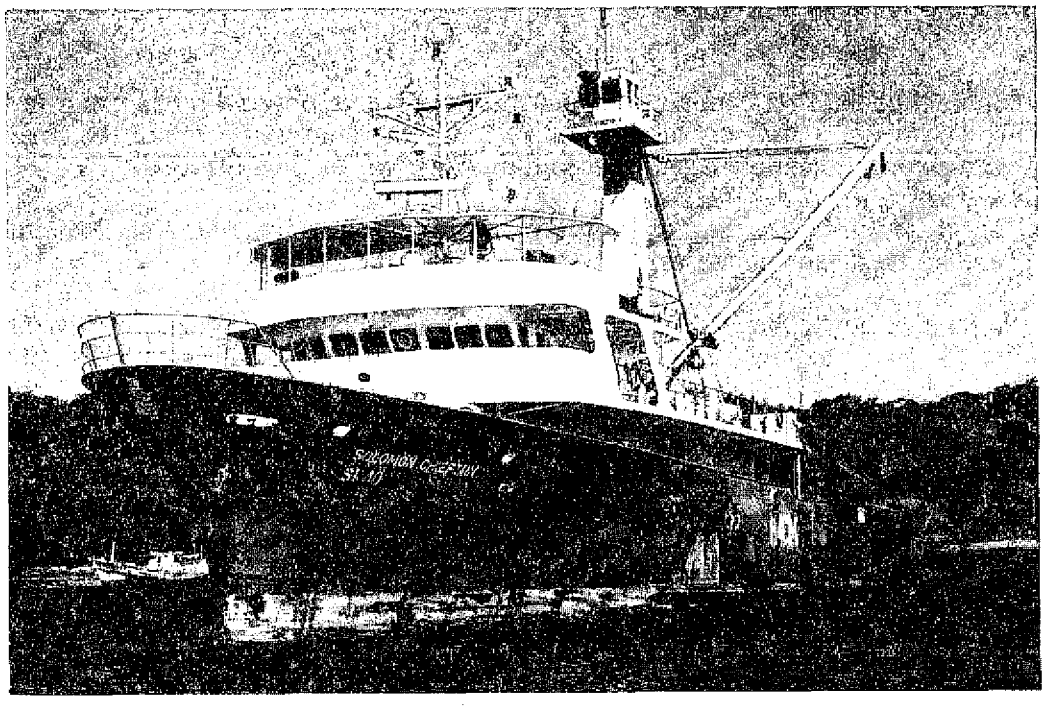
Markets for the giant clam meat include a relatively small and well developed market which pays a premium price for the adductor muscle of larger animals in Taiwan, Hong Kong, Singapore and probably China. Another market is the United States, where in 1986, 78,000 tons of minced clam meat were used. Finally, the third market and perhaps the largest and potentially most profitable of all, is the market for sashimi in Japan.

The clams have to be grown in shallow lagoons, which limits the potential in some countries, and there are still technical problems to overcome. However this is certainly a promising industry for some of the Pacific Island countries, the newsletter concluded.

SHIPBUILDER EXPECTS DEMAND FOR TUNA PURSE SEINERS
(Source: *Samoa Observer*)

One of Australia's leading shipbuilders expects the growing demand in the Pacific Islands for its purse seiners to have a major impact on the region's economy. Australia Shipbuilding Industries (WA) Pty Ltd has already built two tuna purse seiners for Solomon Islands. The company's South Pacific area marketing manager, Doug Gibson, said the vessels, the *Solomon Premier* and the *Solomon Chieftain*, were bound to create enormous interest in the Pacific.

The sophisticated 57 m (187 ft), 500 t craft, built at a combined cost of A$30 million, were forecast to boost Solomon Islands' export sales by up to A$16 million a year. They are now operating from Honiara and are expected to increase the export catch by 22 per cent – an extra 8,000 to 10,000 t of tuna annually — and to enable the Solomon Islands' fishing industry to capitalise fully on the abundant tuna reserves within its exclusive economic zone.



The *Solomon Premier*

Gibson said the purse seiners were the most technologically advanced fishing boats on the market and the most sophisticated fishing boats ever built in Australia (they are equipped with 'bird radar' that locates sea-birds, pinpointing the locations of tuna schools). Each vessel has a carrying capacity of 520 to 530 t of frozen fish and the freezing capacity is about 80 t in 24 hours. 'The *Solomon Premier* secured a catch of 40 t with its first set just before reaching Honiara', he said. 'With the pole-and-line method, it would take more than a week to obtain a catch of that size.'

Funding to build the two vessels was supported by Australia's overseas aid programme.

Australia Shipbuilding Industries also won a contract to build 12 patrol boats for South Pacific nations under Australia's Defence Co-operation Programme. Four of the boats have already been handed over: two to Papua New Guinea, one to Vanuatu and one to Western Samoa. The specially-designed vessels can help with surveillance of 200 nautical mile exclusive economic zones. They are also able to handle disaster relief, search and rescue, medical evacuation, and police and VIP inter-island transport jobs.

Australia Shipbuilding Industries have arranged a comprehensive support package including spares, advisory assistance and intensive crew training in Australia. They achieved another major success recently with the signing of an A$8 million contract to build five 27 m (88 ft) multi-purpose trawlers for Southern Engineering Company in Mombasa, Kenya.

PAFCO SALES AND PROFITS RISE
(Source: *Fiji Times*)

The Pacific Fishing Company (PAFCO) has announced a net operating profit of F$ 1.49 million for the 1987 financial year, with sales worth more than F$ 30 million. In 1988, sales are worth almost F$ 36 million (net profit for the first nine months of the year is F$ 1,632,000).

The Government injected F$ 1.5 million into the tuna canning company when it took over majority shareholding in PAFCO in January 1987. The company, then owned by C. Itoh of Japan, was in a precarious position, with liabilities far exceeding assets, accumulated losses of F$ 5,562,000, and continued unprofitable trading.

The Ministry of Information said that in the first 20 months of government takeover, the company was restructured, production increased significantly and overhead administrative costs per unit minimised. As a result, the company had increased its sales by 50 per cent in 1987 and 1988 and had achieved profitable trading. Sales were committed until March 1989.

Ordinary shareholders have not received any dividend in 1988 but government preferential shares have got a five per cent dividend, as paid out in 1987.

The number of PAFCO jobs increased from 350 to more than 950 during this period, with a clearly evident impact on the economy of Ovalau. The period of expansion was marked by an emphasis on the development of local competence in management and operation, investment to replace outdated equipment and the installation of an additional canning line.

The Cabinet noted that the company cold storage facilities were in 'very poor condition'. The present cold store was built in 1964 and has a capacity of 1800 t. This had adversely affected fishing quality and the overall structure was a safety hazard. The construction of a new cold store under Australian aid is likely to begin within two or three months.

PAFCO had also decided to embark on a two-piece can manufacturing joint venture with Australian, Thai and Taiwanese partners. The venture hopes to produce finished cans by September 1989.

The company also hopes to buy-out Toyo Seiken in the existing three-piece can-making venture, Fiji Can. It intends to continue using C. Itoh as its agent for marketing its products in Europe at a cost of F$ 840,000 in 1988. But it hopes to develop local competence in marketing so that it can establish direct trading relationships in the future.

PAFCO's market comprises 80 per cent lightmeat tuna (skipjack, yellowfin) to Europe and 20 per cent whitemeat to Canada. It has decided to market direct to its major buyers, British Columbia Packers, and to incorporate a technical help component to increase yields, productivity and shared risks against product rejection by the Canadian Department of

Fisheries. It hopes that a pricing formula will guarantee PAFCO stable profits in this traditionally fluctuating market.

PACIFIC FISHERIES OFFICERS ON COURSE

(Source: *Fiji Times*)

Fifteen fisheries and other government officers from the South Pacific region, including Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Niue, Palau, Papua New Guinea, Solomon Islands and Tuvalu have participated in the second treaty observers course at the University of the South Pacific.

The aim of the course was to give participants basic skills which would enable them to carry out observation and monitoring duties on U.S. purse seine fishing vessels licensed under the multilateral treaty on fisheries with the United States. The course was funded by the International Centre For Ocean Development of Canada and organised by the Forum Fisheries Agency (FFA). It focused on fisheries and other officers who have to carry out observer duties, including scientific data collection and monitoring the requirements of multilateral or bilateral fishing treaty.

The two-week programme was co-ordinated by the Multilateral Treaty manager for the Forum Fisheries Agency, Mr Barerei Onorio, assisted by School of Maritime Studies officers. The Fiji Fisheries Division, Food and Agricultural Organization, United Nations Development Programme, South Pacific Commission, United States National Marine Fisheries Service (NMFS) and U.S. tuna industry representatives participated as resource personnel.

A large part of the course was devoted to practical work on data collection and monitoring vessel operations. Fiji was selected as the ideal venue for this type of course mainly because of the low cost involved, enabling the FFA member countries to participate at reasonable cost. Fiji also has a growing fisheries sector where many national and foreign vessels are actively involved in development. The Fisheries Division accommodated all the participants at its training centre in Lami.

Participants were required to sit an examination at the end of the course. Those who passed the examination have been considered for observer duties in 1989 and during the five-year treaty period.

OCEANIC INSTITUTE TO STUDY AQUACULTURE

(Source: *Pacific Business News*)

The Oceanic Institute at Makapuu in Hawaii has plans to develop a new US$ 15 million Applied Aquaculture Research Center, with the goal of improving America's diet while creating a new industry.

The Institute President, William C. Rowland, said that the United States import a billion dollars worth of seafood annually because Americans can't raise it themselves. He added that the Centre would put Hawaii in the forefront of aquaculture development world-wide. Founded in 1960, the Oceanic Institute is a private, non-profit marine research facility that employs more than 100 people. It leases from the state 118 acres of land, of which it subleases 61 acres to Sea Life Park.

The new Center is planned to occupy about 3.5 acres, and when completed will bring employment at the Institute to more than 300 people. To be funded by both Federal and State funds, the Center is still in the planning stage, with ground scheduled to be broken at the end of 1989. Completion date is set for 1991.

Rowland said research contracts generated by the completed Center should bring in between US$ 40 million and US$ 60 million annually. He noted that the commercial potential for

aquaculture in Hawaii was tremendous, and the research conducted at the Institute related directly to private enterprise and jobs in aquaculture. He emphasised that the role of the Institute is to take the basic knowledge of aquaculture, from concept to development to marketing, and transfer that to the commercial sector.

Rowland said a major problem threatening aquaculture is disease, which last year caused the failure of a shrimp farm in Kahuku. US$ 1 million was spent to solve the disease problem. Taiwan lost 60 per cent of its shrimp output last year due to disease, and by 1989 could lose 100 per cent. The Oceanic Institute is developing a disease-free brood stock of shrimp that will be made available to commercial ventures. Rowland said four new shrimp farms were trying to get started in Hawaii.

TUNA CANNERIES EXEMPT FROM NEW OCEAN DUMPING LEGISLATIONS

(Source: *Samoa News*)

A Bill which would 'restrict many kinds of ocean waste disposal but would protect the tuna industry in American Samoa by exempting canneries from these restrictions' was passed in the U.S. House of Representatives in October 1988, according to a release from the Office of the Clerk of the House of Representatives.

The canneries were exempt from the legislation because, it was explained, American Samoa 'did not have the capacity to support the operations of the tuna canneries under the restrictions of this legislation'.

The original House version of the Bill was amended after several members of the Public Works Committee were told that the Territory has problems with 'land-based disposal'. It was explained to the members that ocean dumping in American Samoa consisted of biodegradable 'fish parts' which were causing 'no real threat to the environment'. Several members agreed that the Bill will only exempt 'biodegradable substances'.

The Environmental Protection Agency allowed ocean dumping by the canneries because of these specific needs. The amendment would allow the canneries to continue this practice. The concern of the Congress about ocean dumping began because of a large amount of medical waste that washed up along the U.S. Atlantic shoreline in the summer of 1988, all but ruining many vacationers' ability to swim in the summer heat. The waste and supplies included hypodermic needles and vials of blood, some of which was contaminated with the lethal AIDS virus.

POHNPEI TROCHUS SHELLS EARNING US$ 500,000

(Source: *Pacific Magazine*)

Copra and fish, along with U.S. aid, have traditionally been the economic life-blood of Micronesia. In recent years, however, two other sources of income have contributed significantly to the economy: hibiscus bark skirts, the popular 'grass skirts' of Hawaiian Island fame, and trochus shells, first seeded in Pohnpei's lagoon some 50 years ago.

Trochus shells are harvested annually during a specific season on Pohnpei, with such enthusiasm that the Marine Resources Division must survey reefs annually to determine if a collection season can be allowed. In July 1988, 235 tons of trochus were harvested and this brought more than US$ 500,000 to island residents. The shells were sold for US$1.25/lb pound (≈ US$2.78/kg) to local and Japanese interests and used for the manufacture of buttons.

FISHERIES SCIENCE AND TECHNOLOGY

JOURNEY TO BOTTOM OF THE PACIFIC
(Source: *Islands Business*)

Oceania's seafaring history features many epic voyages of endurance and discovery. Next year, for any Pacific Islander game enough, there will be an opportunity of voyaging into an almost entirely unexplored realm of the Pacific.

The Soviet Union has built two three-people miniature submarines capable of descending to 6,000 metres below the ocean's surface. They want to use the subs for pioneer dives in the Fiji, Tonga, and Papua New Guinea areas, and to the north of New Zealand. There will be a place aboard the craft for scientists or observers from countries that agree to dives being made in their 200-mile zones.

Details of the diving plan were given by Dr Valery Zdorovenin, of the Commission of World Ocean Problems, an arm of the Soviet Academy of Sciences, in Suva last month. He attended the annual meeting of the Committee for the Co-Ordination of Offshore Prospecting in the South Pacific (CCOP/SOPAC). He told *Islands Business* New Zealand had indicated that it would allow dives in the Havre Basin to the north of the North Island. Tonga has given an unfavourable response, Fiji and Papua New Guinea have not replied.

If allowed, the submarines, carried aboard a 6300-ton mother ship, *Academic Mstislav Keldysh*, would descend in two areas of the Lau Basin in Fiji, two areas of the North Fiji Basin, and in the Manus, Woodlark and Bismarck Basins of Papua New Guinea.

Only France and the United States have similar submersibles capable of surviving the immense pressure exerted on hulls at depths of 6,000 metres — six times the depth the most modern war submarine can reach safely. The French intend to use one of theirs in the South Pacific next year also, and the Japanese are constructing one for work near Fiji and Vanuatu.

Why the sudden flush of international interest in what's going on down at 6,000 metres? Geologists are excited by the intensity of volcanism in the area between Fiji and Papua New Guinea. The collision of great plates of the Earth's crust gives rise to the creation of fresh oceanic crust, a 'question of principal significance for modern geological theory' according to the Soviets; hydrothermal activity, and the formation of massive ore bodies. If they can one day be mined, these could transform the economies of small countries within whose 200-mile economic zones they lie.

The Soviets are offering to carry small numbers of Pacific Island scientists and technicians aboard the *Mstislav Keldysh* for training. So far their attempts to become more involved in ocean and seabed research in the South Pacific have been largely frustrated. Neither the Americans, the Australians nor the New Zealanders want the Soviets to win any foothold in the region. By exerting pressure through such bodies as CCOP-SSOPAC, an agency supported by numerous Pacific Island governments, the metropolitan powers have so far kept the Soviets out. However, the inclination now among some Island governments is to exploit the Soviet Union's great fund of ocean science know-how.

Zdorovenin, who has attended CCOP-SOPAC meetings as an observer since the late 1970s, said his efforts to get his country's scientists established in the region 'have been rejected on purely political grounds. I think this is a strategic decision of the ANZUS (Australia, New Zealand, United States) treaty countries. I reject assertions that the Soviet Union wants to use its scientists to penetrate this region. The Soviet Academy of Sciences is the most independent of all Soviet organisations.'

ABSTRACTS

GIANT CLAMS IN ASIA AND THE PACIFIC, edited by J.W.Copeland and J.S.Lucas. 274 pp.

Throughout much of their geographic range, giant clams have been over-exploited, and in some areas of Indonesia, the Philippines, Micronesia and Southern Japan some species are now extinct. Because the clams require clean, shallow, warm sea water and plenty of sunlight to survive, they are easy prey for fishermen. In the Pacific Islands, giant clams form the basis of traditional subsistence fisheries in many locations. However, they are also the target of commercial fishing activities, often illegal, by South-East Asian fishing vessels because of the high value of their adductor muscle. The apparent high marketability of giant clams, coupled with discoveries that they are relatively rapid growing and easy to culture in a semi-intensive fashion, has led to speculation in recent years about the possibility of farming giant clams both for profit and to restock areas that have been depleted by fishing activities.

In April 1988, the Australian Centre for International Agricultural Research (ACIAR) held a workshop on giant clams at James Cook University in North Queensland. The workshop was the culmination of a three-year project in which a variety of institutions and organisations in South-East Asia and the Pacific undertook research into various aspects of giant clam biology, management and aquaculture. This publication brings together the literature and results of most of this work, and provides an up-to-date summary of present knowledge of giant clams.

The results presented indicate that the culture of tridacnidae clams is both technically and economically viable, with markets both for clam meat (particularly in Taiwan and Japan) and for the shells. There appears to be substantial potential for restocking tropical reefs, and for the farming of clams both extensively and intensively in the Indo-Pacific region. There are many problems to be overcome before the farming of giant clams becomes an established new industry. The research so far indicates that clam mariculture has considerable potential even at this early stage of development.

This book contains over 50 papers, many presented by workers from the Pacific Islands region, organised into chapters on stock assessment and conservation, reproduction, culture methods, physiology, growth, production rates, predators, parasites and diseases, socio-economic aspects of clam culture, and others. Recommendations for future research are also noted, in the areas of nutrition, larval survival and settlement, wild stock biology, and the effects of restocking.

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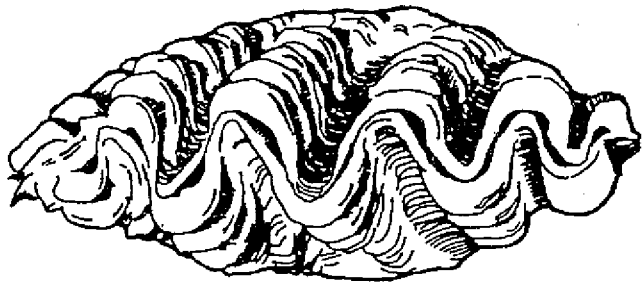

The following article is reprinted from *Australian Fisheries*
(Vol.47, No 9, September 1988)

BOTTOM LONGLINING IN THE SOUTH-WEST LAGOON OF NEW CALEDONIA

by

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New Caledonia is surrounded by a reef structure which is similar to the Australian Great Barrier Reef (GBR) but smaller (Figure 1). In particular, in both instances the nature of the bottom between the coast and the barrier reef changes considerably. The fish species composition in New Caledonia is also very similar to the one found on the GBR.

In a study of the fish populations of the south-west lagoon in New Caledonia, scientists from the French Institute of Scientific Research for Cooperative Development (ORSTOM) used bottom longlining as a technique for fish capture. This method was found to be effective for fishing in untrawlable areas and gave fewer technical problems than gillnets or traps, indicating that bottom longlining could be used in some instances by the artisanal fishery.

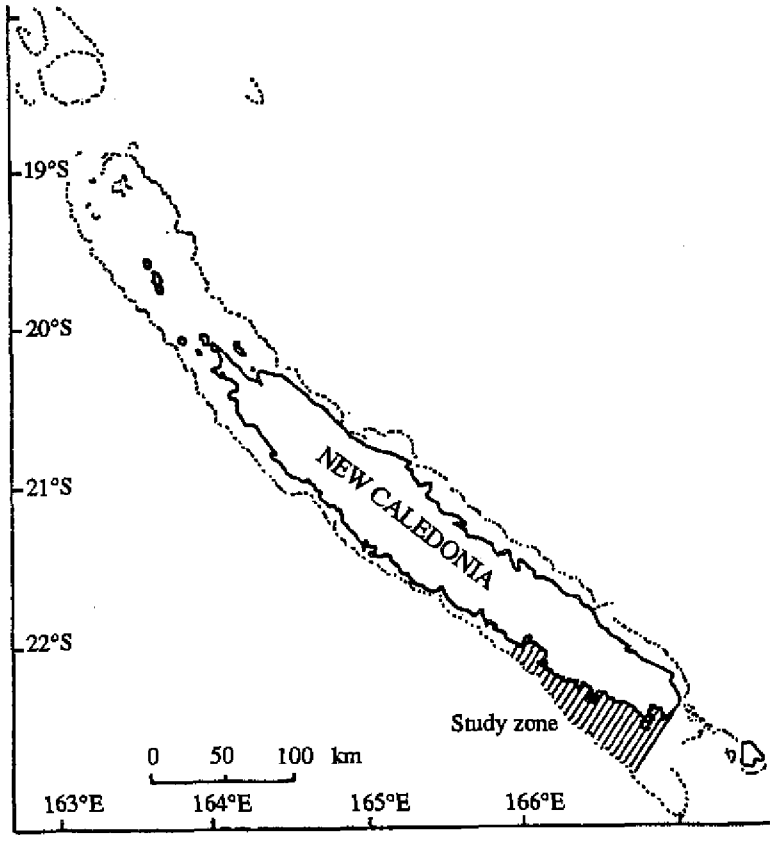


Figure 1. Map showing the reef surrounding New Caledonia and the area of the ORSTOM study

Method and gear

A 10 m aluminum catamaran with a three-man crew was mostly used for the bottom longlining operations. The gear used is illustrated in figure 2.

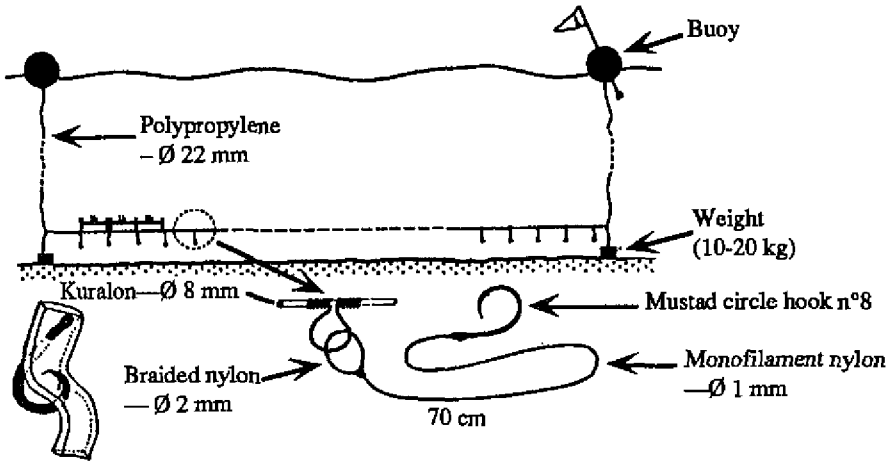


Figure 2. Gear used in the bottom longlining trials

Nylon leaders were used in order to keep the catch of sharks, which tend to tangle the line, to a minimum. Also it has been proved in several bottom longline fisheries that trace leaders catch fewer fish than nylon ones. The leaders had a breaking strength of 30 kg. Hooks used were Mustad circle hooks (39960ST; no 9). The bait was frozen New Zealand squid, *Notodarius sloanii*. Both mantle and tentacles were used, best results being obtained with bait pieces of approximately 3 cm by 1 cm wide, hooked twice as indicated in Figure 2.

Hooks were systematically rebaited every three sets. The amount of bait necessary was 1.5 kg/100 hooks, based on weekly averages. Soak time was 70 minutes on average. It was found that a longer soak time did not necessarily increase catch and could result in loss of fish to sharks.

A limited number of commercial trials were performed with removable leaders of 70 kg breaking strength using clips (JVI set line clips from Gourock, New Zealand). This allowed for easier storage and handling of the line and the possibility of baiting hooks in advance (for instance, while a line was already fishing).

During scientific trials sets of 100 or 200 hooks were used. Commercial trials were performed with lines of 300 hooks. While longer lines save time in the setting and retrieving operations, they can pose a problem in snaggy areas.

Results

For the 289 longlines (34 000 hooks) set in the south-west lagoon of New Caledonia an average yield of 8.3 kg/100 hooks was obtained.

This may seem rather low, but it must be kept in mind that all areas were fished, even those known to have low fish densities. Maximum yields were 38 kg/100 hooks. Preliminary information from commercial trials indicates that professional fishermen were able to get yields of over 50 kg/100 hooks in the north-west lagoon of New Caledonia.

The average size of the fish caught was 1.6 kg, with a maximum size of 12 kg and a minimum of 200 gm. While the use of stronger leaders may help in the catch of bigger fish, the effectiveness of the gear could be decreased.

In a normal day of fishing (6 a.m. to 5 p.m.) 1 200 hooks would be set. Setting a line of 100 hooks took, on average, seven minutes, and a line of 200 hooks, nine minutes. Retrieving time depended upon the catch, sea condition and snags. On average 15 minutes were necessary for a line of 100 hooks and 20 minutes for a line of 200 hooks. While there were three men in the research crew, it may be possible to run this type of fishing with two men only.

Despite the high coral cover of some of the areas fished, there was only a four per cent hook loss. In comparison, trials in the Caribbean on smooth bottoms had hook losses of two per cent (Nelson and Carpenter, 1968). It is estimated that sharks and giant toada (*Gastrophysus sceleratus)* accounted for 50 per cent of the hook losses. Serious snags occurred only on three per cent of the sets.

The catch consisted of 72 species belonging to 15 families. Only 30 species were taken on more than 10 sets. Three groups dominated the catch: groupers, 18.6 per cent; snappers, 10.3 per cent; and emperors, 34.5 per cent. Groupers and snappers are caught mainly near the barrier reef or in coralline areas, whereas emperors are usually found on coarse sand, preferably with a few scattered coral heads.

In New Caledonia a number of species such as sweetlip emperors and red bass are ciguatoxic and cannot be sold. Combined with those species of no commercial value, these trash fish represented 18 per cent of the catch.

This catch composition is very different from that of landings in the GBR region by handline fishermen (Craik, 1985). In particular, coral trout accounted for only two per cent of the ORSTOM catch compared to a catch of 34 to 40 per cent on the GBR (Craik, 1981). Fish caught by longlining were on average larger than those caught by handline or seen during visual census in the same areas — a difference probably due to the large hook size used.

Yields and catch composition were influenced by a number of factors, including depth, time of day and distance to the barrier reef. As Figure 3 shows, catch rate increased significantly with depth down to 35 m. Below that depth, catch rate decreased, mainly because the nature of the bottom changes drastically — in particular silt levels tend to increase. The increase of yields with depth was mainly due to an increase in the average fish size with depth.

Effect of depth

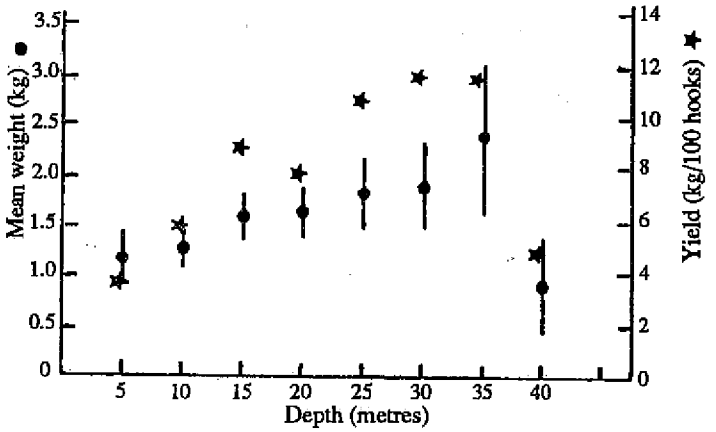


Figure 3. Mean weight and yield in relation to depth

There was also a shift in the species composition with depth. Snappers and groupers became more abundant in the catch as depth increased. On the other hand sharks and trevally were caught in shallow waters. (It should be noted that only juvenile sharks were caught as nylon leaders were used). Emperors and sweetlips were essentially taken in the 15 to 30 m depth range.

Time of day

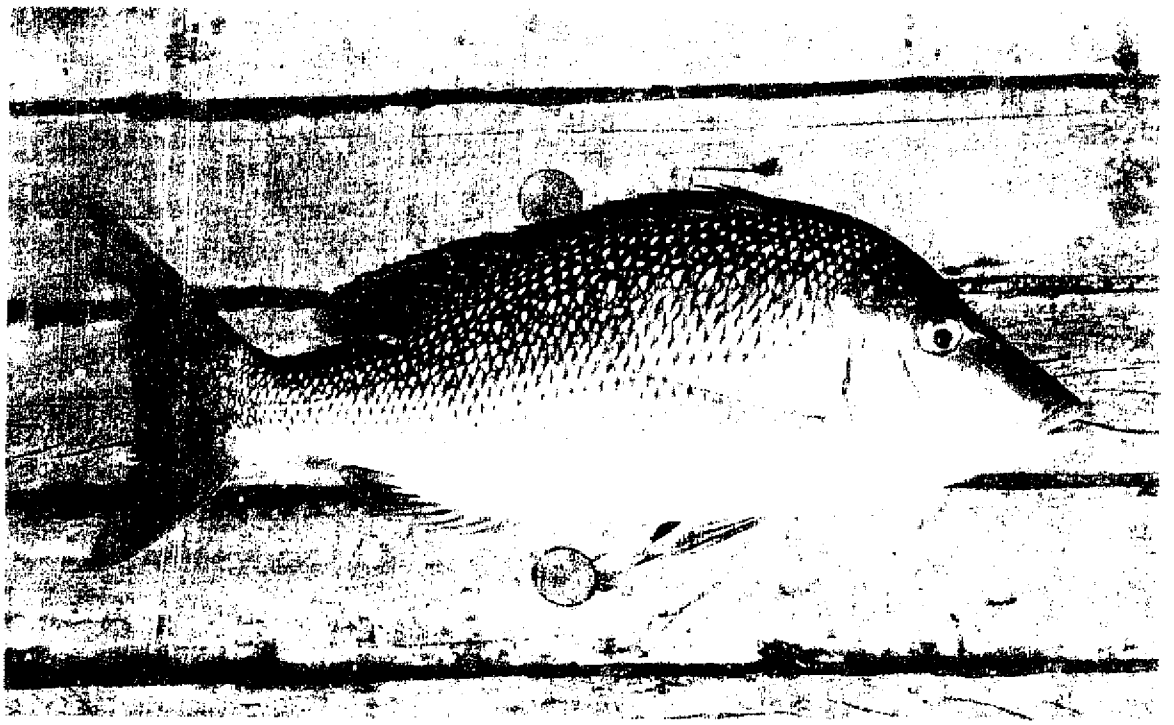
The longlines were set between 6 a.m. and 5 p.m.. Lines were not set at night, mainly because sharks become more active at that time. The results indicate that except for a slight increase in catch between 3 p.m. and 5 p.m., there was no effect of time of day on total catch.

However, some species, specially emperors and hussars, were generally caught in the afternoon. These fish are mainly nocturnal feeders, according to observations made during handlining trials. Longlines proved to be far more effective than handlines in catching these species during the day.

Effect of distance

For research purposes the lagoon was categorised into three parts: the coastal zone, middle reef and barrier reef.

In the coastal zone water is usually turbid and very little of the bottom is covered by coral and rocky areas. It is in that zone that catches were the lowest (5.3 kg/100 hooks) and the amount of trash fish the highest (25.1%). The main commercial species found there were trevallies *Caranx sp*, 8.8 per cent of the catch; painted sweetlip *Diagramma pictum*, 8.0 per cent; spangled emperor *Lethrinus nebulosus*, 21.3 per cent; and green jobfish *Aprion virescens*, 6.6 per cent. Trevallies were captured mainly near shore. These fish generally feed on small pelagic fish (anchovies, sprat, sardines, atherinids) which tend to stay in sheltered areas such as bays, mangroves and leeward parts of the reefs.



Spangled emperor (*Lethrinus nebulosus*)

In the middle reef, which has much coarser sand than the coastal zone and where coral becomes more abundant, yields were of 8.3 kg/100 hooks. Emperors and sweetlips, which tend to be found near coral heads on sandy areas, were the dominant species in the catch.

The barrier reef zone is characterised by very clear water, coarse coralline sand and a high coral cover. The average yield for this area was the highest, with 10.4 kg/100 hooks. Groupers, sea bream and wrasses were the dominant species. Fish tended to be larger the further from shore they were caught.

Comparison with handlining

While the longline was fishing, some handlining was undertaken on the same site (163 fisherman hours) in order to compare yields of both methods. Bottom longlines caught larger fish, less trash fish and had on average better yields (see table).

Comparison between longline and handline results

The catch rate per fishermen per day for each type of gear was estimated. For handlining, we found that real fishing time (time with the hooks on the bottom) was 6 hours/day/fisherman. Since the handlining catch rate was 2.63 kg/fisherman/hour, the catch per fisherman per day can be estimated at 15.8 kg. For longlines, in the boat used and with three fishermen, an average of 1 200 hooks/day could be set. The longlining catch rate was 8.2 kg/100 hooks, i.e. an estimated catch of 32.8 kg per fisherman per day, which is twice the catch by handlines.

However, caution should be used when interpreting these results because the data is for daytime fishing only. Handlining, at least in New Caledonia, gives far better results at night than during the day (Loubens 1978). Unfortunately there is no information on night longlining.

	Bottom longline	Handline
Yield/fisherman/day	32.80	15.80
Percentage trash fish	18.00	21.50
Fish average size (kg)	1.60	1.05

Diving on the lines

The team dived on 45 sets in order to collect information on the fish habitat, to estimate densities and to see how the line operated.

The line takes a few minutes to reach the bottom. During that time swarms of small fish such as mackerel scad (*Decapterus* sp) or whiptails (*Pentapodus* sp) nibble on the bait. Once the line is on the bottom, these bait stealers usually leave the bait.

The line should not be too tight for at least two reasons. Firstly, a tight line on coralline or rocky ground will often not be directly upon the bottom but will hang between corals or rocks with the hooks dangling above the bottom. Underwater observations indicated that bottom fish prefer the bait to lie on the ground.

Secondly, large fish will more easily snap the leaders if the main line is too tight. On the other hand, if the line is too slack fish will more easily snag the main line in their attempts to take refuge in crevices.

The dives offered the opportunity to observe fish biting and see how the circle hook operated. It was seen that the fish very seldom swallows the bait. Usually it will pick up the bait, chew it a little, then spit it out. This operation is repeated two or three times. The fish gets caught when, feeling the sting of the hook, it darts away, thus setting the hook. For this reason, if the main line is too slack, the hook may not set itself.

Conclusions

While bottom longlining may not give sufficient yields to be a worthwhile year-round activity in coralline lagoons such as those in New Caledonia, in some instances it could be a good secondary activity. The yields are usually more regular than those of handlining and the fish larger.

It is a method best suited to small fishing units with a crew of two or three. While the gear could certainly be considerably improved, the experience of local fishermen using bottom longlines on the outer reef shows that the simplest gear is often the most effective.

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FIJI DEEP WATER SNAPPER YIELD ASSESSMENT

by

Charles Ellway

Background

Exploratory surveys by the Fiji Fisheries Division and several visits by the SPC Deep Sea Fisheries Development Project led to the first trial export of deepwater snapper from Fiji in 1985. During that year 20 t of fish were exported and 49 t were sold locally. Two larger vessels (c. 20 m) entered the fishery in 1986, and exports increased to 80 t, with about 45 t sold locally. To July 1987, nearly 60 t of deepwater snappers had been exported.

In view of the rapid growth of this fishery, yield assessment became an immediate task of the Fisheries Division. Length frequency sampling and taxonomic validation of species had already commenced when funds were sought for a yield assessment programme. It was envisaged that once an assessment programme was designed, it could be implemented by Fisheries Division staff and data collection would proceed over a period of 12 months. External assistance would be required for the design and installation of the programme and the concluding analyses. Subsequently discussions between Fisheries Division and NMFS (Honolulu) biologists have led to the formatting of a yield assessment strategy to be adopted in Fiji. This report details current sampling methods and suggests areas for modification.

The fishery

In September 1987, five larger vessels were fishing for deep water snapper in waters around the Fiji coast. Four of the vessels utilise between five and eight hydraulically operated reels for deep water dropline fishing, while the fifth vessel employs a bottom longline system (200 hooks). Baits are fished at depth of 200 — 400 m and catches average 400 kg per boat-day. Fish are stored whole on ice for the duration of the trip (usually 4 or 5 days) after which they are unloaded and processed. Fishing trip duration, unloading and catch processing are co-ordinated to meet departure times of international flights to export markets in Hawaii and the United States mainland.

Up to 10 smaller (9 m) boats also fish for deep water snapper, using wooden Samoan handreels to fish shallower waters to 200 m. Most of the catches are marketed at the same processing plants and although few data on catch sizes and landing frequencies are available, the contribution to the overall deep water snapper catch is considered small.

Sampling of the commercial snapper catches was initiated in May 1987 and has concentrated on catches taken by the larger vessels.

Numerical analysis indicates that two species, short-tailed red snapper (*Etelis carbunculus*) and the ribbon-tailed red snapper (*Etelis coruscans*) constitute 64 per cent of the total catch, reflecting targeting of fishing effort on these species. Four other species are regularly exported: saddled fusilier (*Paracaesio kusakarii*) and bream (*Wattsia mossambica*), which are medium-sized and common in catches, and small-tooth jobfish (*Aphareus rutilans)* and silver-gilled red snapper (*Etelis radiosus)* which although rarer (7% and 1%), are comparable in size to ribbon-tailed red snapper. Six species of *Pristipomoides* and one *Paracaesio* constituted smaller proportions of the catches sampled. Three of these species (*Pristipomoides flavipinnis, P. filamentosus, P. multidens)* occur in sufficient numbers to warrant inclusion in the length frequency sampling programme. Table 1 lists the more common snapper species identified in catches.

Table 1: Species commonly caught in the Fiji deep water snapper fishery, showing the percentage of each species in catches sampled (based on 14 125 fish)

Common name	Scientific name	Percentage
Short-tailed red snapper [1]	*Etelis carbunculus*	36.0
Ribbon-tailed red snapper [1]	*E. coruscans*	28.5
Silver-gilled red snapper	*E. radiosus*	0.7
Small-tooth jobfish	*Aphareus rutilans*	6.5
Saddled fusilier	*Paracaesio kusakarii*	6.8
Stone's snapper	*P. stonei*	0.8
Gonzales' snapper	*P. gonzalesi*	0.1
Bream	*Wattsia mossambica*	5.4
Rosy jobfish	*Pristipomoides filamentosus*	4.8
Yellow jobfish	*P. flavipinnis*	2.6
Large scaled jobfish	*P. multidens*	1.9
Small-scaled jobfish	*P. sieboldii*	0.8
Gold-tailed jobfish	*P. auricilla*	0.1
Banded flower snapper	*P. zonatus*	0.5
Cod	Serranidae	0.6
	Seriola spp.	1.5

[1] may be two species.

While the commercially important species have been recorded here, catches include many fish which are taken either routinely (e.g. snake mackerel) or occasionally (species of tuna) and are disposed of or sold outside the export-oriented processing line.

Identification of catch specimens has been regularly undertaken; however some uncertainty exists regarding the taxon of both short-tailed red snapper and ribbon-tailed red snapper, each of which may constitute two species, a factor taken into account when sampling.

Generally, existing catch data are not sufficiently well analysed to indicate weight proportions contributed by each species to the total catch. However it is estimated that short-tailed red snapper and ribbon-tailed red snapper contribute more than 80 per cent by weight.

Processing

In port, the catch is unloaded from the boats by hand into refrigerated trucks and transported to one of the two processing sites, Feeders Fiji Ltd. or the National Marketing Authority (NMA), Lami. The operational requirement of keeping fish chilled throughout necessitates rapid handling and packing of the product to prevent spoilage once it is unloaded. After unloading, the catch is sorted by species and size into handling baskets. At Feeders, the fish are conveyed to large open ice slurry tanks at the head of the processing line, where they are held immersed and further chilled prior to the commencement of processing. At NMA, the processing commences immediately unloading starts, and iced fish in handling trays are ferried to the start of the processing line.

Processing essentially requires the removal of the head and viscera on a meat bandsaw and the cleaning and packing of fish trunks. This normally involves a bandsaw operator and a series of fish handlers (5 or 6) to clean, wash and pack. Individual fish are placed on the bandsaw table, where the operator removes the head, pectoral and pelvic fins and viscera in a single operation. Heads, fins and viscera are collected in baskets to one side, while the fish trunks are passed along cleaning and washing tables where any remaining viscera are removed and the body cavity thoroughly cleaned. The fish trunks are dried by draining and wiping, then packed in

plastic-lined cardboard cartons which are weighed, sealed and chilled prior to being sent overseas.

On completion of catch processing, snappers which are too small for export are washed and iced separately for local sale. All fish heads are freed of viscera and washed for local storefront sale.

Yield assessment strategy

Assessing the size and yield of the snapper resource is facilitated by virtue of its pristine state and the development of new assessment methodologies. These techniques enable population parameters, particularly natural mortality, to be assessed rapidly.

The approach to yield assessment for deepwater snappers in Fiji waters is essentially that adopted by Polovina and Ralston in an assessment of the deep water fish stocks of the Marianas Islands in 1986. This is an integrated approach utilising new and modified statistical methods to estimate growth and mortality parameters, standing crop or biomass, and yield for fish stocks where little catch and effort data exists. The key elements are large length frequency samples and otolith readings for each of the main catch species. Large length frequency samples enable firstly, an estimate of the ratio of total instantaneous mortality to the von Bertallanfy growth parameter (Z/K) and secondly, an estimate of asymtotic length (L_∞). Independently, the growth parameter (K) is derived from fitting a von Bertallanfy growth curve to otolith data.

The combination of the Z/K ratio and K results in an estimation of total mortality (Z). As the stock can be considered unexploited, fishing mortality (F) can be regarded as negligible. Thus the total mortality equates with natural mortality (M). Yield estimates can then be calculated utilising Beverton and Holt yield-per-recruit equations, where equilibrium yield (Y) can be expressed as a function of growth (K), natural mortality (M), age of entry to the fishery (Tr) and fishing mortality (F).

Finally, the potential effects of fishing can be extrapolated from comparisons of yields and an estimate of unexploited recruited biomass. The latter is obtained from intensive fishing trials in combination with a survey of the relative abundance of stocks.

Data collection

Length measurements

Central to the snapper yield assessment is the aggregation of a large number of length measurements of the common species taken over a time series (i.e. 12 months, to cover seasonal changes). Since May 1987, a programme of regular length frequency sampling has been undertaken, based on commercial landings at the processing sites. Following unloading of the catch at the site, a sampler and assistant are stationed adjacent to the bandsaw operator. All fish passed to this operator are measured on a standard fish measuring board, and the recording assistant notes (preferably on waterproof slates or paper) details of species and lengths for later tabulation and computer entry. At the completion of processing, snappers not included in the export line are measured separately.

To the end of September 1987, 32 of the 38 (84%) of the commercial landings had been sampled in this manner, with nearly all the snappers in each landing being measured, resulting in a total of 13,653 measurements from more than a dozen species.

Current sampling is carried out on an intensive basis, requiring considerable time. While such sampling is justifiable in the face of a rapidly expanding catch, it is difficult to justify on a longer term basis.

A random sampling programme stratified by simple groupings would achieve similar results and be much less time-consuming. These groupings can be based on vessel size, gear type, home port, etc. (see Hodgkinson and Williams, 1984). It is suggested that sampling be retained on a monthly basis to gather sufficient data for a time series analysis.

Initially a list of all vessels fishing for deepwater snapper is compiled and vessel sampling is stratified according to vessel size; in this instance, the larger vessels fishing deeper waters and secondly, the smaller nine-metre vessels. From each of these two size classes, a number of vessels (or vessel landings) are randomly selected for sampling during the month.

A second stratification can be made according to gear type on the larger vessels, i.e. dropline versus longline. Preliminary analysis of catches show a marked difference in species composition according to the fishing method (and perhaps fishing depth) (Table 2). While short-tailed red snapper and ribbon-tailed red snapper are major contributing species in both catches (68% in dropline catches and 99% in longline catches) the relative proportions of each in these catches differ markedly. Given such results, sampling strategy needs to take careful account of differences due to fishing gear type.

Table 2. Numerical and percentage composition of species sampled from dropline and longline catches

Species	Longline		Dropline		Total
Short-tailed red snapper	3 830	(76.5%)	1 148	(15.4%)	4 978
Ribbon-tailed red snapper	1 140	(22.8%)	2 334	(31.4%)	3 474
Others	38	(0.7%)	3 964	(53.2%)	4 002
Total	5 008		7 446		12 454

Currently, catch sampling involves measuring all the snappers in the catch. Analysis indicates that 8 species comprise 98 per cent of the numerical catch and 5 of these species contribute 88 per cent of the total catch. Although species composition varies according to many factors, sampling based on the 8 common species will account for very high proportions of the total catch, both numerically and by weight. In general, it appears that sampling an entire landing (*ca.* 400—500 fish) is an efficient method of generating the large number of length measurements required.

Stratification of catch sampling by area is more difficult, as much of the fishing is still exploratory and catches from different areas and types of fishing grounds (sea mounts, offshore mainland areas) are mixed in a single landing. If stratification is required on an area basis, the catches need to be clearly differentiated on board and during transhipment.

Reproduction studies

Studies of snappers suggest that differential growth rates exist between the sexes for species of *Pristipomoides* and *Etelis*. In an effort to quantify such differences, the sex of the fish is recorded, along with its length measurement.

Exposure of the body cavity during heading and evisceration facilitates the collection of these data. Identification of gonad type and state of maturity provides data on male:female sex ratios and lengths at first maturity. Assessment of sex and maturity requires the development of nimble expertise by a third person during sampling, simply because of the speed at which fish are processed. However it is often advantageous to skip fish rather than sacrifice accuracy.

The gathering of reproductive data, although not an essential component of the yield assessment, is undertaken with a view to the longer term benefit of defining sampling techniques for larger fish which occur more commonly in catches from virgin stock. Because of the time consumed in sampling for reproductive data, a sub-sampling programme may need to be instigated where data are collected from 50—100 individuals of each of the common species over a size range on a monthly basis.

Otoliths

In September 1987, otolith collection was initiated. This required a modification of the sampling method. Fish required for otolith removal were identified by a slip of waterproof paper attached to the gill cover prior to measurement and heading. After its removal, the head was bisected in the dorso-ventral plane by the bandsaw operator and the two halves re-joined (to prevent loss of the otoliths) and placed in a separate basket. Bisection of the heads at this stage facilitated access to and removal of a pair of otoliths from each head. Accuracy in cutting along the midline is important, particularly for small fish, as off-centre cuts usually result in destruction of one otolith. The heads were dissected for otoliths at the completion of processing and each otolith pair was washed and placed in an envelope containing information on species, length, sex and date of sampling. Otolith samples were then forwarded to NMFS scientists in Hawaii for reading and age determination.

Catch and effort information

A key facet of the stock assessment and and the successful monitoring of the deep water snapper resource is the compilation of catch and effort data from vessels, particularly the larger boats, fishing the resource. In an effort to quantify effort and catch within the fishery, fishing log books were prepared and distributed to vessel masters. For each vessel landing, the trip report relates gear type, fishing time and depth, bait, catch weight and species composition on a day and area basis.

Although they are sometimes incomplete, catch and effort records have been actively collected since May 1987, and it is hoped that coverage of all catches by the larger vessels can be achieved. The completion of trip reports will make it possible to monitor effort and catch on an area and time basis and provide the necessary catch per unit of effort (CPUE) parameters for the yield assessment.

Biomass estimates

The assessment of biomass or standing stock for each area is derived from an estimate of area of suitable habitat, a survey of relative abundance and an estimate of catchability. Suitable habitat for deep water snappers generally ranges between 100 and 400 m and is usually expressed in standard units of nautical miles of the 200 m isobath. Estimates of relative abundance can be derived from commercial or research catches where documentation of catch and effort is available. Catchability can be quantified from a fishing experiment in an isolated area. This involves intensive 'fishing down' the area over a period (usually 4–6 days) sufficient to produce a significant decline in CPUE. The regression of CPUE against cumulative catch produces estimates of catchability (Leslie method, Ricker 1975).

Data recording and analysis

Data gathered on snapper lengths and reproductive status have been collated and transferred to computer files. Length measurements for each species and landing have been accumulated in individual files. Although this approach creates a multiplicity of files, it suits the computer data entry system and allows for later file merging according to fishing area, time or other analytical requirement. Computer programs have been developed by Fisheries Division staff which allow graphical presentation of length frequencies and calculation of basic parameters such as average size and L_{∞}. Biological data are separately compiled in computer files listing date, fishing method, fishing depth, species, length,sex and gonad maturity stage.

Issuing of fishing log books has recently been completed and it is envisaged that data entry will commence on receipt of trip reports. Available data from commercial vessels have been collated. Ideally, catch and effort information is transferred to computer files and automatically checked for accuracy of input information by means of an interactive computer program.

Summary

The assessment of deep water snapper stocks in Fiji waters is proceeding, using techniques developed for stock assessment in tropical areas. A considerable quantity of length frequency information for the major catch species has already been accumulated, some of which has been processed to the species parameter stage. Regular collection of otoliths and reproductive information and the formatting of this data for computer storage and analysis have commenced. Effort and catch fishing log books have been distributed to the major fishing operators and a system of collection of completed reports has been developed. Apart from continued sampling and analyses, the major elements required for successful completion of the stock assessment will be intensive fishing trials coupled with a survey of the relative distribution of snapper stocks.

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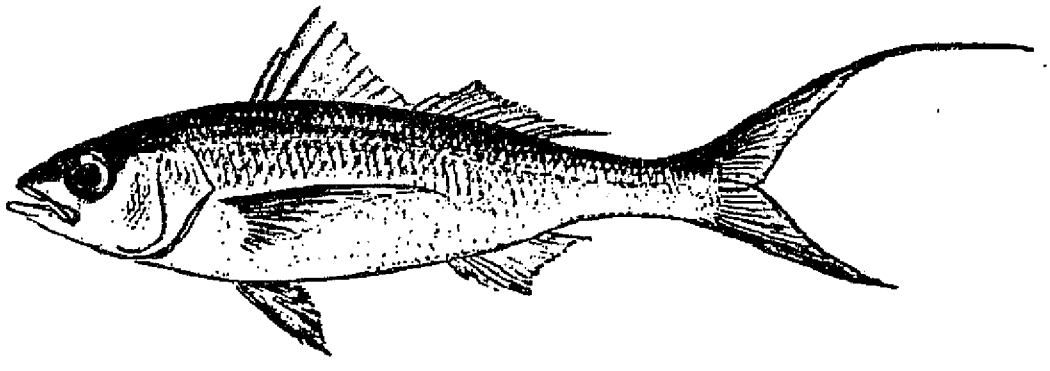

The ribbon-tailed red snapper

Appendix

Deep water snapper trip reports

This fishing log is designed to assist both fishermen and fisheries officers in the collection of fish catch statistics of the deep water snapper fishery. Analysis of these statistics will result in better management of this resource for fishermen. The following notes will help you to complete the trip report as accurately and with as much detail as possible. All the information is treated in strictest confidence. A new page should be commenced at the start of each new trip.

Notes:

1. **Date:** Use a separate line for each day's fishing. If there was a change in fishing position to a new grid square or a change in fishing depth, use a new line (see notes 2 & 3).
2. **Position:** Use the maps in the front of this log book to indicate which grid square most of the fish were caught in. If there was a change in fishing area to another grid square, commence a new line.
3. **Hooks:** Indicate the total number of hooks used in the droplines or the longlines.
4. **Bait:** Note the type of bait used.
5. **Depth:** Indicate the average depth (in metres) fished during the day. If fishing depth changed 50 metres or more as a result of vessel repositioning, then use a new line.
6. **Fishing time:** Indicate the actual time spent fishing
7. **Number of sets:** Indicate the number of longline sets or dropline shifts in position.
8. **Catch:** Indicate catch weight of each of the species on a daily basis as well as total daily catch in kilograms.

DEEP WATER SNAPPER — TRIP REPORT

(CONFIDENTIAL) (CONFIDENTIAL)

Vessel: _____ **GRT:** _____ **Captain / F.Master:** _____

DATE D/M/Y	GRID POSITION (CODE)	TOTAL HOOKS	FISHING TIME (HOURS)	AVERAGE DEPTH (M)	N° OF SETS OR SHIFTS	BAIT TYPE	SHORT TAILED RED SNAPPER (kg)	RIBBON TAILED RED SNAPPER (kg)	SMALL TOOTH JOBFISH (kg)	MISC. JOBFISH	SADDLED FUSILIER (kg)	BREAM (kg)	COD (kg)	SHARK (kg)	OTHER (kg)	TOTAL (kg)
TOTALS	XXXXXX	XXXXX		XXXXXX	XXXXX	XXX										

AN EVALUATION OF FAO/KIRIBATI CANOES IN TOKELAU

by

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Introduction

In January 1988, two FAO/Kiribati canoes, one made of fibreglass and the other of plywood, were shipped to Fakaofo, Tokelau on board the *MV Wairua*. At that time, I was spending my holiday at home (Fakaofo). From the experience I gained while I was in Suva working together with Robert Gillett in the same type of canoe as those in Tokelau, I was asked by the Director of Agriculture and Fisheries, Foua Toloa, to look after the canoes, and to pass on the techniques of operating the canoes, such as reefing, general sailing and safety, to the local people. Because the local people have sailing skills from using their traditional canoes, which in some aspects are similar to the FAO/Kiribati canoes, and also because of their willingness to work and learn, the job was an enjoyable one.

Use of the canoes

After negotiations with the elders of the village, it was agreed that the canoes could be used by any individuals or family in the village for any purpose, provided that:

(a) There must be someone from each family going with me to learn from me;

(b) Because the canoes were powered by a four horse-power outboard motor (Yamaha), each individual would provide his own fuel (petrol) in case of calm weather; otherwise the sails were to be used in favourable winds.

During the time of this operation, the sails were always used. In some cases, the individuals who used the canoes got tired of waiting in unfavourable winds and wanted to use the outboard motor, but because of my encouragement the sails were used all the way. In favourable winds, the individuals were happy not only with the fact that they saved their petrol for other purposes but also with the fun they had when sailing.

It was up to the individuals to choose which canoe they preferred. In most cases, the fibreglass canoe was used. When I asked people why they preferred the fibreglass canoe, the answer was that it was faster, and easier to handle than the plywood canoe.

As the canoes were not allowed to be taken out in the open ocean (because of hazards crossing the reef), the major use of the canoes by individuals was to provide transport between the main village and the plantations on the outer islets. Sometime the fibreglass canoe was used for fishing, without the sails or the engine being used, but with the help of paddles to go to the fishing grounds which are not very far from the main village. Tables 1 and 2 show the different types of use for each canoe.

Table 1: Use of the fibreglass canoe

User's name	Hrs used	Sailing	Motoring	Stand-by
Pio Tuia	6	1h15		4h45
Mataalofa Neemia	1	1		
Agriculture Dept.	7	1h30		5h30
Fisheries Dept.	2	2		
Agriculture Dept.	6	1		5
Tofi Tagata	3	2		1
Feleti Tulafono	7	2		5
Luka Alefaio	7	2		5
Agriculture Dept.	6	2		4
Peau Lui	5	2		3
Agriculture Dept.	6	1	1	4
Katieli Paleti	4	1		3
Moses Pelasio	6	2		4
Total	**66**	**20h45**	**1**	**44h15**

Table 2: Use of the plywood canoe

User's name	Hrs used	Sailing	Motoring	Stand-by
Fisheries Dept.	2	2		
Fisheries Dept.	2	2		
Leo Niko	5	1	1	3
Eli Lapana	5	1	1	3
Medical Team (NZ)	5	1	2	2
Total	**19**	**7**	**4**	**8**

On most afternoons, the canoes were used to provide training for the youth or whoever was interested in learning how to handle the canoe, in the lagoon in front of the main village. These afternoon sessions were very useful to those who did not have other opportunities to use the canoes because of work commitments.

Advantages of one canoe over the other

The people of my village considered that both types of canoes have advantages and disadvantages, including the following:

Plywood canoe

— Quite big and has a good height to prevent water from splashing on to the boat and getting people wet;
— Has more space than the fibreglass canoe;
— Position of the outboard motor is more favourable than on the fibreglass canoe; it causes less sea water to splash into the canoe.

Fibreglass canoe

— Fast and makes less leeway than the plywood canoe;
— Easy to paddle;
— Outrigger can take more weight than the plywood canoe outrigger;
— The self bailer is very helpful;
— Regarding the sails, both the gaff and the boom have jaws, while the plywood canoe has no jaws on the boom and the gaff.

Problems encountered

Several problems arose, but they were not serious and were fixed before the next trip was made. Most of the problems were on the plywood canoe. When it came to Tokelau, it did not have any lines or rope for the main or jib halyard, or the main sheet, while the fibreglass canoe did.

When the plywood canoe platform arrived in Tokelau, one wood piece was broken, and after some days of use, somebody broke two pieces of wood just by walking on it. I found that the wood on the plywood canoe was much thinner than that of the fibreglass version.

We had some difficulties when the plywood canoe was used because neither the boom nor the gaff had any jaws on them, and that caused the mast to shake, which could be very dangerous in times of strong winds.

Despite the above problems, there were no major difficulties.

Concluding remarks

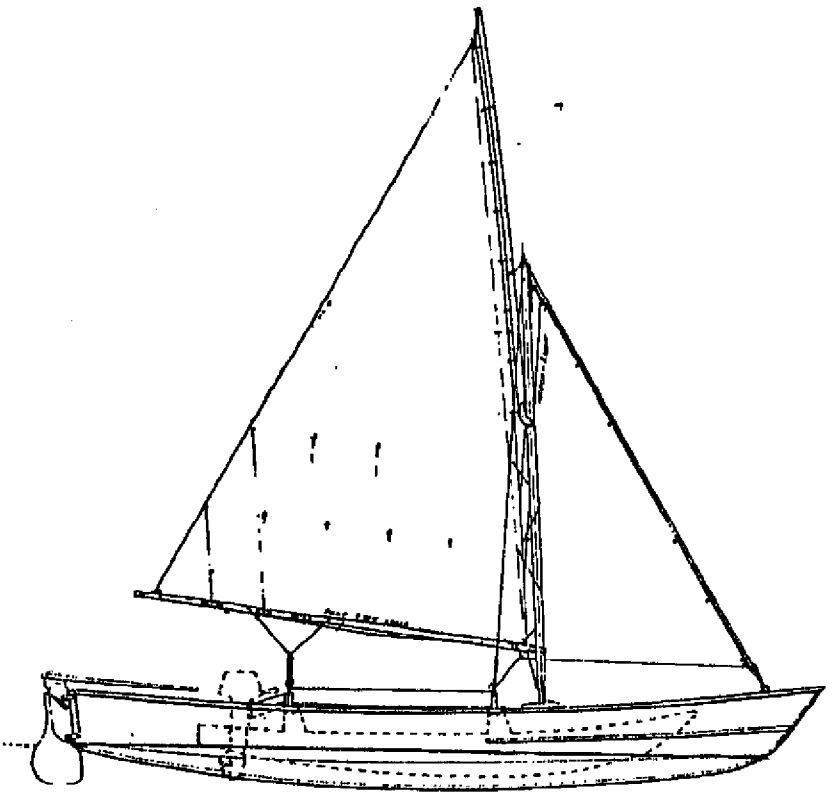
I believe that everybody who went out with me on the canoes enjoyed themselves, and learned techniques such as reefing, safety, and general sailing. I believe that they can now handle or operate the boat themselves. In terms of economy, the canoes proved better than dinghies with outboard motors.

I learned that several people wanted to buy the fibreglass canoe for themselves. They said the canoe would be really nice to use in the open ocean for fishing. I agreed with their thoughts, but we were not able to prove our hypothesis because the canoes were not allowed to cross the reef to enter the open ocean.

I am not aware of the exact financial arrangements for the canoes, but several people mentioned to me that the government should consider making canoes (especially the fibreglass type) available for use or lease by people who cannot afford a dinghy. There would be additional savings when the wind was favourable.

The fibreglass canoe, using the 4 horse-power outboard motor, can do two trips from the main village to the plantations (outer islets) using 5 litres of petrol, compared to a dinghy which needs more than 5 litres of petrol for just one trip.

I think everybody who used the canoes was happy with the results, just as I was very happy with my job.



The FAO/Kiribati canoe