

# FISHERIES NEWSLETTER

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## This issue. . . .

. . . We introduce a new occasional feature, 'Consultancy Corner', which aims to publicise some of the specialised short-term assignments undertaken within the SPC region by specialists from other countries. We hope that this will increase awareness in Pacific Island countries of relevant fisheries work being undertaken in other countries, and perhaps help avoid some of the duplication of effort which occurs from time to time. The editors encourage Pacific Island readers to forward details of consultancy work recently carried out in their own countries for publication in this section.

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## SPC ACTIVITIES

### 18th SPC Regional Technical Meeting on Fisheries

The above meeting is scheduled to be held at SPC Headquarters in Noumea from 4-8 August 1986. The outline agenda presented in the last issue of the SPC Fisheries Newsletter has been finalised and circulated as a draft to SPC member countries and relevant institutions in SPC Savingram No 18/86. The complete draft agenda is as follows :

1. Opening Address
2. Administrative arrangements
3. Approval of Chairman and other office bearers
4. Approval of agenda and timetable
5. Review of Coastal Fisheries Work Programme
6. Regional Fisheries Training Programme
  - (i) Report on 1985/86 training activities
  - (ii) Preliminary report on training needs and opportunities in SPC area
  - (iii) Fisheries Training Directory
  - (iv) Consideration of core training programme for 1986/87
7. Oceanic Fisheries
  - (i) Progress on priority items of the Tuna and Billfish Assessment Programme
  - (ii) Revision of regional log sheets for reporting commercial tuna catch and effort statistics
  - (iii) Report on Southern Albacore Research Workshop
  - (iv) Standing Committee on Tuna and Billfish
8. Workshop Session : Fisheries Extension Services in the Pacific Islands
9. Regional marine resource information needs
10. Survey and assessment of inshore fisheries resources
11. Reports by other organisations
  - (i) Forum Fisheries Agency study of fisheries research needs and priorities in Pacific Island countries
  - (ii) Report of the Food and Agriculture Organisation of the United Nations Regional Aquaculture Study Mission

- (iii) Proposal for an artisanal fishing vessel workshop
- (iv) Progress report - Australian Centre for International Agricultural Research-Vanuatu coconut crab project

12. Other business

13. Adoption of the report.

A large number of nominations have already been received and the meeting promises to be stimulating and informative.

#### Second Refrigeration Course Starts

The second SPC/FAO/UNDP Regional Refrigeration course began on 8th June in Rarotonga, Cook Islands. The course, which is being implemented as a collaborative project between SPC and the FAO/UNDP South Pacific Regional Fisheries Development Programme in Suva, Fiji is the second of its kind to be run. The first, held in 1985 (also in Rarotonga,) was intended as a 'one-off' activity. However, its success, and the continuing demand for training in the maintenance and repair of fisheries sector refrigeration equipment in the region has led to its repetition this year.

The participants, who came from 14 different Pacific Island countries (Cook Islands, FSM, Fiji, Kiribati, Marshall Islands, New Caledonia, Northern Mariana Islands, Palau, P.N.G., Solomon Islands, Tokelau, Tonga, Tuvalu, and Western Samoa) will study the theory and practical application of refrigeration as used in South Pacific Island small-scale artisanal and commercial fisheries, and will hopefully develop skills and understanding necessary to be able to operate, maintain and repair common commercial refrigeration systems. The course, which lasts for 19 weeks, will also cover related diesel generator maintenance and repair, electrical repairs, and training in various types of welding and soldering.

The Senior Course Tutor is Michael Vincent, who also ran the 1985 course. He will be assisted by Course Tutor John Naslund, and Administrative Assistant William Powell.

#### Development of Fisheries Statistics Programmes in Micronesia

During April, the SPC Tuna and Billfish Assessment Programme (TBAP) Fisheries Statistician, Dr Tom Polacheck, visited Palau and the Federated States of Micronesia. The main purpose of the trip was to coordinate the transfer and interface of tuna statistics prepared by the TBAP to the licencing and statistical system being developed by the Micronesian Maritime Authority (MMA) of the Federated States of Micronesia on their micro-computers. In addition, he reviewed the system being developed and recommended areas of improvements, particularly with respect to the logging of raw data sheets and processing of catch totals. He also held discussions with the staff of MMA on the statistical programme of the Tuna and Billfish Assessment Programme. These discussions focused on the problems of handling log sheets and the statistical summaries, and resulted in practical suggestions for a number of improvements. In Palau,

discussions were held with the staff of the Palau Maritime Authority (PMA) and the Department of National Resources (Marine Resources) Division. Discussions with PMA focused again on logistical problems with the physical transfer of the log sheets to SPC and improvements to the statistical summaries provided by the TBAP. Discussions with the Marine Resources Division centred around the problems of collecting fisheries statistics on local commercial and subsistence catches, ways of improving the current system, and possible help by SPC in solving problems with the current systems. Historical records and effort data which had not previously been sent to the TBAP for the now defunct Van Camps pole-and-line operation and by Taiwanese longliners in 1980 were found and brought back to SPC Headquarters in order to add them to the regional data base.

SPC Regional Fisheries Course

Deep-Sea Fisheries Development Project Notes 7 9000\CAT\992 brood: 811  
an international guide to deep-sea fishing. The course, Cook Islands, Rarotonga, was held from 10 to 14 June 1985. Two of the Commission's three field fishing staff were on assignment during the April-June period. The third, Master fisherman Paul Mead was enjoying a long and hard-earned vacation with his family in his native Oklahoma, USA. Lindsay and Sema Robatin, now have a well-established Friday night fishing routine. The bait nets are set on the reef slope from a small dinghy late in the afternoon and hauled about 10pm, cleared, reset, and hauled again about 2am. Since the footropes of the net often gets hooked up on the coral off the reef slope, it is sometimes necessary to use SCUBA gear to dive down and free it. The two sets generally provide enough bait for the next weeks vertical longline trials.

Master Fisherman Lindsay Chapman's assignment to Rarotonga, Cook Islands, started late in November 1985. The main aim of the visit is to carry out vertical longlining trials around FADs located close to Rarotonga, and an integral element of this work has been to develop a reliable local supply of suitable bait for the longlines. Lindsay's earlier efforts were thus directed towards bait catching, by setting gill nets for atule (*Selar crumenophthalmus*) in the waters off the outer reef slope. The nets have worked out surprisingly well, once the initial problems of correct weighting and setting procedure were ironed out. Lindsay and his Cook Islands counterpart, Sema Robatin, now have a well-established Friday night fishing routine. The bait nets are set on the reef slope from a small dinghy late in the afternoon and hauled about 10pm, cleared, reset, and hauled again about 2am. Since the footropes of the net often gets hooked up on the coral off the reef slope, it is sometimes necessary to use SCUBA gear to dive down and free it. The two sets generally provide enough bait for the next weeks vertical longline trials.

The results of the longlining trials themselves have also been very encouraging. Most of the fishing has been during the daytime, using the fresh atule as bait. Lindsay and Sema carry out three trips a week on a regular basis, fishing from before dawn until nightfall. Two vertical longlines are fished directly from the boat, a 28-foot Makia catamaran. Catches have been variable but on average satisfactory, with a few spectacularly good days which have generated a lot of local enthusiasm for the project. The best day yielded 26 yellowfin weighing in at just under 400kg, for only 4 hours fishing. Since then, there has been a lot more interest among local fishermen in accompanying Lindsay and Sema on their trips to see the technique first-hand.



(Photo: L. B. Chapman)

Unloading a morning's vertical longline catch in Rarotonga.

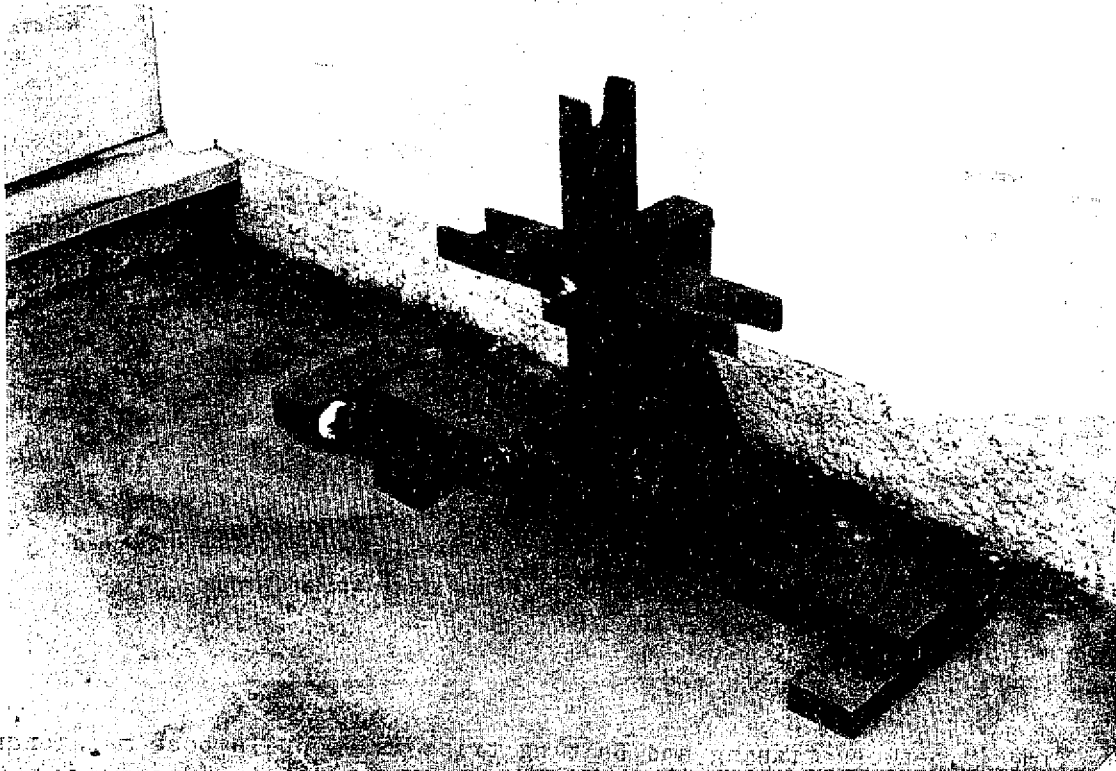
Time in between fishing and baiting trips is spent in boat maintenance and keeping catch records up to date. Lindsay has also been assisting the Cook Islands Ministry of Outer Island Affairs in its attempts to set up a fish shop on Rarotonga to market outer island fish. Most of the fish is presently coming in from Palmerston Island, and Lindsay has been helping the fish shop manager and staff to improve handling procedures in order to reduce the proportion of rejected or low-grade fish among the landings.

#### - Tuvalu

Master Fisherman Pale Taumaia's 8-month assignment to Funafuti, Tuvalu, concluded late in June, when he departed to Western Samoa for home leave. The work Pale has undertaken during his stay in Tuvalu has been varied, and has included a detailed appraisal of several different fishing boat designs, and a month-long visit to the northern island of Nanumea with the Fisheries Division's extension team. During this visit, Pale was responsible for training island fishermen in deep-bottom fishing methods.

The main thrust of the visit, however, has been to take the basic vertical longline technique developed during other project visits, and adapt it to be usable from very small boats such as the dinghies and canoes often used for fishing in Tuvalu and other small island countries. This has involved a number of changes to the gear itself, and to the method of

handling it. One of these has been the development of a "mini" version of the FAO wooden hand reel, which can be used from a canoe or other small boat. The reel is similar to an earlier version designed for use with the KIR-1 and KIR-2 canoes built in Kiribati, but is adjustable to allow its use in craft with different beams.



(Photo: B.R. Smith)

The canoe handreel developed for use with vertical longlines in Tuvalu.

One of Pale's last activities before leaving Tuvalu was to organise a fishing competition among local commercial fishermen. The competition lasted a week, and any type of line fishing (trolling, bottom-fishing, vertical longlining, etc.) was permitted, with prizes of cash and fishing gear for the winners. 13 commercial fishermen registered as entrants, and their catches were weighed in at the Fisheries jetty on landing, following which they were taken away by the fishermen for sale or consumption. Total competition landings were 1,225 kg, a big surge in local fish supply for a community as small as that on Funafuti. Both fishermen and householders were pleased with the result, and many fishermen who did not participate are now asking for another competition to be organised.

#### Fiji

SPC Masterfisherman Paul Mead's visit to Fiji's Northern Division concluded in 1984. However, his work has had lasting effects, according to the following extract from a letter from Fiji's Senior Fisheries Officer (Northern), Mr Mitieli Baleivanualala :

"After Paul Mead's work in 1984, many fishermen showed a lot of interest in this development. To maintain their interest premium prices were negotiated with the National Market which in fact provided the incentive boosting the Deep Sea Fishing Programme. A total of 14 fishermen were involved with 4 on a very regular level for 4 consecutive months in 1985. These fishermen landed 3,136.5 kilogrammes of snappers valued at F\$6173.00. In addition the staff of the Fisheries Division also conducted training by taking trainees out on fishing trips which at the same time explored new fishing grounds. Fishermen were then advised of the outcome of our exploratory fishing programmes. Through the training conducted a total of seven fishermen were shown the snapper vertical long-line technique. One weak area which was experienced by fishermen was the difficulty of catching tuna for bait, therefore fishermen reverted to the use of barracuda and shark mackerel. Hopefully the Fish Aggregation Device development will assist in catching tuna for bait. No trial was carried out on the 18-hook vertical long line technique which Paul has been trying out around FADs".

#### Nelson Students Travel to Tonga

The 12 students attending the seventh SPC/Nelson Polytechnic Pacific Fisheries Officers Training course (see SPC Fisheries Newsletter No 36 p 4) travelled to Vava'u in Tonga in mid-June to start the 5-week practical fishing module which is the second phase of the course. The module, which began on Monday June 16, teaches the trainees a variety of practical fishing and boat handling techniques under seagoing conditions. Being integrated with the Nelson-based training, the module also allows practice and development under working conditions of the skills taught during the earlier Polytechnic lecture and practical sessions.

Specific subjects being taught this year include the following :

- (i) Surface trolling
- (ii) Livebait trolling
- (iii) Daytime and nighttime deep reel fishing
- (iv) Vertical floating longline
- (v) Deep bottom-set longlines
- (vi) Verandah net fishing
- (vii) Use of small echo-sounders
- (viii) Construction, deployment and use of FADs
- (ix) Onboard and onshore fish processing
- (x) Record-keeping and economics of fishing operations

The module is being run by SPC Fisheries Training Officer Alastair Robertson, SPC Masterfisherman Paul Mead, and Nelson Polytechnic lecturer Mike Wells, all fishing skippers with many years combined experience.

### Stock Assessment Workshop

A two-week workshop on fish stock assessment being run by the SPC Tuna and Billfish Assessment Programme, started at SPC headquarters on June 30th. The Workshop is being coordinated by SPC Senior Fisheries Scientist Dr Ray Hilborn and consultant Dr Carl Walters from the University of British Columbia in Canada. There are 11 participants from 11 different Pacific Island countries.

The workshop is aimed at government fisheries officers who have the responsibility of evaluating the status of existing fisheries and planning the development of new fisheries. The primary workshop objective is to provide the participants with the background to assist them in planning stock assessment projects and in initially evaluating their results.

Subject areas to be covered include: dynamics of exploited populations; bioeconomics of fisheries development; stock assessment methods; case studies in stock assessments in other developing countries; common problems in stock assessment; and the role of stock assessment in fisheries management. The training is primarily by hands-on data analysis using microcomputers, augmented by lectures and case studies in stock assessment in developing countries.

### Fish Handling and Processing Course Commences

The SPC Fish Handling and Processing Course was formally opened in Port Vila on Monday 9 June by Vanuatu's Director of Fisheries, Mr Richard Kaltongga. 16 participants from 12 Pacific Island countries (FSM, Fiji, Guam, Kiribati, Marshall Islands, Palau, PNG, Solomon Islands, Tonga, Tuvalu, Vanuatu, and Western Samoa) are attending the course, which lasts for 10 weeks. The group includes fish market managers, extension officers, and trainers working in fisheries education, but the trainees have in common that they are required to organise or teach post-harvest fishery practices in their home countries.

The course itself aims to impart the necessary knowledge and skills to enable participants to take charge of all aspects of the operation of small-to-medium size fish processing unit. The course is unique in that the instruction material has been tailored specifically to the needs and conditions prevailing in Pacific Island countries. In particular, detailed attention will be given to a number of products which are of particular importance to Pacific Island countries. These include fresh-chilled deep water snappers (for Japanese and Hawaiian markets), sashimi tuna, trochus and green snail shell, and beche-de-mer. In addition, the course includes more general material on fish composition and spoilage; freezing, icing and cold storage; design of fish working areas; fish cutting and packaging; factory hygiene; marketing and business management; alternative fish processing methods; specialist fish products; quality assessment; and the planning of extension work and training. The course is very practical in its orientation, and the classroom sessions will be heavily supplemented by hands-on experience. Most practical work involving the handling of wet or frozen fish, will take place at 'Natai', the Vanuatu Government's fish market, which has both wholesale and retail premises. The Vanuatu



Agriculture Departments Veterinary Laboratories have been made available for bacteriological and hygiene control experiments, and the Vanuatu Fisheries Department will provide fishing vessels and the infrastructure support necessary for two 3-day fishing trips, during which the trainees will cover various aspects of on-board fish handling.

Because the course is so wide-ranging, it has been necessary to enlist the assistance of a number of specialist institutions who have provided instructors to cover different parts of the course. These include the U.K. Tropical Development and Research Institute; the New Zealand Fishing Industry Board; the New South Wales Fish Marketing Authority; the Food and Agriculture Organisation of the United Nations; and the Vanuatu Governments Fisheries Department and Fish Market. Several private sector specialists from New Zealand and Vanuatu are also scheduled to participate. The course is being coordinated by SPC Fish Handling and Processing Officer, David Burford with input from other SPC coastal fisheries staff as required.

#### Southern Albacore Workshop

The South Pacific Commission coordinated a workshop, initially proposed by New Zealand at the 17th SPC Regional Technical Meeting on Fisheries in 1985, on research into the potential of developing fisheries for southern albacore in the Pacific ocean. The workshop was hosted by the New Zealand Fisheries Research Division in Auckland from 9 - 12 June 1986. SPC was represented by Tuna and Billfish Assessment Programme Coordinator, Dr John Sibert. The workshop generally proceeded smoothly, with participants from Cook Islands, Fiji, New Caledonia, Tonga and Vanuatu making excellent and productive contributions on the status of and plans for albacore fisheries in their respective countries. A complete report on the meeting was prepared and will be presented as a document to the 18th SPC Regional Technical Meeting on Fisheries in August.

Research conducted last February by U.S. and N.Z. boats indicate that southern albacore can be found in fishable quantities in association with the same sorts of oceanographic features as in the north Pacific. Similar research is planned for 1987 and the U.S. will again send the Townsend Cromwell to the South Pacific. It is possible that the French vessel, Coriolis will also participate.

The presence of two Taiwanese participants to the workshop was particularly encouraging. They seemed to be very pleased to have been included and are keen to widen their relationship in the South Pacific area. They have a research vessel, but internal difficulties prevented any commitment of activities for 1987.

The question of assembling a coherent set of data on southern albacore received considerable attention. Workshop participants generally favoured the idea that the SPC should attempt to compile such data, but it was clear that detailed data would not be available from Korean, Taiwanese or U.S. landings in Pago Pago. Workshop participants were keen to avoid the identification of the research programme with any single country. The SPC was thus urged to continue in its role as coordinator of the programme.

The workshop planned a tagging programme utilising both research and commercial fishing vessels to release tagged fish. The SPC will collaborate with N.Z.F. and U.S. scientists in the general design of tagging procedures and will be responsible for maintaining the tagging records. The total number of tagged albacore is expected to be less than 3,300.

More details of the tagging programme and research fishing results can be found in the article on page 25 of this issue. The Commission is currently preparing a directory of fisheries training opportunities available to Pacific Island countries. This directory is being compiled by SPC Fisheries Training Assistant, Sylvia Rodgers and SPC Fisheries Training Officer, Alastair Robertson. The directory is being prepared in response to observations made during a survey of fisheries training needs and opportunities in the region which the Commission has been carrying out according to a recommendation from the 17th SPC Regional Technical Meeting on Fisheries in 1985. An important point noted by the survey is that Pacific Island countries often find it difficult to select the best training programmes to match their own needs because they lack information about the opportunities available to them.

The planned directory should help overcome this problem. Information will be included from all major training bodies offering courses in fisheries-related subjects, classified in two ways, by country and by topic. The ultimate aim is that an island Fisheries Officer or Training Officer, having in mind a subject area and a potential candidate for training, can obtain comparative information on a variety of training programmes which may suit his purpose. If necessary he can write to the contact addresses given to seek supplementary or more up-to-the-minute details of those courses which seem most appropriate to his or his candidates requirements.

The directory is at an advanced stage of preparation, and will be circulated in draft form at the forthcoming 18th SPC Regional Technical Meeting on Fisheries in August (see article p.2 in this issue). The purpose of this is to seek comment on the usefulness of the format, and encourage input from institutions who may not be adequately covered before finalising the directory towards the end of the year.

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## CONSULTANCY CORNER

### Consultancy work in the Pacific Islands region

Duplication of effort in the fisheries field, especially that concerning work by specialised consultants, has become increasingly evident in the South Pacific region. For example, there have been two specimen shell surveys of Tuvalu, three yellowfin trolling studies of the Line Islands and close to half a dozen consultancies to advise on appropriate types of purse seining operations for the various island groups. Both on the part of the consultants involved and the governments for which the work is carried out there has been a lack of knowledge of similar work undertaken previously in the same or neighbouring countries. To disseminate information on recently completed or on-going consultancies in the region, this new feature of the Fisheries Newsletter is being added which will give a brief description of known consultancy work being carried out in the region while keeping specifics of the work confidential if the government of country so wishes.

Bob Gillett, of the FAO/UNDP South Pacific Regional Fisheries Development Programme in Suva, Fiji sent us our first list of consultancies, as well as the following comments:

"The recent report by Semisi Fakahau and Mike Shepard, entitled 'Fisheries Research In The South Pacific' stated "fisheries officers in virtually every country and in every regional organisation have identified difficulties in keeping abreast of development and research activities in other countries as one of the most serious problems in their work". In response to this, it appears as though efforts by the SPC and USP will be undertaken in the near future to facilitate the collection, storage, and cataloguing of available Pacific Islands fisheries literature.

"For some time I have felt that another important but frequently available source of information is the body of reports and findings of specialised short-term consultants who have worked in the fisheries sector of the region. The results of these consultancies, most often presented in an unpublished form, are characteristically not well known outside the country for which the work was performed. Even within a country, present day fisheries workers are frequently unaware of previous consultancies. In this situation much duplication of effort occurs. The number of independent investigations into the Hawaiian market for Pacific Island bottom fish is a prime example.

"In recent years a large number of agencies have sponsored fisheries-related consultancies. An attempt to list such international agencies would include ACIAR, ADB, BDDP, CIDA, CFTC, EEC, FAO, FFA, FSP, ICOD, ORSTOM, PFDF, PIDP, SPC, SPEC, UNDP, USP, and the World Bank, as well as the overseas aid agencies of most metropolitan countries which provide bilateral or multilateral aid to the region.

"In many cases the results and reports of consultancies are confidential with the control of the confidentiality being exercised by the government of the country concerned. However, the fact that a consultancy has taken place is rarely a sensitive issue. Publicity for recently

completed studies would create an awareness of the work throughout the region and interested workers could contact the recipient government directly to possibly obtain non-confidential results. In the case where a government may be reluctant to release results, an exchange of consultant's reports between countries becomes a possibility.

"Most agencies are happy to receive credit for the work that they sponsor, and there would appear to be numerous advantages in encouraging them to publicise the work they are supporting. I hope therefore that by compiling the following list of consultancies sponsored either directly or indirectly by FAO/UNDP in the first half of 1986, other organisations may be encouraged to do likewise. The reports by regional consultants are available from the FAO/UNDP Fisheries Programme, UNDP Private Mail Bag, Suva; inquiries concerning country-specific consultancies should be directed to the fisheries division of the country concerned."

We invite readers knowing of recent consultancies in the fisheries sector to send us a brief description of the work carried out to be added to the compiled list above. By adequate dissemination of this information to governments and fishery personnel in the region, perhaps duplication of effort can be controlled so that the time, money and energy can be better spent in other needed research.

**Consultancies sponsored by FAO/UNDP  
South Pacific Regional Fisheries Development Programme  
in first half of 1986.**

Area	Consultant	Work
Regional	Gulbrandsen	Inspect ongoing boat construction and give on site advice to boatbuilders and fishery officers.
Regional	Anraku, Popper	Formulate plans for Japanese aquaculture assistance project.
Regional	Burke	Provide legal opinions on multi-lateral fishery agreement with USA; executed by FFA.
Regional	Walters	Provide instruction at SPC Stock Assessment Workshop.
Regional	Several	Provide instructions at FFA Ocean Management Training course; executed by FFA.
Regional	Belew	Provide graphic work for SPC fisheries training manuals.
Regional	James, Lupin	Provide instructions at SPC Fish Handling Workshop.
Regional	Munro	Review South Pacific coastal fisheries research.
Cook Islands	Lewis	Review fisheries research in Cook Islands.
Cook Islands	Savins	Assemble 'KIR-2' canoe; instruct in operating canoe.
Federated States of Micronesia	Mattson	Conduct pre-feasibility study for tuna cannery at Yap; executed by FFA.
Fiji	Mornement	Improve fish handling logistics at tuna cannery.
Papua New Guinea	Mendoza	Assess the potential for developing a village level trap fishery.
Papua New Guinea	Van Eys	Investigate foreign markets for local fish.
Papua New Guinea	Barrat	Investigate utilisation of prawn bi-catch.
Tonga	Polacheck	Identify main problems of the fishery statistics system.
Vanuatu	Hammond	Prepare code of practice for airfreighting fish.
Western Samoa	Crossland	Advise on the enhancement of the structure and role of the Fisheries Division; executed by FFA.

## NEWS FROM IN AND AROUND THE REGION

### Micronesian Tuna Fishing Pacts

(Sources: PNG Times, Marshall Island Journal)

While agreement on fishing access is yet to be reached by member countries of the FFA and the US Tuna Boat Association, a 3-nation pact has been ratified by the Federated States of Micronesia, Palau and Kiribati. Negotiations over the treaty, which began in September 1985 in Guam, were ratified in March 1986. The Congressmen of the 3 nations believe that the agreement is in accord with the overall foreign policy for fisheries matters and that it provides a very satisfactory interim licensing arrangement until a wider regional agreement can be concluded and implemented. The pact enables the three nations to contract directly with owners and operators of US purse seine vessels rather than the American Tuna Boat Association. Under the treaty, fees collected and interest earned thereon will be shared among the three nations with ninety one percent going to the country in whose zone the fish are caught, and the remaining nine percent being divided equally among the three nations. Contracted vessels would be paying \$58,000 per vessel license fee which is approximately \$24,000 higher than the chargeable fee imposed in 1984.

Despite the pact, which provides some basis of dealing with US fishing boats, there seems to be still some consideration by Kiribati to go further in its fishing agreement with the Soviet fishing Fleet. Kiribati president, Mr Ieremiah Tabai has said that his government is prepared to study possible longer term proposals to allow port access to the Soviet tuna boats. Mr Tabai noted Kiribati's appreciation of the way the Soviets have been adhering to the conditions of the fishing agreement, which prohibits Soviet boats from entering Kiribati's 12-mile territorial waters under any circumstances, and on their timely payment of fees - both areas in which Kiribati experienced major problems with the U.S. fleet. Vanuatu, which is also considering a fishing agreement with the USSR, is presently awaiting further details from the Soviet Union on its application for a fishing deal.

### Fisheries Infrastructure Development in Tonga

(Source: Tonga Chronicle)

Ministry of Agriculture, Forestry and Fisheries officials in Tonga are confident that a reliable fish marketing infrastructure will be in place in the country by the end of 1987. This follows the finalisation of an agreement with the EEC to fund the construction of a new fishing harbour at Fuaa, and with the government of Japan to provide over T\$4.5 million (541 million yen) worth of infrastructure facilities, including cold stores, ice plants, ice boxes and fish carrier vessels.

The two complementary projects aim to establish a continuous fish marketing chain in Tonga, from fisherman to consumer. The development of the collection system is needed to cater for the growing number of fishermen landing increasing quantities of fish in remote locations among the scattered islands. According to Principal Fisheries Officer Mr Semisi Fakahau, an estimated 850 boats will be harvesting some 3,675 tonnes of fish by the end of 1987. There are about 1,700 registered fishermen in the country, but many other people fish and occasionally sell their catches.

Fisherwomen's Training Course in Fiji  
(Source: Fiji Times)

As talks dwell around how disadvantaged groups could be assisted to enable them to participate openly in the economy of their country, the Fisheries Division in Fiji has already facilitated a training programme specifically run for Fiji's fisherwomen. The idea was conceived by the Minister for Primary Industry in Fiji and implemented by the Fisheries Division. The course was the first of its kind conducted by the Fisheries Division and involved 12 women participants from around the Fiji group of islands. Over a period of 3 weeks the participants were taught net mending, cutting and hanging, and business management with field trips organised to enable them to visit project sites and to be shown the only button factory in Fiji. To ensure that the women are able to utilise what they have learnt from the course, each participant was given 2 coils of fish nets to take home with them. Funding for the programme was provided by the Fiji Government to cater for accommodation, passages, pocket allowance and food.



(Photo: Fiji Times)

Participants at Fiji's first workshop for fisherwomen. Left and right are instructors  
Akuila Vuakaca and Sunia Waqanabeta

USAID Commit Major Funding to Fisheries Projects  
(Source: SPC/USAID)

The United States Agency for International Development (USAID) held a meeting in Honolulu, Hawaii from May 10-12 1986, in order to involve Pacific Island countries in the design of USAID South Pacific Regional Development Office's (SPRDO) new South Pacific Fisheries Development Project. The meeting which was attended by Pacific Island nations' fisheries and development planning representatives, as well as observers and resource persons from relevant organisations, aimed to discuss and identify country-specific fisheries development needs which might be eligible for funding support from the project. The USAID Regional Director

for the South Pacific, Dr William Paupe, explained to participants the philosophy and methods by which USAID funds support development activities in the region, and stated that USAID has earmarked approximately US\$6.5 million over the next four years for fisheries projects in the region. Of this US\$1 million is to be appropriated in fiscal year 86 (i.e. before September 1986).

In discussing the way in which these funds could be best utilised, delegates to the meeting made a number of enlightening comments and suggestions. Several participants expressed concern that their countries could use less advice and more direct hard currency in expanding and improving their fisheries development, and suggested that the project focus should be turned toward the private sector. Some indicated that multi-lateral donors have in the past tended to pull out of activities before they mature, and expressed the hope that project funding will continue beyond four years where appropriate. There was a suggestion that discretionary funds be included within new projects to allow greater flexibility in their implementation.

On the mechanics of funding, several participants expressed their desire to seek projects that would allow personnel from neighbouring countries to be used as experts and consultants during the implementation of various efforts, and that maximum flexibility in the purchase of hardware and other commodities be allowed within the project guidelines. Concern for donor coordination was discussed regarding the USAID fisheries development project and it was suggested that USAID coordinate its activities with those being implemented by regional organisations such as the Forum Fisheries Agency (FFA), Food and Agriculture Organisation (FAO), and the South Pacific Commission (SPC) as well as those assisted by bi-lateral donor agencies. Participants stated the need for such coordination to assure programme continuity and effective allocation of financial and scarce technical resources, and to more effectively plan activities complementary to on-going work.

Within the technical assistance framework, participants identified needs including short- and long-term feasibility studies, and augmentation of technical staff. The need for expanded technical support for research received attention especially along the lines of resource assessment. Consultants, on the other hand, were viewed as a mixed blessing by the participants. While they recognised that there is a need to use consultants, they wished to carefully gear consultative activities towards specific needs such as helping in negotiations and development of export marketing.

Participants identified needs which included support for research surveys, stock assessment, data management, cooperation and exchange services, hydrographic surveys and zone defining. All forms of training geared toward technical fisheries self-sufficiency were placed high on the needs list. These included the training of rural fishermen, short- and long-term training for others in the fishing industry, and training for maintenance and repair of hardware and mechanical devices. Such training should include institutions both in the recipient country and overseas.

With a view toward improving rural fisheries, participants identified equipment needs that included small vessels, FADs (fish aggregation devices), laboratory equipment for research projects, fishing gear and small vessel engines. The purchase and installation of computers also received a significant amount of attention. Infrastructure building to include the development of docks, jetties, freezing, and ice making facilities, extension centres and training workshops were viewed by the participants as priority needs.

Lastly there was a general consensus that the island nations would appreciate assistance to include funding for institutional credit to finance boat construction, small enterprise development and equipment. Such credit programmes would be administered through the Development Banks, or other existing fisheries revolving funds and would be supplementary to assistance that may be provided for gear and other small inputs.

Overall there was a strong feeling expressed by delegates that the USAID fisheries assistance programme should have a strong national rather than regional focus with bilateral discussions to establish funding priorities. It was also emphasised that the project should be structured for optimum flexibility and responsiveness to ensure greater effectiveness in meeting country requests for assistance. The framework would appear to be in place for a successful project which can make a significant contribution to fisheries development in the region and would seem to be reasonably free of cumbersome administrative procedures.

Support for ICLARM South Pacific Research Programmes  
(Source: ICLARM Newsbrief)

Development of hatchery facilities and research on culture of giant clams in the Solomon Islands under ICLARM's (International Centre for Living Aquatic Resources Management) International Giant Clam Mariculture Project is receiving wide support from a number of funding agencies. ICLARM will receive US\$10,000 from the San Francisco-based Skaggs Foundation, a technical co-operation officer and project support funds from the UK Overseas Development Administration and core funding of some A\$70,000 from the Australian Development Assistance Bureau (ADAB). This latter sum is for research projects in general, but most will be used to support the clam project, and other activities in the South Pacific region.

New Canoes on Trial in Papua New Guinea  
(Source : Times of Papua New Guinea / Patrick Matbob)

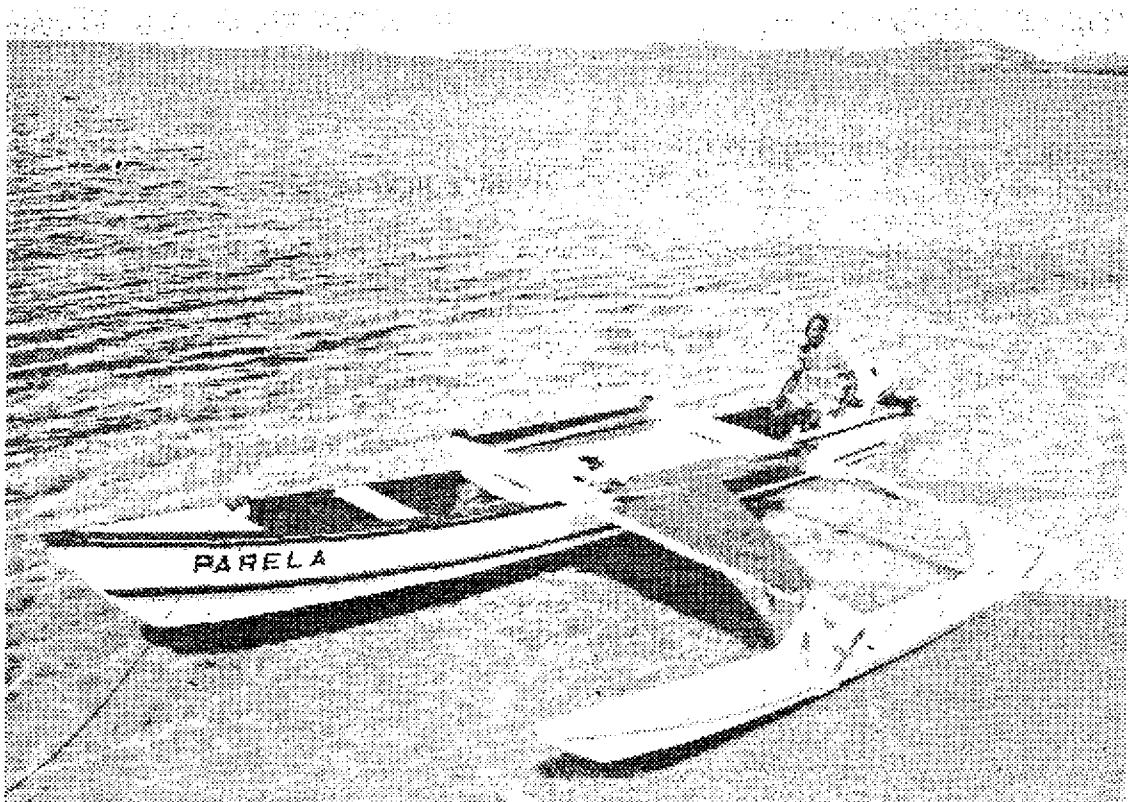
In efforts to improve the effectiveness of village fishing operations, the Fisheries Division of Papua New Guinea's Department of Primary Industry has been investigating improved small-scale fishing craft which can decrease the fishermen's operating costs, and allow him to put to sea in a wider range of weather conditions.



The Division has chosen two canoe designs to test their suitability for village fishing operations. The new designs, by FAO naval architect Oyvind Gulbrandsen, are known as the 'Red Snapper' and the 'prototype improved dugout'. Mr Gulbrandsen is well known to the Pacific Islands region for his earlier work in developing the Samoan 'alia' catamaran, and, more recently, the KIR-1 and KIR-2 sailing canoes in Kiribati. PNG's 'Red Snapper' is in fact a successor to the Kiribati canoes, and is designated KIR-4.

The Red Snapper in particular is felt to be highly suitable as a small-scale commercial village fishing craft in PNG. It is similar in layout to traditional dugout canoes, can carry heavier loads and withstand rougher seas than most traditional dugouts of a similar size, and because of its fine lines and relatively light weight, travels faster when heavily laden and powered by a small outboard motor than does a dinghy under similar circumstances. It is easy to sail with the wind coming from either side of the vessel, as the outrigger does not have to be kept to windward. The bottom is double planked, so that the outer layer can be replaced when it becomes damaged by marine borers, and the hull can be constructed from either plywood or planking.

The disadvantages of the Red Snapper are the cost, estimated at about Kina 2,150 (including labour valued at K1,000), which makes it really suitable only for fishermen in locations where there are reasonable cash earning potentials; and the fact that buyers need to undergo training in sailing and handling the canoes, particularly in heavy weather. This latter problem has been overcome by an agreement with the US-based International Human Assistance Programme (IHAP), who have already funded two training courses in which youths and village fishermen received instruction in building, looking after and using the 'Red Snapper' canoes. Future similar courses are planned.



(Photo: 'Times of Papua New Guinea')

The KIR-4 canoe on trial in Papua New Guinea.

The Red Snapper canoes perform well when powered by small outboard motors in the 4 to 15hp range (the sail is provided for auxiliary power when conditions are right, and for emergency use). The top speeds obtained with a crew of three in a light breeze were:

4 h.p. outboard	: 6.7 knots (12 km/h)
8 h.p. outboard	: 9.3 knots (17 km/h)
10 h.p. outboard	: 9.3 knots (17.5 km/h)
15 h.p. outboard	: 13 knots (23 km/h)

At speeds of 8 knots the Red Snapper canoes travel about 4 km/litre when powered by an 8 h.p. two-stroke outboard and about 6.5 km/litre when powered by a 10 h.p. four stroke. The four-stroke would cover 53 nautical miles (98 km) at 9.5 knots (full throttle) and 70 nautical miles (130 km) at 8 knots (three-quarter throttle) on a full 20 litre tank of petrol. The fishermen of Roku village, who use an 8 h.p. two-stroke outboard on 'Iamera', the Red Snapper canoe they are testing, say that the boat goes twice as far on a full tank of fuel as their own canoe.

#### Tragic losses at sea

(Source: Pacific Island Magazine)

Three local fisherman from Kiribati left their homes at one week intervals on 3 separate fishing expeditions and not one returned. The incidents all happened in January, coinciding with the sudden storms that hit Kiribati at that time, according to the Marine Division. All attempts to find the missing persons failed.

In a different incident a Truk congressman, Mr Tony Otto, along with three constituents, were reported missing during a fishing trip in January. The four were found 24 hours later, making it the first lost and found for a Trukese congressman for this year and possibly the first this century, according to the report.

#### Workshop on Manned Submersible Use in Fiji

(Source : UNESCO International Marine Science Newsletter)

Scientists and engineers from countries that possess advanced undersea technology were brought together recently with their counterparts and policymakers in developing countries of the South Pacific, in an attempt to assist the latter countries to effectively participate in the exploration and exploitation of submarine resources. Advanced technology in this field was the topic of study at the "STAR Workshop" which was held in Suva, Fiji, from 24 to 29 September 1985. STAR is the South Pacific Tectonics and Resources Working Group, co-sponsored by CCOP(SOPAC) and IOC.

This activity, entitled the "STAR Workshop on the Use of Manned Submersibles and Remotely Operated Vehicles in the South Pacific", was organised and sponsored jointly by the STAR Working Group Co-sponsors (above) and by France's ORSTOM and IFREMER.

The objectives of the workshop were to :

help determine the feasibility of the use of manned submersibles and remotely operated vehicles (ROVs) in the South Pacific geological and geophysical exploration activities; develop guidelines for their use in mineral resource assessment, resource management and engineering studies; identify appropriate technologies and target areas for their use in the South Pacific region; and encourage the establishment of international cooperative programmes for their use in the region.

Over 40 papers were presented, discussions were held and recommendations were made, focusing on : (a) new developments in manned submersible and ROV strategies as well as the use of such vehicles toward the solution of geological problems in the South Pacific; (b) how these vehicles can best be utilised in prospecting for and assessing mineral resources in both shallow and deep waters surrounding the island states of the South Pacific; and (c) the design of research projects and programmes for the use of these vehicles in the region.

The workshop was attended by 72 participants from 14 countries; Australia, China, Cook Islands, Fiji, France, Japan, Kiribati, New Zealand, Solomon Islands, Tonga, Tuvalu, UK, USA, and Vanuatu. A report of the workshop, including its recommendations, will be published in the IOC Workshop Series.

#### PNG Wants better Fishing Access (Source: The Bulletin)

The Papua New Guinea Government, beset by the problems of a sagging agricultural economy, desperately needs to develop its lucrative fishing industry to help boost its economy. PNG wants better access for its fishing vessels on the Australian side of the Torres Strait border so that local fishermen can cash in on the lucrative prawn and lobster fish markets. Better access could be worth an extra \$3 million to local fishermen. Under the existing Torres Strait border agreement only PNG boats up to 20 metres are allowed into Australian waters in the Strait. PNG's problem with the agreement is that all its commercial fishing boats (about 20 in all) are bigger than 20 meters and therefore are denied access. PNG's Primary Industry Minister, Mr Iambakey Okuk, has written to his Australian counterpart, Mr John Kervin, asking for a review of fishing access rights and is still awaiting a reply. PNG's present fishing industry is grossly underdeveloped, netting only \$22 million a year. According to Mr Okuk, it has the potential to bring in \$210 million a year which is money PNG desperately needs.

#### 5th Coral Reef Congress Proceedings Available

The Proceedings of the Fifth International Coral Reef Congress, held in Tahiti, French Polynesia, in May/June 1985 are now available. The proceedings, 3,486 pages in total, are presented in six volumes.

**Volume 1 - French Polynesian Coral Reefs:** general features of French Polynesian islands and their coral reefs.

**Volume 2 - Abstracts of Intended Contributions:** abstracts in English and French of 424 intended contributions.

**Volume 3 - Symposium and Seminars (A):** Late Quaternary and Present Sea-Level Changes - Magnitude, Causes and Future Applications; Advances in Reef Diagenesis; Hurricane Effects on Coral Reef Environments; Role of Micro-organisms in Coral Reef Ecosystems; Reef Growth and Sea-Level Change - the Environmental Signature.

**Volume 4 - Symposium and Seminars (B):** Herbivores - Plant Interactions on Coral Reefs; Evolutionary Ecology of Reef Organisms; Protection and Conservation of the Reef Environment - A Gamble on the Future; Reproduction and Recruitment of Corals; Ciguatera and Other Reef Seafood Poisoning; Metabolism, Calcification and Carbon Production in Reefs; Assessment and Management of Coral Reef Fisheries - Biological, Environmental and Socio-Economic Aspects.

**Volume 5 - Miscellaneous papers (A):** Calcareous Algae - Halimeda; Other Algae; Terrestrial Plants; Sponges and Cryptic Communities; Molluscs; Crustaceans and Other Invertebrates; Echinoderms; *Acanthaster planci*; Bioerosion; Fish - Reproduction and Recruitment; Fish Communities; Turtles; Reef Fisheries; Other Reef Resources; Socio-Economy.

**Volume 6 - Miscellaneous papers (B):** Hydrology and Plankton; Biology of Corals; Zooxanthellae and Reef Calcification; Coral Growth; Coral Communities; General Ecology; Physiology and Morphology; Environmental Stress; Management of Coral Reefs; Paleoecology of Holocene and Ancient Reefs; Reef Sediments and their Evolution: Various.

The volumes are free to participants in the Congress, and are available at a special launching price of US\$200 per set of six (not sold separately) to others. Contact address: Antenne Museum/EPHE, Centre de l'Environnement d'Oponuhu, B.P. 1013, Papeete, Moorea, French Polynesia.

#### **Pago Pago Wins Tuna Longliners**

(Source: Tonga Chronicle : Pacific Magazine)

Tonga's longliner MFV Lofa will be joining the tuna fleet of the Republic of China (Taiwan) in switching its landing base from Fiji to American Samoa. According to Fisheries Division in Tonga the new arrangement will be beneficial as MFV Lofa will be able to get cheaper fuel and lower port fees from Pago Pago compared to Fiji. According to the Lofa management committee, the arrangement will last at least through the

transfer of management at the Levuka cannery from the Japanese to the Fiji Government.

Although MFV Lofa will enjoy the benefits offered by the Pago Pago cannery, officials are concerned that competition from the increasing number of boats which are switching to neighbouring Pago Pago as a base may be more than the Kingdom's developing fishing industry can handle. Despite the concerns there is very little that Tonga can do about the increasing fishing traffic in the area.

Meanwhile, plans by a local entrepreneur to construct a fish processing and cold storage plant in Pago Pago are meeting opposition from local fishermen. While supported by several at a well-attended meeting to discuss the proposal, a number of local fishermen expressed doubts as to the benefit of the plant. Some noted that for the plant to generate economically, fish from 'non-local' sources would have to be obtained - namely the fish sold over the side of foreign vessels discharging their catches to the canneries. Many local fishermen claim that in the past they have been unable to sell their catches because of competition from fish which the crews of large vessels sell cheaply to make beer money.

Two 'Alia' on Trial in New Caledonia  
(Source : Les Nouvelles)

Two 'alia' design catamarans have been imported into New Caledonia by the territorial government, so that their suitability for local fishing operations can be assessed. The catamarans were brought in as bare hulls and will be fitted out with decks and cabins before being delivered to experimental fishing sites at Mare island and at Poindimie on the mainland.



(Photo: 'Les Nouvelles Calédonniennes')

The two 'alia' hulls after delivery to Noumea.

Giant Marlin Caught in Tahiti?  
(Source : La Depeche)

Like a bad April Fool's day joke, the fisherman who captured this record breaking blue-marlin offshore of Moorea, French Polynesia, will not have his catch recognised by the International Game Fishing Association. Professional fisherman Francis Bonnet contravened the IGFA's strict regulations on competitive fishing, by having his fishing partner Andre Tavanae clear a loop of line from the deck to prevent it from catching on the deck fittings. Under IGFA rules, the person holding the rod must bring the fish to boat by his own efforts: if anyone also touches the line, this constitutes help, and the catch is disqualified.

Nevertheless, this fish would have challenged established records. Weighing in at 709 kg, the marlin measured 4.41 metres, a little shorter than the 5.70 metre boat from which it was caught. The fish was taken on a home made 'whistling' trolling lure, which was rigged with a piece of octopus as bait.



(Photo: 'La Depeche de Tahiti')

The 709 kg marlin caught off Moorea on April 1st 1986.

Correction

Issue 36 of the SPC Fisheries Newsletter carried an article (page 20) advising readers that French Polynesia's Fisheries Service, EVAAM, had recently released a documentary video-cassette on pearl-culture techniques. The article stated that the video is only available in SECAM colour system. In fact, the video is also available in PAL and NTSC colour systems, and in both standard formats (BETAMAX and VHS). We apologise to the producers and to our readers for the error.

## FISHERIES SCIENCE AND TECHNOLOGY

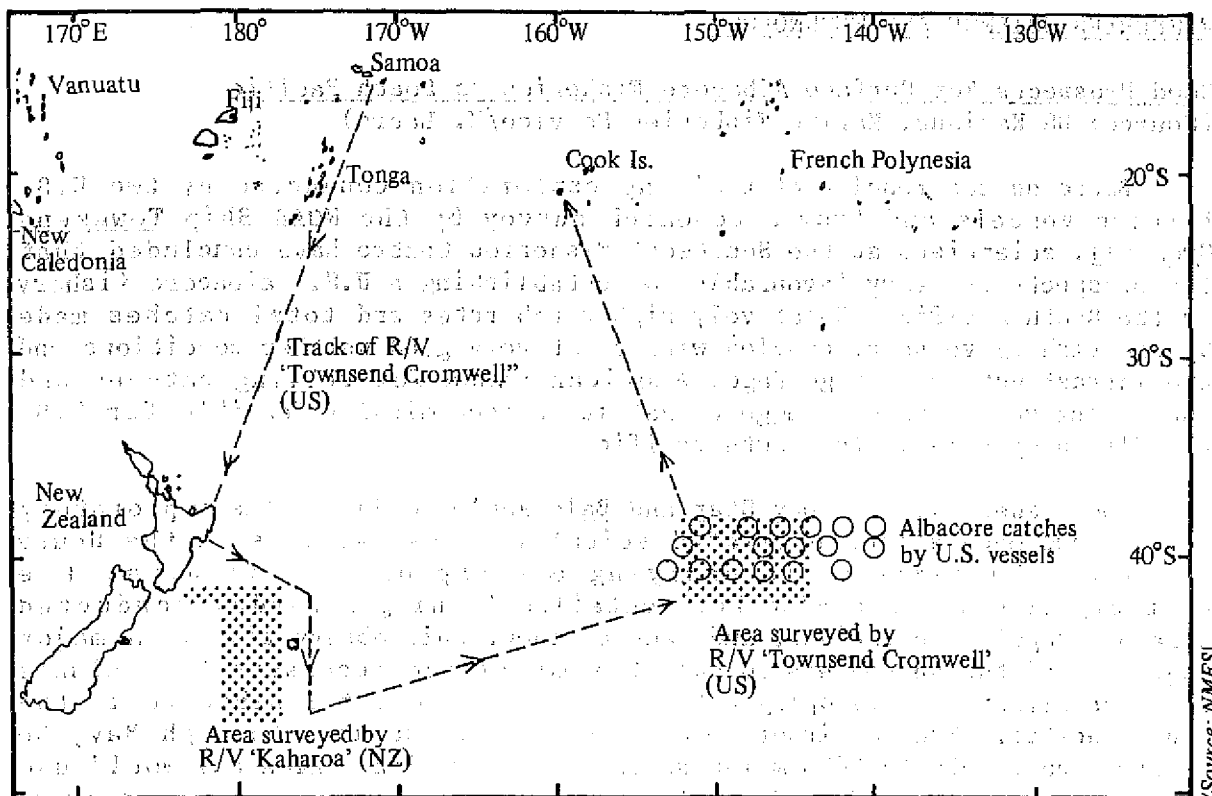
### Good Prospects For Surface Albacore Fisheries in South Pacific (Source: US National Marine Fisheries Service/M. Laurs)

Based on the results of trolling exploration conducted by two U.S. fishing vessels and from a research survey by the NOAA Ship Townsend Cromwell, scientists at the Southwest Fisheries Centre have concluded that the prospects are very favourable for establishing a U.S. albacore fishery in the South Pacific. Relatively high catch rates and total catches made by the fishing vessels, coupled with relatively good weather conditions and the infrastructure in Pago Pago, American Samoa for selling catches and supporting vessel needs, suggest that it is economically feasible for U.S. vessels to operate in the South Pacific.

The fishery vessels Day Star and Bald Eagle conducted the exploratory fishing and made albacore-related scientific observations in the South Pacific. In addition to carrying out exploratory fishing, the participating vessels also kept detailed fishing records, conducted albacore tagging operations, and made oceanographic observations. A major objective of the survey was to gain the experience necessary to evaluate the feasibility of developing a U.S. troll fishery for albacore in the South Pacific. Such a fishery would operate from January through May, be centred about 1500 to 2000 miles southeast of American Samoa and would use the infrastructure in Pago Pago, American Samoa for selling catches to U.S. canneries, refuelling, making repairs and reprovisioning

The objectives of the Cromwell operations were to obtain information for use in developing understanding and improved models of South Pacific albacore biology, ecology and population dynamics. Data were also collected to describe the physical and biological characteristics of the ocean environment associated with high concentrations of albacore in order to develop methods of predicting favourable fishing areas and conditions. In addition the distribution and availability of albacore in surface waters of the Subtropical Convergence Zone of the South Pacific were investigated in order to assess the potential for development of a fishery in the region.

The Cromwell operations were part of a multi-ship investigation which, in addition to the U.S. fishing vessels, also included the New Zealand R/V Kaharoa. A schematic diagram showing the area of operations is shown below. The survey was part of an international cooperative effort investigating South Pacific albacore which involved the U.S., New Zealand, France and South Pacific Island nations. Cruise personnel included fishery scientists from the SWFC Honolulu, and La Jolla Laboratories, New Zealand Ministry of Agriculture and Fisheries, French ORSTOM in New Caledonia and an observer from the Kingdom of Tonga.



Areas surveyed by southern albacore research and commercial fishing vessels.

The F/V Day Star caught an estimated 55.5 tons of albacore. The vessel was filled to capacity after 29 days of fishing and delivered 50.6 tons of albacore to the cannery in Pago Pago. The Day Star also tagged and released 602 albacore with an estimated weight of about 5 tons. The Bald Eagle caught about 52 tons of albacore, including 100 fish that were tagged and released. The average weight of the catch was about 17.5 pounds (7.9 kg). The fishing was carried out within a rather narrow latitudinal range between about 38°30' and 41°30'S. The area of best fishing was between about 141° and 151°W; westward of 151°W the catches dropped off considerably.

Examination of the albacore catch results made by the fishing vessels and the Cromwell and oceanographic measurements that were made concurrently with the fishing revealed that albacore catches were associated with the Subtropical Convergence Zone (STCZ). Fishing success was highest near the north boundary of the STCZ, and nearly all albacore catches were associated with sea surface temperature (SST) fronts, usually with gradients about 0.5° to 1°C per mile or less. Catches were made in waters having SSTs in the range of 16.5° to 19.0°C with best catches made in warm water intrusions at SSTs near 18.3° to 18.6°C.

In summary, it appears feasible to establish an albacore fishery in the South Pacific. From what is known at this time, the South Pacific albacore population is in good condition and can support a surface fishery. However, substantially more fishery exploration and knowledge of the migration patterns and biology of the population are required before a viable U.S. fishery can be successfully developed in the South Pacific.



Albacore Tagged in Southern Fishery  
(Source: SPC/NMFS)

As noted in the preceding article the New Zealand fisheries research Kaharoa, the United States research vessel Townsend Cromwell and two United States troll boats, Day Star and Bald Eagle conducted a joint research and exploratory fishing cruise during February and March of 1986. The area of operation was around 40°-45°S latitude between New Zealand and 165°W longitude. Fishing was very successful for surface dwelling southern albacore and about 800 fish were tagged. Two types of tags were used - red and yellow.

Yellow tags were used for most of the albacore tagged. Albacore recaptured with yellow tags should be measured from the tip of the snout to the fork of the tail. Length should be recorded to the nearest 1 centimetre (or half inch if you prefer) along with date and location of capture. This information should be forwarded, with the finder's name and address, to:

Albacore Tagging Program  
Southwest Fisheries Center  
P.O. Box 271  
8604 La Jolla Shores Drive  
La Jolla, CA 92038  
UNITED STATES

In return the finder will receive a US \$2.00 reward and a special baseball cap bearing the symbol of the albacore tagging project.

Red tags were used to mark fish that have been injected with a special dye to leave a mark in the fish's ear bones (otoliths). These marks will be used to determine the age of the fish so it is vital that the entire fish be returned with the tag intact. If any albacore are caught with red tags, they should be stored separately from the rest of the catch, and the United States National Marine Fishery Services agent in Pago Pago who will arrange to collect the fish should be notified. His address is:

NMFS Agent  
c/o Office of Marine Resources  
P.O. Box 3730  
Pago Pago  
AMERICAN SAMOA 96799

If accurate information is provided on the date and location of capture, fish with red tags will be bought by NMFS at cannery price. In addition, an albacore returned to NMFS intact with a red tag and proper information will receive a US \$50.00 reward and the special cap.

Special steps are being taken to ensure that albacore tags will be returned with complete and reliable information. The American Fishermen's Research Foundation is sponsoring a lottery for people who return tags, with big cash prizes for the winners.

# 8000 Skipjack And Yellowfin Tagged In Micronesia

(Source: SPC/Tohoku Research Laboratory)

The SPC has recently been informed that the Japanese Fisheries Agency has completed a relatively large tuna tagging program in the central Pacific. Between October 1985 and February 1986, 8418 fish were tagged by the training vessels, Yaizu Maru and Mie Maru, training vessels of the Shizuoka and Mie Prefectural Fisheries Schools. Tags were released in from about 140°E to 180°E longitude and 4°N to 18°N latitude. Most of the tagged fish were skipjack, but some yellowfin were also tagged.

Tags are yellow "dart" tags bearing the words

TOHOKU SUIKEN SHIOGAMA JAPAN  
and the letters "YZ" or "ME". Fishermen finding tagged fish are requested to report the following information to:

Fisheries Agency  
Tohoku Regional Fisheries Research Laboratory  
Shinhamacho 3-27-5  
Miyagi Prefecture  
JAPAN 985

- Date and location of catch
- Tag number, length and weight of fish

- Name and address of finder

The return of the tag itself would also be appreciated. Release information and a T-shirt will be presented to the finder.

## Quality Considerations for Warm-Water Shark

(Source: FAO Fish. Tech. News)

Shark is one of Australia's major fisheries, totalling around 10,000t a year. Most of the shark is caught in southern waters, and consumed in the southern states of Victoria, South Australia and Tasmania. Shark is eaten as "fish and chips", that curious British "take away" meal which has been exported to many parts of the English-speaking world. After deep-frying in batter the fish is eaten with chips (french fries) which have also been deep-fried.

Almost all Australia's shark comprises two species, gummy shark (Mustelus antarcticus) and school shark (Galeorhinus australis) caught in the warmwaters of 12-18°C by gill netting.

Recently, the Northern Territory of Australia has become interested in developing the shark fishery to the north of Australia. The resource is presently being fished under foreign fishing arrangements (bilateral and joint-venture) for marketing outside Australia. At least 7,000t is thought to be available annually.

Initiatives from the Northern Territory Fisheries have led to surveys of resource by species (see Lyle and Timms, Australian Fisheries, November 1, 1984). Parallel studies have been carried out on consumer reaction to tropical shark (Welsford et al., Australian Fisheries, November, 1984) in which taste panelists were required to differentiate between "warm-water" (mainly Carcharhinus limbatus and C. sorrah) and "cold-water" sharks (gummy and school sharks). Of 1040 tastings, 723 (70%) could differentiate warm and cold water shark in a triangle test, with 325/723 (45%) preferring cold-water, and 398/723 (55%) preferring warm-water shark (non-significant). Panelists cited cold-water shark as smoother, moister, softer, blander and whiter than warm-water species, which were meatier, flakier and more tangy in flavour.

Fish quality has been linked with catching rate and with on-board handling. Students from RMIT's Food Technology Unit in Melbourne have worked from vessels in Darwin in Australia's Northern Territory to try to solve an interesting textural problem with tropical shark. Students Jenny Welsford, Trevor Feldtman and Elena Zubryn have investigated toughness attributed to shark brought on board live and quick-frozen. Using taste panelists and an Instron Food Tester they have shown that conventional wisdom about handling cold and temperate-water fish may not be applicable to tropical species.

Textbook handling says, in effect, "get it on board live, and then cool it quickly". But in the case of tropical shark brought aboard live (the work was done as part of a live shark tagging and release exercise, so only live sharks were used) and then sacrificed, filleted and frozen, consumers and Instron established a very tough texture. When sharks were brought aboard "commercially", that is either alive or dead for 1-3 hours in the net in waters around 30°C, and then processed as usual, by bleeding and washing the catch, toughness was reduced and the fish rated "meaty" texture.

Some recent work by researchers at the Tropical Development and Research Institute (TDRI) has shown similar findings with tropical fish, and the authors hinted at a kind of "cold-shortening" similar to that established in the chilling and freezing of red meats.

#### New Anti-Corrosion Products Available in Australia (Source: Australian Fisheries)

Two anti-corrosion products extensively used world-wide in the shipping and dockyard fields are now available in Australia. Neutra Rust 661 Rust Converter and Neutra Rust TL Corrosion Inhibitor are used in a large range of applications such as outside dock maintenance, ballast tanks, hulls, buoys, vehicle decks and ramps.

The company says that in tests Neutra Rust 661 has shown no rust after 500 hours in the salt sea spray test in accordance with ASTM B117. After months of exposure to heavy seas or spray the UK Ministry of Defence found no re-occurrence of the problems associated with a sea spray marine environment. It says the Royal Navy uses Neutra Rust on many types of vessel and tests conducted by the Norwegian company Nortek on Scandinavian merchant ships have resulted in 12 test ships becoming regular users.



SPC Fisheries Newsletter No.37  
April - June 1986

THE HAWAIIAN AKU FISHERY: A LESSON TO BE LEARNED

by

John Sibert  
Tuna and Billfish Assessment Programme  
South Pacific Commission

A sad story unfolded at a recent workshop in Honolulu on Hawaii's aku (skipjack) fishery. Although the fishery has never been large, it has been a colourful and important feature of island life in Hawaii for much of its 80-90 year history. It is now close to total closure.

The aku fishery is a live bait, pole-and-line fishery for skipjack using unique boats, "sampan", designed specifically to operate in Hawaiian waters. In the 1950s, there were about 30 of these boats successfully landing fresh skipjack to local markets. A small cannery operated closely with the fishermen, buying fish when the fresh market was oversupplied. The mainstay of the aku fishery is the so-called "season" fish, larger size (70 cm) skipjack not abundant in most Pacific catches.

In the 1970s, things began to change. Fuel prices became very high discouraging fishermen from spending too much time hunting for schools. The ever increasing age of the vessels decreased their reliability, increased maintenance expenses, and increased insurance costs. Fish aggregation devices were introduced, causing further disruptions in usual fishing patterns. Pollution, combined with legal restrictions on access to principal baiting grounds, decreased the availability of bait. Catches of skipjack increased in the eastern and western Pacific and in the western Hawaiian chain, arousing suspicion that stocks were becoming generally depleted.

At the same time, fishermen reported that catches, particularly of the larger "season" fish, were dropping. Several boats have been retired and there are currently only about nine aku boats active in the fishery.

As if all this was not bad enough, the local cannery has closed and fresh frozen skipjack loins, imported from Japan, have appeared in local markets.

The purpose of the Honolulu workshop was to review the available information as a first step towards possible rehabilitation of the fishery. Scientists and economists were invited from several agencies including the South Pacific Commission, Inter-American Tropical Tuna Commission and National Marine Fisheries Service. These experts reviewed pertinent information but none could conclusively identify the cause for the decline in catches.

The local aku fishery did not command much attention during the time when it was operating successfully, and information is incomplete. Data are available on catch by commercial size categories (extra large, large, small, extra small) and some detailed size/frequency distributions are also available. Some tagging studies were done in the 1960s. Effort information is restricted to days fished; no information is available on fishing patterns, catch per bucket of bait or school sighting frequency. The extent and impact of Japanese pole-and-line and drift-net fishing in the western Hawaiian chain are unknown because by U.S. law these fisheries are unlicensed and not required to report catch.

Under these circumstances, it is little wonder that scientists were unable to commit themselves to firm conclusions. There was even some uncertainty whether the trends in catch (lack of season fish and lower catch rates in general) were a reflection of changes in the stock or due to changes in fishing patterns. The only irrefutable points are that catch rates are low, season fish are absent from the catches, and fishermen are not making a living. The consensus among the scientists seemed to be that both changes in local conditions and developments in far distant fisheries must be rigorously analysed to determine the causes of the decline in the aku fishery. The economists, by comparison, were much more confident in their prediction that more boats would drop out of the fishery. What will actually happen is not clear. Steps are being taken to ensure that biologists have the opportunity to re-examine available information more rigorously. Adjustments may take place in the infrastructure to enable greater access to bait and construction of more efficient vessels. There is a clear lesson for fisheries managers. Sound advice can only be provided from a solid information base. When one fishery is operating successfully, it is tempting to deploy expertise in other areas of more urgency. That very understandable decision is in retrospect a mistake. Every fishery sooner or later experiences a period of difficulty. If conditions prior to the problem are not understood, fisheries managers will be unable to suggest sound remedial action. It is absolutely necessary for long term fisheries management to have an ongoing information gathering system. If such systems are absent when the crisis comes, as it inevitably will, it is the fishermen who will bear the consequences.

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SPC Fisheries Newsletter No.37

April - June 1986

BOTTOMLINING IN FIJI CREATES GREAT INTEREST

by

Antony D. Lewis  
Fisheries Division  
Ministry of Primary Industry  
Suva, Fiji

Catches taken from the Tuvalu pole and line vessel Te Tautai using a modified bottom longline and an average of 1100 hooks per set have recently captured the imagination of deep water snapper fishermen in Fiji and stimulated the development of small commercial fishery. The experimental technique, carried out during the final phase of the 3 year joint Fiji-Tuvalu EEZ Survey funded by the Japan International Cooperation Agency (JICA), has averaged approximately 300kg per set (35 sets) over the December 1985 - March 1986 period, targetting on known and unknown seamounts in the Fiji zone.

Following the conclusion of gillnetting trials in July 1985, which had generally yielded disappointing catches, it was agreed by all parties that the remaining part of the survey should be devoted to a combination of pole-and-line surveys of areas in Fiji and Tuvalu outside the normal operational area, and bottom fish surveys, primarily around seamounts.

The experimental bottom fishing gear, modelled on that used by Okinawa fishermen by fishing master Misao Yokoyama after a visit to Okinawa, involves the use of pressure floats near each branch line to lift the mainline clear of the bottom. As it is actually a form of trotline, the term bottomlining is used rather than bottom longlining. Generally 20 rather small Tankichi hooks (nos. 23-25) were used per branch. Monofilament leaders and branch lines were used, with 9mm polypropylene for the main line as shown in Figure 1.

With the alternation of fishing methods on trips, the Te Tautai has been able to catch and store the considerable quantities of bait required (approx. 100kg per set) during pole and line trips. This would otherwise be a severe constraint for many fishermen. Both skipjack and frozen saury, purchased at Levuka, were used as bait during the survey.

As fishing was experimental, only a single set was made per day, generally early in the morning (0300 hrs). Setting time was usually 20-30 minutes, with a 3 hour soak time, and 1.5 - 2 hour hauling time. Depths fished ranged between 150 & 600m, with most sets in the 200 - 400m range. The line was set upcurrent on seamounts and down the slope on island ridges. Considerable experience was required and often 30 - 50% of hooks were not effectively fishing because of tangling.

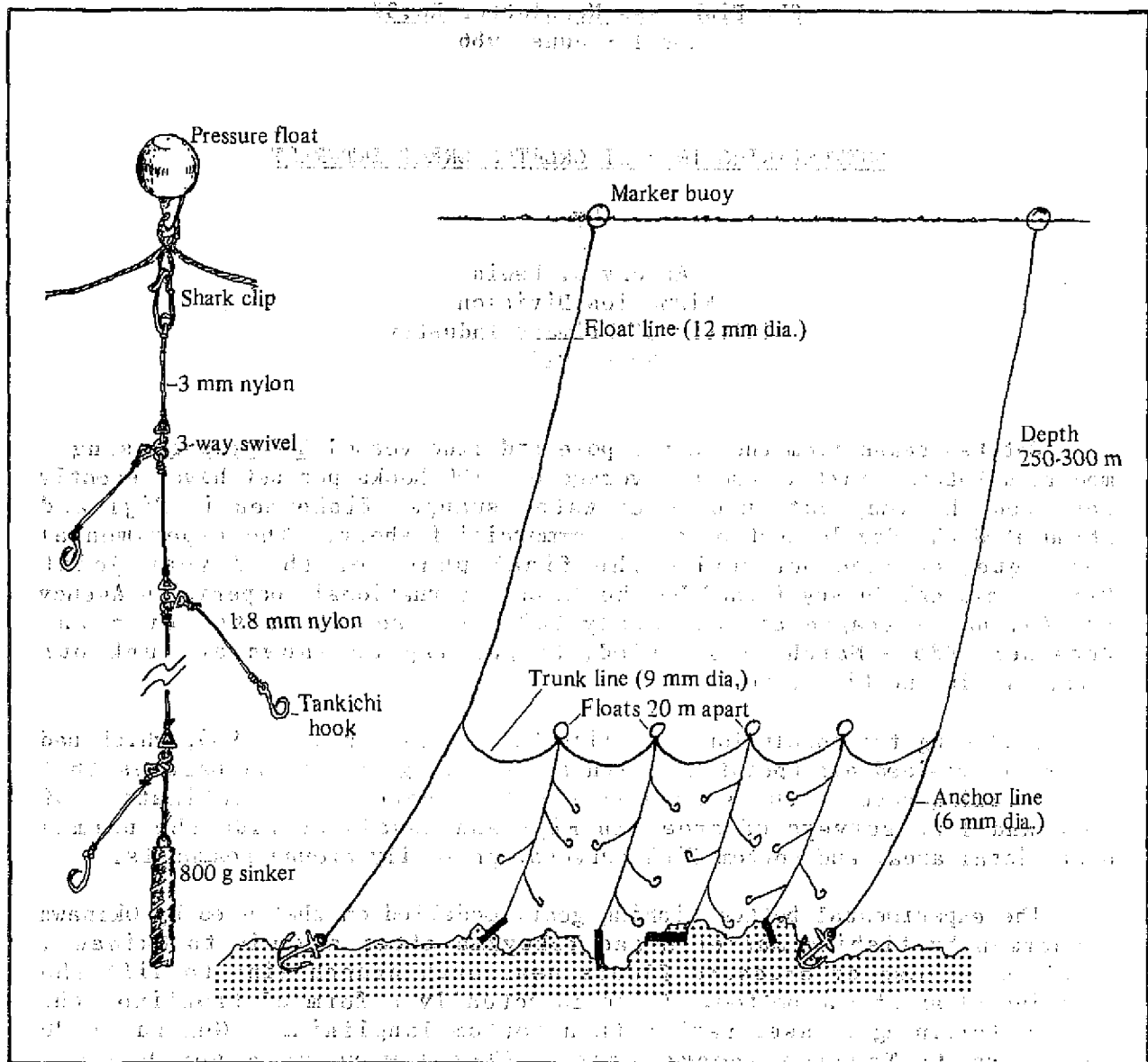


Figure 1: Specifications of the bottom lining gear used during the survey.

Over the 35 sets, all within Fiji waters, catches averaged 300kg per set. Red snappers (*Etelis spp.*) comprised just over half of the total catch. Figure 2 shows the location of sets within the Fiji EEZ. No sets have yet been made in Tuvalu, but six trips are planned for the June - October 1986 period and a final trip to the northern portion of the Fiji EEZ, around Rotuma, in October. The catch was handled by Ika Corporation and sold at a previously agreed price to a local buyer, who in turn exported desirable species to Honolulu. Prices realised at auction averaged between US\$6-9 per kg.



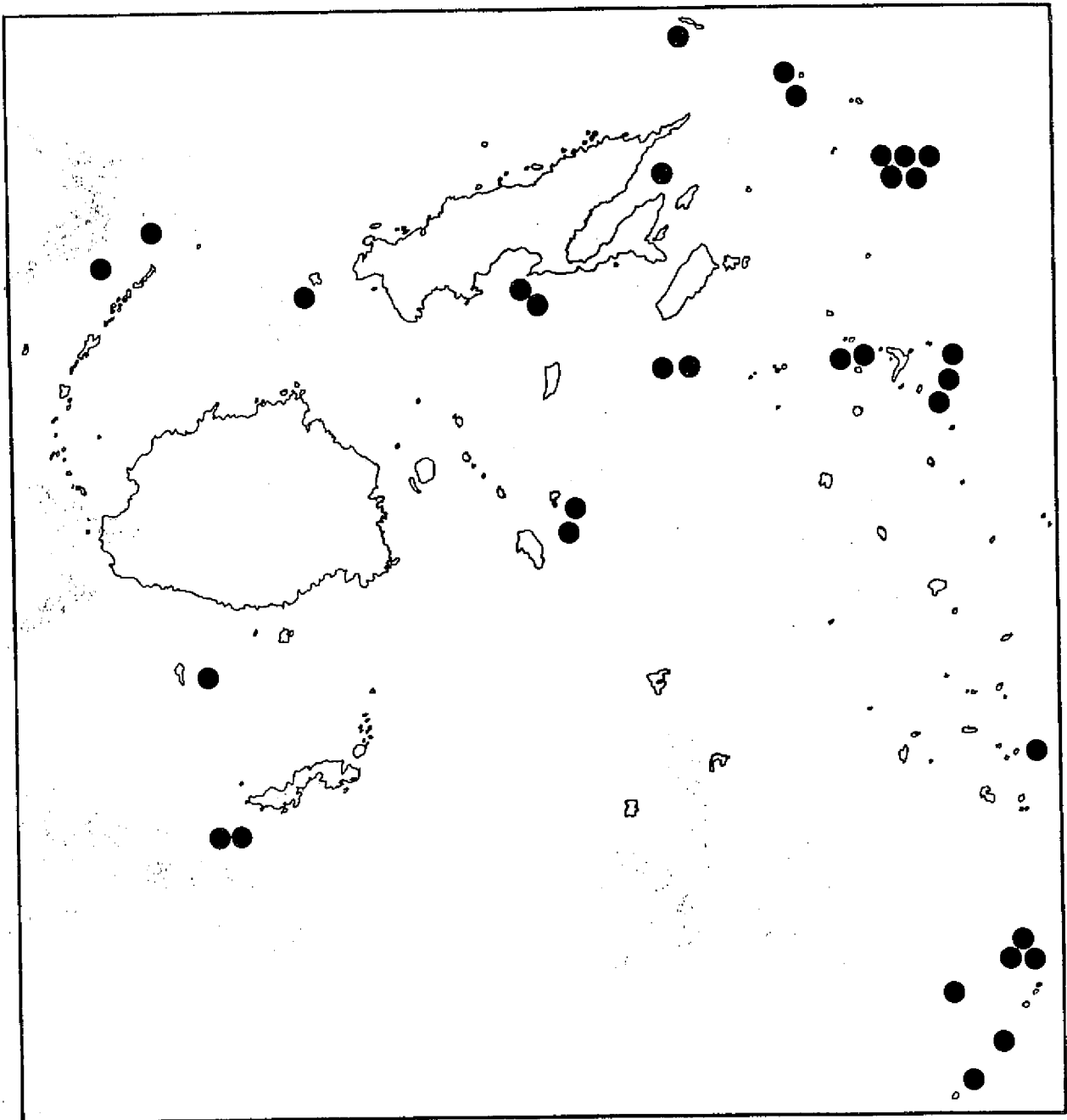


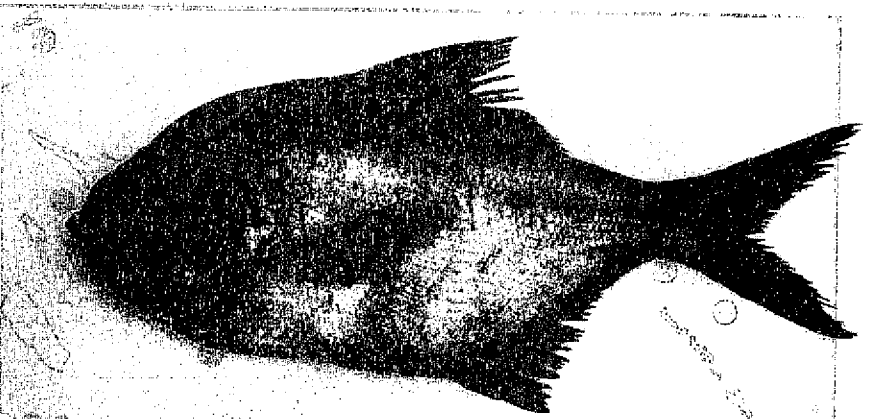
Figure 2: Locations fished during the survey.

The survey work also involved mapping seamounts by sounder transect, collection of limited environmental and biological data, and deployment of FADs.

As sets were made over a wide area of Fiji and at times in depths greater than those generally fished by hand or electric reels, numerous rare or seldom seen species were collected, including those shown in Figure 3. Sharks and eels of various species were also captured but generally were not retained.

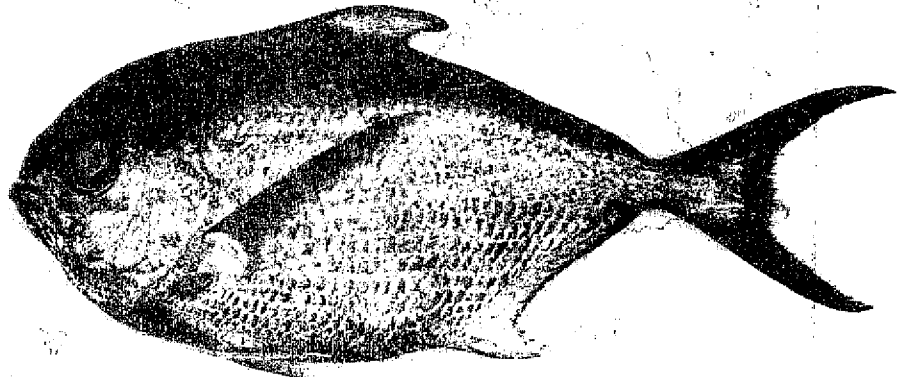
*Beryx decadactylus* and (not illustrated) *Beryx splendens* (Berycidae)

Exclusively deeper water species; up to 14 taken in one set, less than 2 kg in weight.



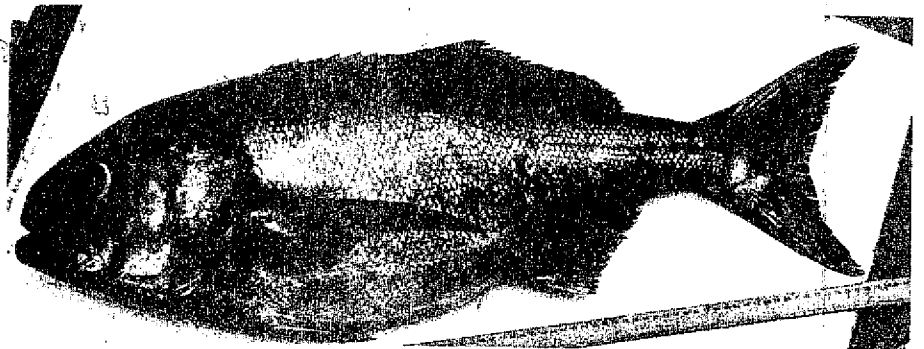
*Eumegistus illustris* (Bramidae)

Regularly caught in deeper water sets. The closely related *Taractes* and *Taractichthys*, frequent in long line catches, were not captured to our knowledge.



*Hyperoglyphe antarctica* (Nomeidae)

One large specimen taken (7 kg); well known from deeper water in Southern Australia and New Zealand but by far the most northerly locality recorded.



*Neopinnula orientalis* (Gempylidae)

Small snake mackerel taken in deeper sets.



*Rexea promethoides* (Gempylidae)

Small snake mackerel taken in deeper sets.

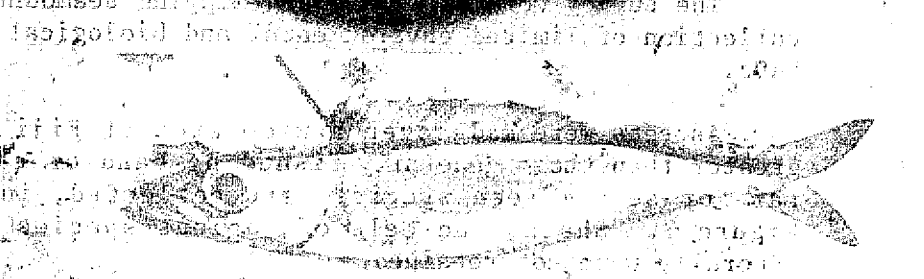
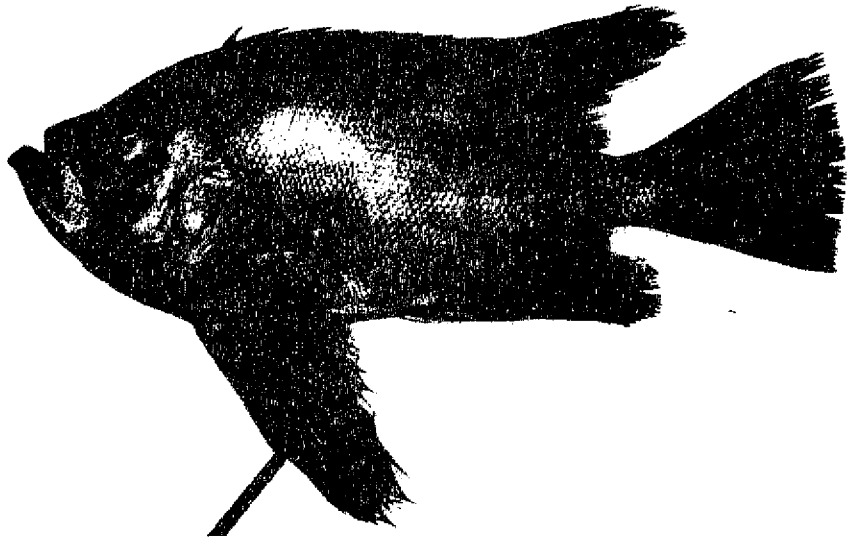


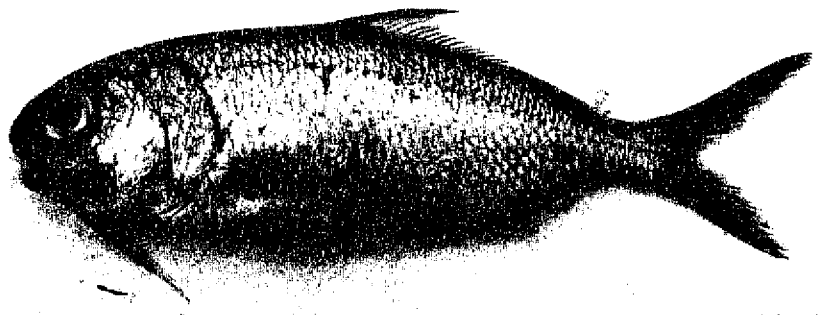
Figure 3 (above and facing): Some of the more exotic fish species captured during the survey.  
(Photos: A.D. Lewis)

*Cookeolus boops* (Priacanthidae)



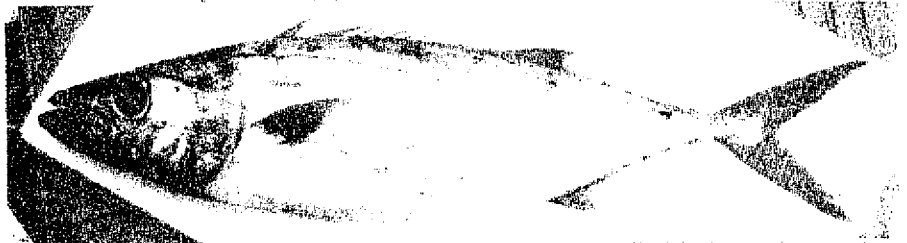
*Polymyxia* spp. (Polymixiidae)

At least two species, one apparently *P. japonica* and possibly two other unidentified species.



*Tongaichthys robustus* (Gempylidae)

This species, described from the Tonga Ridge and hitherto known only from there, was collected on several occasions in deeper water.



*Pristopomoides sielboldii* (Lutjanidae)

All eight species of this genus known from Indo Pacific are now recorded from Fiji. Up to 13 specimens of this species were captured in a set. They invariably appeared in shallower sets (150-220 m).



*Randallichthys filamentosus* (Lutjanidae)

Specimens to 8 kg, but not common. Caught with *Etelis* spp.



*Ariomna evermanni* (Ariommatidae)

Specimens up to 3 kg taken, probably in midwater as the line was being hauled.



Interest generated locally by the survey results was considerable, so much so that two local vessels have switched to full-time bottomlining. They have modified the gear further to use fewer hooks for a similar catch and are making 3-4 sets per day in good weather (see Figure 4). Targetting specifically on red snappers, the ventures have been exporting up to 2 tonnes per week in total to the Honolulu market. Finding a market for some of the by-catch has been a slight problem, but Etelis spp. have generally made up 80% or more of the catch.

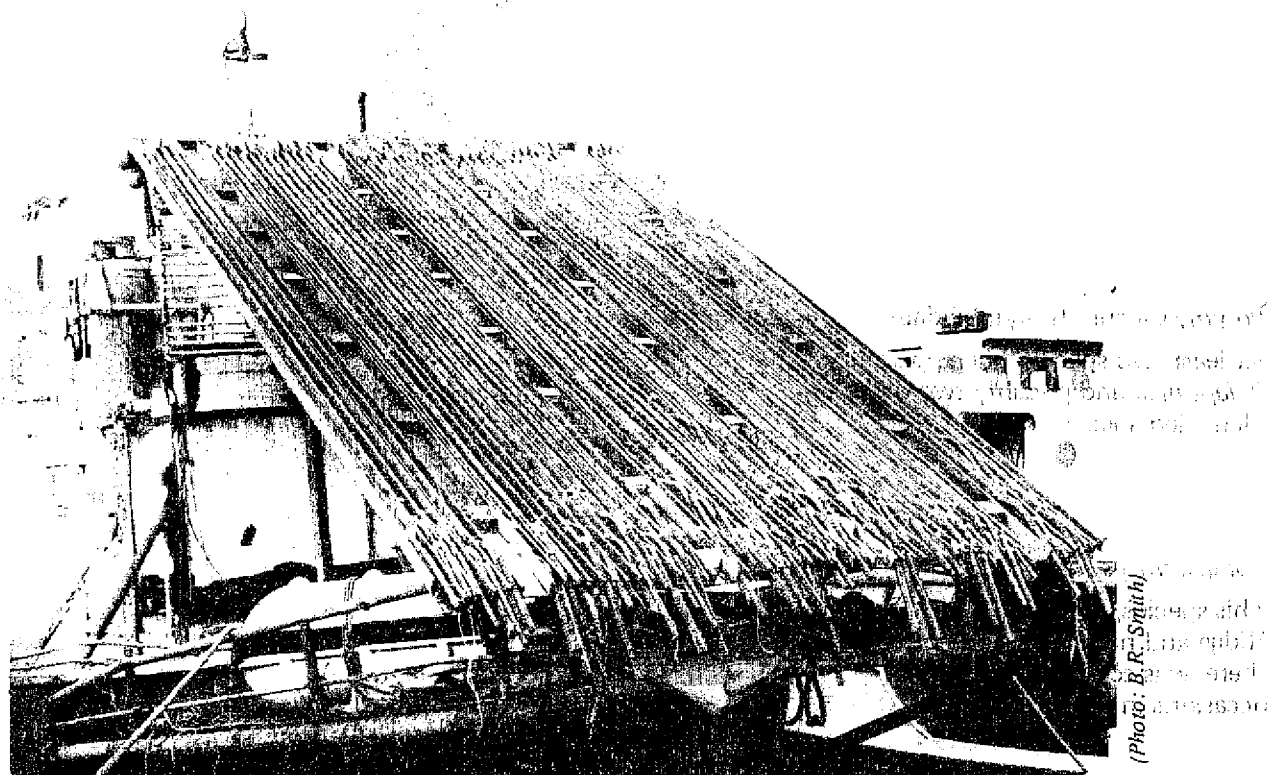


Figure 4: The bottom lining gear as modified by one Suva fisherman. Branch lines are stored in a wooden rack on the vessel's after deck, so that the line can be set from the stern while the vessel steams ahead.

Overall, the Te Tautai's survey has demonstrated that bottomlining for deep-water species is a technically feasible method of fishing, at least under Fiji conditions. Further commercial development may reduce the handling problems associated with the gear and increase the range of bottom types where it can be used. The future for a small bottomline fishery in Fiji looks reasonably bright, particularly if access to higher-priced overseas markets can be maintained.

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FISH AGGREGATION DEVICE (FAD) ENHANCEMENT OF OFFSHORE FISHERIES  
IN AMERICAN SAMOA

by

Raymond Buckley  
Office of Marine and Wildlife Resources  
Pago Pago, American Samoa

Introduction

There is little, if any, hard scientific evidence in the literature which verifies that Fish Aggregation Devices (FADs) improve fishing success. However, there is such a preponderance of circumstantial evidence that FADs "work", and FADs are so popular with fishermen and fisheries management agencies, that this enhancement technique can be considered an established entity in many offshore fisheries.

In American Samoa, FADs are currently in the third generation of major improvements in design and deployment technology. In 1979, ten FADs were deployed (lasting for apparently very short periods) by the office of Marine Resources (OMR) under a programme funded by the National Marine Fisheries Service (NMFS) and the Pacific Tuna Development Foundation. From 1981 through 1983, the second generation system deployed and re-deployed six FADs utilising Fish and Wildlife Service (FWS) funding. Residence times ranged from 0 to 13 months, averaging 3.0 months.

Deployment of third generation FADs began in August 1984 under a design analysis programme funded by NMFS. The programme goal of six FADs deployed for one year each has not yet been attained. Five FADs were on station by March 1985, however, this was reduced to four FADs by April 1985. In December 1985, there were five FADs on station, recording deployment times of 12.5, 9.5, 9.0, 3.0 and 1.5 months. The longest deployment time achieved in the third generation of FADs was 14.5 months; the failure of the mooring system on this FAD was caused by a confirmed shark bite which cut the nylon mooring line.

Troll fishing test fishery catch-per-unit-of-effort (CPUE) data are available, in vessel lb/hr, from the offshore waters of Tutuila Island, American Samoa since 1975. Test fishery information for FADs began in Fiscal Year (FY) 1980, but remained sparse and lacked standardisation in the number of lines/lures fished, etc., through FY 84. In FY 85, standardised test fisheries, using troll fishing techniques under experimental and control conditions, provided the first quantifiable data on the effectiveness of FADs in enhancing offshore pelagic fisheries in American Samoa. This test fishery data also enabled a comparison of fishing success on FADs and offshore banks; the latter are natural fish aggregation "devices".

## Test Fishery Results and Discussion

Troll fishing test fishery data for FY 75 through FY 79 showed a steady decline from 16.8 to 9.8 lb/hr. In FY 80, the test fishery CPUE increased to 15.4 lb/hr, apparently attributable to 3 FADs which accounted for approximately one-third of the FY 80 total catch. However, the FY 81 test fishery CPUE increased slightly to 16.2 lb/hr when only one, poorly producing FAD was on station.

70

Two FADs were on station during the FY 82 test fisheries and accounted for 325 lb (29%) of the 1,121 lb total catch. The FY 82 total CPUE of 16.3 lb/hr was comprised of a FAD trip CPUE of 30.2 lb/hr and a non-FAD trip CPUE of 13.1 lb/hr. During FY 83, the total CPUE increased to 17.9 lb/hr but little effort was expended around FADs. A new OMR boat made it possible to reach offshore banks which had not been fished in previous test fisheries. In FY 83 the test fishery catch of 1,561 lb resulted from a bank trip CPUE of 22.7 lb/hr and a non-bank trip CPUE of 9.3 lb/hr. The amount of test fishing expended around FADs (and included in the non-bank trip data) is unknown. Test fishing effort became more standardized in FY 84 making CPUE data more comparable; however, the fishing trips were still categorised based on their destinations and did not detail the effort expended in the different areas during each trip. The FY 84 total test fishery CPUE of 18.2 lb/hr. was derived from a bank trip CPUE of 25.2 lb/hr and a non-bank trip (including FAD trip data) CPUE of 14.6 lb/hr. The fishing effort and catch for FAD trips is unknown. In FY 85, test fishing effort was completely standardized by specific fishing areas (FAD, bank, open-water, nearshore, etc.) and different types of fishing methods (trolling, longline, jigging, etc.), and was based on lure-hours (or hook-hours). To maintain the maximum comparability between years, the troll fishing data used to assess FAD enhancement was quantified for a CPUE expressed in lb/hr for the research vessel using a standard fishing power of six lures and one lure per line. The FY 85 total CPUE of 26.5 lb/hr is derived from a FAD CPUE of 40.4 lb/hr, a bank CPUE of 90.9 lb/hr, and an open-water (control) CPUE of 7.9 lb/hr (Table 1). This is the first quantifiable data available to show the magnitude of FAD enhancement of offshore fisheries in American Samoa. The FAD CPUE is 4.8 times greater than the rate of success when fishing in comparable open-water (non-bank) areas without any aggregation enhancement. The CPUE for the offshore bank areas is 2.3 times greater than the FAD CPUE, and 10.8 times greater than the open-water CPUE. Although troll fishing on offshore banks is considerably better than around the FADs, this data demonstrates a remarkable level of enhancement by the FADs, especially when the tremendous differences in magnitude, or mass, of these two "aggregation devices" are considered.

Table 1: FY 1985 (October 1984 - September 1985) troll fishing test fishery vessel CPUE in lb/hr, effort and catch by species, for fish aggregation device (FAD), offshore bank and open-water areas in American Samoa.

Species	FAD (37.4 hr)			Bank (14.2 hr)			Open-Water (79.1 hr)		
	No.	Lb	CPUE	No.	Lb	CPUE	No.	Lb	CPUE
Blue marlin	1	100	2.7	0			1	120	1.5
<i>Makaira nigricans</i>									
Dolphinfish	28	406	10.9	0			1	15	0.2
<i>Coryphaena hippurus</i>									
Yellowfin tuna	31	478	12.8	38	703	49.5	5	52	0.7
<i>Thunnus albacares</i>									
Skipjack tuna	83	347	9.3	8	58	4.1	36	270	3.4
<i>Katsuwonus pelamis</i>									
Kawakawa	28	120	3.2	2	8	0.6	66	100	1.3
<i>Euthynnus affinis</i>									
Wahoo	2	50	1.3	2	39	2.8	4	64	0.8
<i>Acanthocybium solandri</i>									
Dogtooth tuna	0			17	334	23.5	2	29	0.4
<i>Gymnosarda unicolor</i>									
Rainbow runner	2	10	0.3	51	149	10.5	5	15	0.2
<i>Elagatis bipinnulatus</i>									
TOTAL	174	1,511	40.4	118	1,291	90.9	120	665	8.4

For practical purposes, these can be considered experimental (FAD and bank) and control (open-water) test fisheries, even though the control data was not obtained from the exact FAD location with the FAD absent. Preliminary information from other areas (Hawaii, for example) indicates that certain offshore (non-bank) areas seem to be natural fish aggregation locations and FADs placed in these areas may just augment natural processes. This does not appear to be the case with the FAD locations in American Samoa, as they lack significant changes in bottom contour, current patterns, or other physical features, which might create a natural fish aggregation situation. Also, sparse test fishery information from two FAD locations which had lost their FADs, indicated a drop in fishing success to levels comparable with open-water areas, and then a rebuilding to previous enhanced levels when the FADs were replaced.

**Table 2: November 1984 - March 1986 troll fishing test fishery vessel CPUE in lb/hr, effort and catch by species, for all areas in American Samoa.**

All areas					
Trips		34			
Hours		211.6			
Hours/Trip		6.2			
Species	No.	Lb	CPUE		
Blue marlin	4	520	2.5		
<i>Makaira nigricans</i>	0	0	0.0		
Dolphinfish	39	695	3.3		
<i>Coryphaena hippurus</i>	0	0	0.0		
Yellowfin tuna	160	2,214	10.5		
<i>Thunnus albacares</i>	0	0	0.0		
Skipjack tuna	309	1,857	8.8		
<i>Katsuwonus pelamis</i>	0	0	0.0		
Kawakawa	109	256	1.2		
<i>Euthynnus affinis</i>	0	0	0.0		
Wahoo	14	280	1.3		
<i>Acanthocybium solandri</i>	0	0	0.0		
Dogtooth tuna	35	601	2.8		
<i>Gymnosarda unicolor</i>	0	0	0.0		
Rainbow runner	81	263	1.2		
<i>Elagatis bipinnulatus</i>	0	0	0.0		
<b>TOTAL</b>	<b>751</b>	<b>6,686</b>	<b>31.6</b>		

**Table 3: November 1984 - March 1986 troll fishing test fishery vessel CPUE in lb/hr, effort and catch by species, for open-water fish aggregation device (FAD), offshore bank and open-water areas in American Samoa.**

	FAD			Bank			Open-Water		
Trips	42			10			45		
Hours	55.7			23.7			132.2		
Hours/Trip	1.3			2.4			2.9		
Species	No.	Lb	CPUE	No.	Lb	CPUE	No.	Lb	CPUE
Blue marlin	2	300	5.4	0	0	0.0	2	220	1.7
<i>Makaira nigricans</i>	0	0	0.0	0	0	0.0	0	0	0.0
Dolphinfish	31	468	8.4	1	43	1.8	17	184	1.4
<i>Coryphaena hippurus</i>	0	0	0.0	0	0	0.0	0	0	0.0
Yellowfin tuna	74	903	16.2	60	1,956	40.3	26	355	2.7
<i>Thunnus albacares</i>	0	0	0.0	0	0	0.0	0	0	0.0
Skipjack tuna	212	912	16.4	17	118	5.0	80	827	6.3
<i>Katsuwonus pelamis</i>	0	0	0.0	0	0	0.0	0	0	0.0
Kawakawa	32	124	2.2	2	8	0.3	75	124	0.9
<i>Euthynnus affinis</i>	0	0	0.0	0	0	0.0	0	0	0.0
Wahoo	3	57	1.0	7	159	6.7	4	64	0.5
<i>Acanthocybium solandri</i>	0	0	0.0	0	0	0.0	0	0	0.0
Dogtooth tuna	0	0	0.0	33	572	24.1	2	29	0.2
<i>Gymnosarda unicolor</i>	0	0	0.0	0	0	0.0	0	0	0.0
Rainbow runner	2	10	0.2	73	235	9.9	6	18	0.1
<i>Elagatis bipinnulatus</i>	0	0	0.0	0	0	0.0	0	0	0.0
<b>TOTAL</b>	<b>356</b>	<b>2,774</b>	<b>49.8</b>	<b>193</b>	<b>2,091</b>	<b>88.2</b>	<b>202</b>	<b>1,821</b>	<b>13.8</b>



Troll fishing test fishery data for the maximum period of standardised methodology (November 1984 - March 1986) available to date provides a more accurate determination of comparative fishing success than the data from just FY 85. This occurs because the sampling effort during the first four months of FY 85 was not evenly distributed between the experimental and control areas (open-water-29.6%, FAD-4.5% and bank-69.0% of the total test fishing hours for FY 85). During this 17 month period, the CPUE for all areas combined was 31.6 lb/hr (Table 2), which resulted from an open-water CPUE of 13.8 lb/hr, a FAD CPUE of 49.8 lb/hr, and a bank CPUE of 88.2 lb/hr (Table 3). The FAD CPUE is 3.6 times greater than the open-water CPUE, and the bank CPUE is 1.8 and 6.4 times greater than the FAD and open-water CPUEs respectively. These differences are in the same order as those derived from the data covering just FY 85, but they are considerably lower.

It is within the technological capabilities of modern fishery management and engineering to enhance fish aggregation and fishing success through the proper design and deployment of offshore FADs. Offshore banks in American Samoa waters have a greater potential than FADs for productive troll fishing, but these areas are relatively few in number, usually located considerable distances from the islands, and are often inaccessible during inclement weather conditions. The objective of FAD enhancement is to create target fishing locations near major harbours, which significantly increase fishing success; it would seem both impractical and impossible to construct massive offshore banks, which rise from 300+ fathoms to within 10 fathoms of the surface, as an enhancement alternative to FADs.

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