



SOUTH PACIFIC COMMISSION

FISHERIES NEWSLETTER

No.25 April - June 1983

A Message to Readers

This is the second issue of the SPC Fisheries Newsletter to appear in a revised format, which, in addition to the more substantial articles listed below, tries to incorporate current information from around the region - project reports, news and views. To enable us to present timely information, the editors welcome readers to submit local news clippings, articles, activity summaries or comments for inclusion.

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SPC 15th Annual Regional Technical Meeting on Fisheries, 1st-5th August 1983

This year's meeting, formally announced in SPC Savingram 17/83, promises to be of considerable significance to fisheries development in the region. Several items of particular importance are included in the draft agenda, including the discussion of the future requirements for conservation of the regions tuna resources, and the role of regional organisations in this field. The meeting of the South Pacific Commission's Planning and Evaluation Committee, held in May, requested the Regional Technical Meeting on Fisheries to consider alternatives for the continuation or otherwise of the activities of the SPC Tuna and Billfish Assessment Programme, in their present or a modified form, with a view to making detailed and specific recommendations for consideration by the 23rd South Pacific Conference.

The report of the Commission's recent design study of fish aggregation devices will also be presented, together with details of the Deep Sea Fisheries Development Project's work in developing appropriate small-scale fishing techniques to harvest the aggregations of fish around FADs. Additionally, a one-day workshop on appropriate small-scale fish handling and processing techniques is planned. This will include practical demonstrations and presentations by the SPC master fishermen, all three of whom will be present, and contributions from the UK Tropical Development and Research Institute and FAO. Representatives are expected from most Pacific Island fisheries departments, and a wide range of scientific and technical institutes, regional organisations and representatives of the fishing industry.

SPC ACTIVITIES

Deep Sea Fisheries Development Project Notes

Cyclone relief work in Fiji

As announced in the last newsletter, SPC masterfishermen Pale Taumaia and Lindsay Chapman were both assigned to join a UNDP-sponsored cyclone relief project aimed at rehabilitating fisheries in those coastal areas of Fiji severely damaged by cyclones Oscar and Sarah earlier this year. The two masterfishermen commenced work in late March and early April respectively, Pale in the islands of Viti Levu's west coast and Lindsay in the islands and coastal areas to the south and east, in an integrated work programme combining government fishing boats, collection vessels of the National Marketing Authority, and local fishing groups, as well as individual village fishermen. The master fishermen provided the guidance to enable and encourage villagers to fish intensively for the duration of the teams visit, concentrating where possible on the deep-bottom resource, and also assisted in the evaluation of cyclone disruption to local fishing activities. Staff of the collection vessel purchased the production surplus to local requirements, which was very substantial in most cases, and thus channelled much needed cash for reconstruction into the local village economies. The provision by UNDP of fuel and fishing gear made the fishermen's involvement in the project financially attractive, and the work overall generated some 26 tonnes of fish, valued at about F\$30,000.

SPC involvement was short-term as intended, and mainly directed towards getting the project off the ground. Pale left Fiji on May 1st to commence work in a new project visit to Palau, while Lindsay returned to Vanuatu on May 8th to resume his interrupted work schedule there.

Cook Islands

Master fisherman Paul Mead moved to the Cook Islands in February to commence a project visit aimed at developing appropriate small-scale fishing techniques, particularly for the harvesting of fish concentrations associated with fish aggregation devices. In some ways the project will continue the gear development work commenced during Paul's preceding visit to Niue, although the different environmental conditions prevailing in the Cooks will probably lead to quite different results. One aspect common to both locations has been the lack of adequate supplies of suitable bait for vertical longlining and ika-shibi fishing trials, and it has proved necessary to arrange a shipment of saury from American Samoa to overcome this problem in the short term. Since its

arrival Paul has been experimenting with both techniques, but results have been mixed. Large tunas have been taken only infrequently on the FADs, despite an abundance of small tunas in surface schools.

Prior to the arrival of the consignment of saury, an extended period of bait shortage enabled Paul to spend some time in deep bottom fishing, and he has obtained good catches by fishing while drifting with the current using a parachute anchor. Steep dropoffs in many areas around Rarotonga make bottom-anchoring difficult, while currents which often parallel the reef, and light winds, are amenable to the drift-fishing technique.

Palau

Master fisherman Pale Taumaia arrived in Koror, Palau, on May 3rd and spent the first few weeks of his stay training a government demonstration team in deep-bottom fishing techniques in that area. Pale subsequently moved to Pelileu, in the south, to train members of a fishing cooperative who operate one of Palau's 11 35-foot fibreglass Yanmar fishing boats (see SPC Fisheries Newsletter No.24). Two separate crews went through the training programme, and took some good catches, including one overnight total of 468 kg. Pale's two weeks in Pelileu saw the production of over 1,000 kg of fish and generated a profit for the vessel of US\$637.84. This was shared among the trainees according to participation, each crewman receiving US\$9.52 per overnight trip.

Pale is now back in Koror working with a local cooperative, and reports that he is impressed with the smooth way in which the project has so far been coordinated and run. As a small fishing incentive, he has offered a prize of US\$50 for the biggest Etelis carbunculus (short-tailed red snapper) caught during his stay. The current front-runner weighed in at 46 lbs (21.8 kg), but the competition is far from closed yet.

Pale will be visiting several areas in Palau in the coming months as weather and other conditions permit, conducting his training programme with other fishing groups.

Vanuatu

Master fisherman Lindsay Chapman returned to Vanuatu to complete the project's visit there, after his brief assignment to work in Fiji. Prior to the Fiji visit, Lindsay was carrying out experimental work on fish aggregation devices near Port Vila, which included the setting of surface gill nets for pelagic schooling fish, and experimentation with different trolling rigs.

From now on, however, Lindsay's work will involve members of fishing groups operating in more remote localities within the framework of the Vanuatu Fisheries' Department's village fisheries development project. A number of commercial fishing ventures have been established with government assistance, and Lindsay will visit several of them, offering refresher training where appropriate and helping to identify and overcome any technical problems the groups may have.

Lindsay reports that a difficulty many groups face is that of acquiring enough bait. Fishing groups frequently need to spend time collecting reef fish or octopus and other invertebrates, which in any case are inferior to the preferred bait, fresh skipjack or yellowfin tuna. The Fisheries Department hopes to combat this problem in the long term by installing FADs in strategic locations, and in the short term have been assisting the groups by airfreighting bait from Port Vila when possible.

Tuna And Billfish Assessment Programme

During this quarter, the work of the Programme has been concentrated on making the regional statistical database as comprehensive as possible, and in finalising numerous Programme publications. Input to the statistical database is now being received from many of the countries of the region and national summaries of this data have been prepared and distributed to countries on request. Programme scientists are optimistic that the regional compilation of tuna catch and effort figures by one degree square by month for the whole of the South Pacific Commission area will be finalised in time for the first published summary to be presented about the end of the year.

Numerous final country reports and technical papers have been published in recent months or are presently in final draft or manuscript form. Those published and distributed to date are:

a) Technical Reports;

KEARNEY, R.E. (1982). Development and implementation of the Skipjack Survey and Assessment Programme.

KEARNEY, R.E. and R.D. GILLET (1982). Methods used by the Skipjack Survey and Assessment Programme for tagging skipjack and other tuna.

ARGUE, A.W. (1982). Methods used by the Skipjack Survey and Assessment Programme for collecting biological, tuna school and ancillary data from a pole-and-line fishing vessel.

HALLIER, J-P., R.E. KEARNEY and R.D. GILLET (1982). Baitfishing methods used by the Skipjack Survey and Assessment Programme and recommendations on baitfishing techniques for the tropical Pacific.

KLEIBER, P. and C.A. MAYNARD (1982). Data processing procedures of the Skipjack Survey and Assessment Programme.

All five of the above reports appeared in Kearney R.E. (ed.) 1982. Methods used by the South Pacific Commission for the survey and assessment of skipjack and baitfish resources. Tuna and Billfish Assessment Programme Technical Report No.7, South Pacific Commission, Noumea, New Caledonia.

b) Final Country Reports;

KEARNEY, R.E. (1982). An assessment of the skipjack and baitfish resources of Fiji. Skipjack Survey and Assessment Programme Final Country Report No.1, South Pacific Commission, Noumea, New Caledonia.

LAWSON, T.A. and R.E. KEARNEY (1982). An assessment of the skipjack and baitfish resources of the Cook Islands. Skipjack Survey and Assessment Programme Final Country Report No.2, South Pacific Commission, Noumea, New Caledonia.

ARGUE, A.W. and R.E. KEARNEY (1982). An assessment of the skipjack and baitfish resources of Solomon Islands. Skipjack Survey and Assessment Programme Final Country Report No.3, South Pacific Commission, Noumea, New Caledonia.

ARGUE, A.W. and R.E. KEARNEY (1982). An assessment of the skipjack and baitfish resources of Pitcairn Islands. Skipjack Survey and Assessment Programme Final Country Report No.4, South Pacific Commission, Noumea, New Caledonia.

KLEIBER, P. and R.E. KEARNEY (1983). An assessment of the skipjack and baitfish resources of Kiribati. Skipjack Survey and Assessment Programme Final Country Report No.5, South Pacific Commission, Noumea, New Caledonia.

ARGUE, A.W. and R.E. KEARNEY (1983). An assessment of the skipjack and baitfish resources of New Zealand. Skipjack Survey and Assessment Programme Final Country Report No.6, South Pacific Commission, Noumea, New Caledonia.

GILLET, R.D. and R.E. KEARNEY (1983). An assessment of the skipjack and baitfish resources of French Polynesia. Skipjack Survey and Assessment Programme Final Country Report Report.7, South Pacific Commission, Noumea, New Caledonia.

Brief abstracts of technical reports being produced by the Tuna Programme will appear in future editions of the Fisheries Newsletter.

Fish Aggregation Device Design Study

Fisheries Adviser Barney Smith and consultant Lt. Richard Boy of the U.S. Department of Commerce' National Data Buoy Centre travelled together to Fiji, Western Samoa, American Samoa, Cook Islands, and Vanuatu, and individually visited Palau, Hawaii, and French Polynesia, to examine and evaluate FAD designs and construction and deployment techniques currently in use in the Pacific. During discussions with fisheries officers and industry representatives, the consultant was able to pinpoint many potential problem areas with current FAD designs, and to suggest changes in design and component hardware which should increase the effective life of the present generation of FADs.

Failure of the mooring line itself has been the major cause of premature loss with FADs in the region and the study has concentrated on this area of concern. This evaluation of regional experience provided essential background information for the development of an improved "generic" FAD design which should eliminate or minimise many of the identifiable sources of FAD loss, and increase the average life expectancy to double or treble that of most present designs, while economising on construction costs. The final report, which is in preparation, will be discussed in detail at the coming Regional Technical Meeting on Fisheries.

SPC/Nelson Polytechnic Fisheries Training Course Concludes

The SPC's 18 week Pacific Fisheries Officer Training Course, held annually at Nelson Polytechnic in New Zealand, ended early in June, with most students returning directly home to resume their duties. The course tutors commented that this years intake of 15 participants from 12 countries was the best to date. Individual students showed a very definite awareness of their own training requirements, and many commented on the value of the practical instruction offered by the course. Subjects of study ranged from welding to net-mending, and trainees left the college with a basic knowledge of the many practical skills essential to an all-round fisheries worker.

NEWS FROM AROUND THE REGION

Third International Artificial Reef Conference Announced

The Third International Artificial Reef Conference, to be held in Southern California from November 2nd-4th, 1983, has recently been announced in a circular leaflet from the conference organisers at Occidental College, Los Angeles. The meeting aims to bring together fisheries officers, engineers and biologists to discuss recent developments relating to artificial reefs, fish aggregation devices and other fish attraction systems. The titles of conference sessions already planned include: Siting Criteria; Design and Function; Recruitment and Successional Development; Aggregation Production; Artificial vs. Natural Reefs; Surface and Mid-water Aggregators; and Fishery Management Considerations. In addition to enabling these topics to be examined simultaneously from the viewpoints of planners, designers and scientists, the conference hopes to promote personal contacts in the field and encourage more coordination between fish aggregation projects.

For further information, contact: Dr J.S. Stephens, Occidental College, Department of Biology, 1600 Campus Road, Los Angeles, CA. 90041.

Trochus Hatchery Feasibility Study For Vanuatu

Pending approval by the Government of Palau, Mr Gerald Heslinga, of the Micronesian Mariculture Demonstration Centre, is to be engaged later this year by SPC as a consultant to assist the Vanuatu government in determining the feasibility of establishing a hatchery for Trochus niloticus, the top shell. T. niloticus support a small but important commercial fishery in Vanuatu, shells being bought by a local company for the manufacture of mother-of-pearl button blanks. If feasible, the hatchery will be used to breed and grow on Trochus juveniles to a size suitable for seeding local reefs, and therefore supplementing recruitment to the natural population. Tagging studies on trochus conducted jointly by ORSTOM (Office de Recherche Scientifique et Technique Outre-Mer) and Fisheries Department research workers have enabled legal minimum size limits to be established by the Vanuatu government as a means of ensuring maximum production. However, the Fisheries Department feels that yields can be raised above natural levels by seeding reefs and enhancing natural recruitment.

Gill Netting Trials Carried Out On FADs In Samoa

The Fisheries Division of the Western Samoan Government's Department of Agriculture has conducted gill netting trials around fish aggregation devices, with encouraging initial results. Chief Fisheries Officer Mr Alphonso Phillipp, who planned and conducted the trials with his staff, used 6-inch mesh 210/30

white nylon multifilament netting, 1,700 meshes long and 120 deep. The net was hung on a 10mm polypropylene head rope, with 5.5" x 3" net floats at 10 foot intervals and a 30 lb float at each end. 14 lb sinkers on the end ropes completed the arrangement. No foot rope or sinkers were used along the length of the net, the bottom edge being left completely free. This arrangement ensures that the net enfolds fish which run into it, rather than acting as a springy barrier from which they can escape.

Due to the frequency of trolling operations around most Samoan FADs, there were few opportunities for the net to be set without interfering with the activities of professional fishermen, or risk of damage. Therefore, only three sets were made between January and June 1983. Of these the first two gave catches of 198 skipjack of 4-5 lb each, and 980 yellowfin and skipjack, of 2-3 lb each respectively. The second set, which yielded the higher catch, was accompanied by the use of live mollies, which stay close to the head rope and lure the tuna into the net. Although a few tuna were caught, the third set was disrupted by huge fish, possibly marlin or sharks, which tore the net near the middle. Some shark damage also occurred near the end of the net on the second set, and this emphasised the importance of timing the sets correctly and keeping the net in the water for as short a time as possible. The ideal setting time appears to be about 1 hour before sun-up, with live-bait seeding commencing when the tuna rise, about 15 minutes before sun-up.

Although the results obtained are by no means conclusive, it appears from these trials that FAD-associated gill netting is a productive technique worthy of further attention.

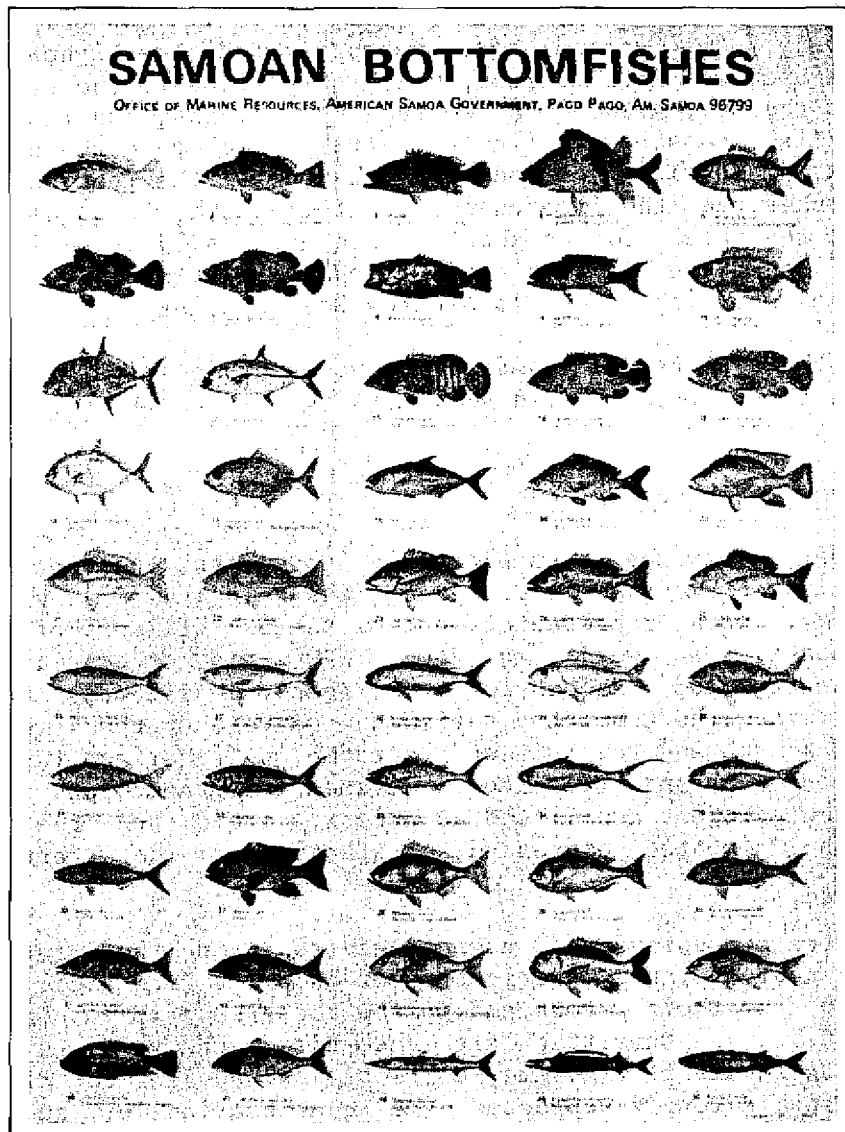
Forum Fisheries Committee Meeting Held

The 8th meeting of the Forum Fisheries Committee, the controlling body of the South Pacific Forum Fisheries Agency, was held in Apia, Western Samoa from 2nd to 5th May, with representation from senior officers of many of the region's governments, as well as FAO, SPC, and other international organizations. Apart from discussing the Agency's 1983/84 budget and administrative matters, the Committee reviewed progress on the implementation of the Regional Research and Development Programme on fisheries (RRDP). Within the RRDP the SPC's Tuna and Billfish Assessment Programme and its Deep Sea Fisheries Development Project are listed as priority items, and the governments represented in the Committee expressed satisfaction at the progress made in these activities.

The Committee recognised the urgent need to ensure that members receive reasonable returns and equitable distribution of benefits from highly migratory fish species taken from their waters and wished the Agency to consider this as its primary objective. The Committee also recognised the value of the SPC's Tuna and Billfish Assessment Programme, currently scheduled to terminate in September 1984, and strongly supported the continuation of such research activities as high priority in the RRDP.

Fish Posters

The Office of Marine Resources of the Government of American Samoa have recently published a wall poster of Samoan bottomfishes. The poster, pictured below, features 50 colour photographs by Dr Richard C. Wass of fish frequently caught bottom-fishing, including the common deep-water snappers of the outer reef slope. Scientific, Samoan and English names are given, with space for the addition of local names. Copies are available, price \$5 plus postage, from Mr H. Seseapasara, Manager, Office of Marine Resources, American Samoa Government, Pago Pago, American Samoa 98788.



The Fisheries Division of Fiji's Ministry of Agriculture and Fisheries is also planning to produce an educational poster which will carry photographs of 50 to 60 of Fiji's most important food fishes, including inshore species which make up most of Fiji's landings.

Fishing Boat Evaluation For Cook Islands

The SPC has been requested by the Cook Islands Government to assist in the evaluation of a small fishing vessel designed for artisanal use. The vessel, an aluminium diesel powered version of the Filipino 'banca', is prefabricated in Australia and shipped in kit form for local assembly, resulting in a durable, low-maintenance and very economical fishing unit. The Cook Islands Government is tentatively considering purchasing a number of these units, but recognising that the twin outrigger craft is a novel design untested under local conditions, wishes first to see the vessel undergo a series of thorough sea trials conducted by an experienced small-boat fisherman. SPC will assist the Cook Islands government with its evaluation, which will probably involve the preliminary importation of a prototype and its use in extensive local fishing trials.

Handbooks On Fishing Techniques Planned

The presence of all three SPC master fishermen in Noumea for the 15th Regional Technical Meeting on Fisheries in August represents a unique opportunity to draw on and document their collective experience of fishing. In the two weeks following the meeting, the masterfishermen and other SPC staff plan to collaborate in the preparation of two technical manuals on fishing techniques applicable to the region. The style of presentation will be simple and generously illustrated so as to be of practical value to fishermen and technical fisheries staff, and each handbook will cover a major subject area. One, dealing with bottom fishing techniques, will document the Commission's ten years experience in fishing the outer reef slope and lagoon, and detail the many variations in technique which have been developed to cope with differing operating conditions. The other will cover the broad subject of troll fishing, and in addition to describing the various gears and methods used for trolling coastal pelagic fish and open water schools, will detail more recent innovations developed to harvest fish associated with fish aggregation devices.

Funding assistance for this project has been generously provided by the Commonwealth Foundation.

Ni-Vanuatu Extension Officer Studies FAD Fishing In Western Samoa

Fisheries Extension Officer Mr Walu Sak, of the Vanuatu Fisheries Department, recently returned home from a three-week visit to Western Samoa, where he studied the established fishing techniques practised around the numerous fish aggregation devices installed in coastal waters. The study trip, funded by SPC, was kindly hosted by the Western Samoan Fisheries Division. Chief Fisheries Officer Mr Alphonso Philipp arranged for Mr Sak to stay for the duration of his visit with a local fisherman and his family on the south coast of Upolu. During this period the fisherman made twice-daily trips to the FADs on his 'alia' catamaran, landing on average 40-50 kg of tuna per trip. In his report on the study tour, Mr Sak describes some of the tips he gathered, such as the use of skipjack as livebait to catch large yellowfin on surface mini-longlines.

The Vanuatu Government has an active FAD development programme, and Mr Sak, already an experienced bottom-fisherman and extension officer, will be largely responsible for demonstrating the potential yields from FADs to Vanuatu's fishermen.

EEZ Management Course Held in Fiji

A course on EEZ management was held early in June at the Institute of Marine Resources of the University of the South Pacific in Suva, Fiji. The four-week course, organized jointly by the International Oceans Institute, the Commonwealth Secretariat, and the Forum Fisheries Agency consisted of lectures on a wide variety of topics within the broad theme of management of ocean resources and affairs. Participants, who were mainly middle to senior-level officers from Government Departments of the region involved in EEZ management, generated lively and fruitful discussions after the sessions, and thereby highlighted the complex nature of the topic and the problems individual countries face in making the best of their own ocean resources.

Vanuatu Village Fisheries Development Project Evaluation Meeting Planned

The Vanuatu Fisheries Department and CUSO, the Canadian University Service Overseas, have jointly organised a four-day meeting, to be held in Port Vila, in August, at which the various contributors to the Government's Village Fisheries Development Project will assess progress to date. The project, reported in SPC Fisheries Newsletter No 24, receives considerable input from CUSO in the form of volunteers assigned to work as Village Fisheries Advisers (VFAs) with fishing groups which have been established in island locations. Five VFAs are currently in post with some assisting more than one fishing group. All groups are producing substantial quantities of fish, mostly high-quality deep-bottom fish, much of which is channelled to Port Vila through the newly opened fish market. Catch rates have also been very encouraging, particularly in view of the fact that members of most of the groups are new to fishing. However, each group is experiencing its own unique set of problems (see Deep Sea Fisheries Development Project Notes, Vanuatu - this issue) and developing its own answers to them. The planned meeting is seen as a way of identifying common difficulties and gaining insights into potential solutions from the experience of others. Participants will include representatives of the Fisheries Department and CUSO administration, the volunteers themselves, and members of the fishing groups. Several sessions are planned for attendance by all participants, while others are designed for those with specific requirements. For instance, while those responsible for financial administration report on the groups' profits and losses, vessel skippers and fishing crew will have the opportunity to go fishing around the FADs off Port Vila and discuss variations in methods and techniques.

New Fisheries Institute Established

The International Institute of Fisheries Economics and Trade has been formed, as a result of a recommendation by the first International Seafood Trade Conference held in Anchorage, Alaska, last year. The Institute, membership of which is open to individual at a cost of US\$10, hopes to attract members from governments, industry and universities all over the world. Its major goal is to facilitate information exchange, and to serve as a clearing house for cooperative research undertakings through bringing together members with common interests.

For further information write to : Richard S. Johnston, International Institute of Fisheries Economics and Trade, Department of Agricultural and Resource Economics, Oregon State University, Corvallis, OR 97331-3601, USA.

1983 International Seafood Conference

The 1983 International Seafood Conference is to be held in Vienna, Austria, from November 6th-9th this year. The conference is designed principally for fishing industry representatives, particularly of processing and marketing companies. Presentations are planned by technical experts and conference leaders, and the meeting also provides opportunities for business contacts with key industry figures from over 35 countries.

For more information, contact : International Seafood Conference, 1101 Connecticut Avenue N.W., Suite 705, Washington, D.C. 20036, U.S.A.

"Asiafish 83" Conference

The Second International Conference on Fisheries Investment and Development in S.E. Asia and the Pacific, or "Asiafish 83", is scheduled to take place from September 7th-9th in Singapore. The conference's aim is to identify investment and development opportunities in the Asia/Pacific region. To promote this aim, major speakers will deliver talks under 5 major themes : commercial fishing opportunities, catching, handling and processing the fish, and funding the industry. Field visits to an integrated seafood processing plant and a commercial floating fish farm are also planned.

For further information, contact : Asiafish 83, Exhibition and Conference Management Centre (Pte) Ltd, 150 Cecil Street # 14-01, Wing On Life Bldg, Singapore 0106.

SPC Fisheries Newsletter No.25 April - June 1983

PROGRESS REPORT ON THE GREEN MUSSEL CULTURE PROJECT IN
WESTERN SAMOA, APRIL 1983

by

Lui Bell and Jane Albert,
Fisheries Division, Apia, Western Samoa.

Introduction

Investigation of the possibility of culturing the Philippine green mussel, *Perna viridis*, in Western Samoa was initiated by the Chief Fisheries Officer in October 1981. This species was seen as a potential cash crop, rich in protein and suitable for cultivation at village level. Funds were donated by the Canadian International Development Agency and the United Nations Development Project in early 1982 to enable a pilot culture project, which involved the growing on of imported mussel spat, to be carried out. The first importation in mid-June, 1982, consisted of about 40,000 spat, which were placed in sites close to Apia to enable growth rates and environmental conditions to be carefully monitored by Fisheries Department staff. A second phase in February, 1983, saw the importation of about 70,000 spat, which were placed in more remote areas on Savai'i and Upolu islands, as shown in Figure 1, to enable evaluation of their performance under conditions more closely akin to those anticipated in village culture projects.

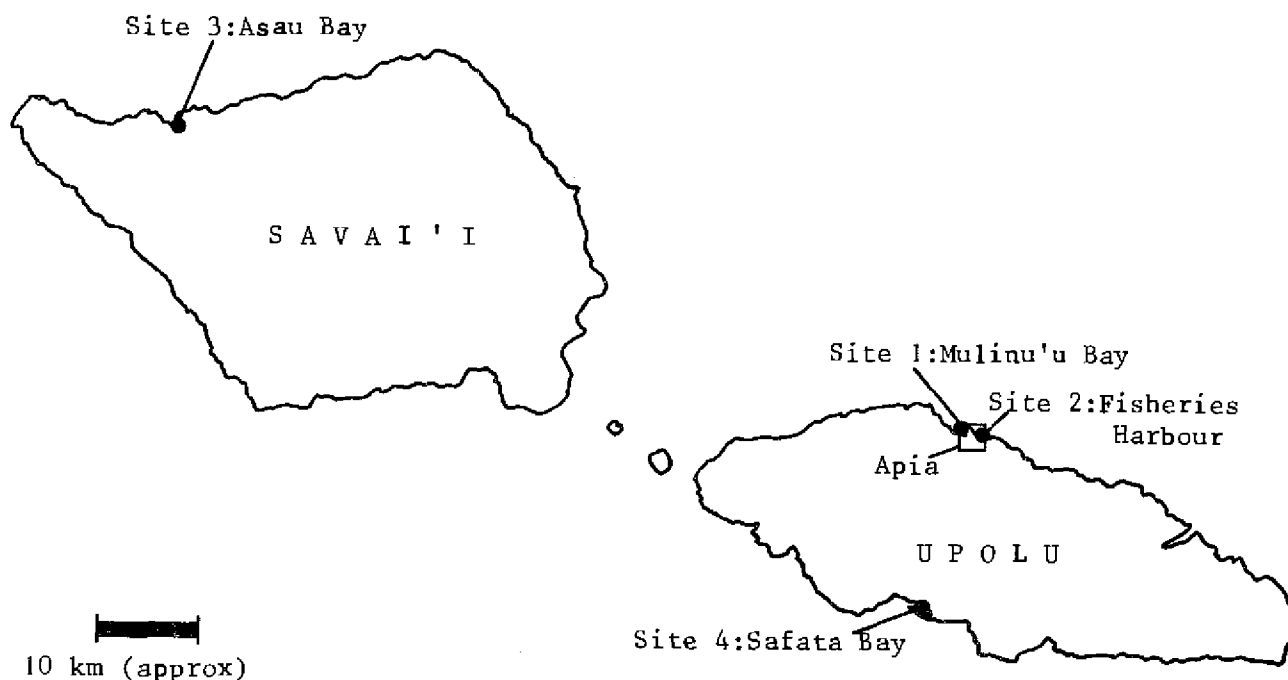


Figure 1: Pilot mussel culture sites in Western Samoa

Phase 1

The 40,000 spat delivered in mid-June 1982 had an average shell length of 9 mm, and were bound onto short lengths of 1.5 cm diameter polypropylene rope by wrapping them around the rope with strips of old knotless 5 mm square-mesh netting. This holds the spat in close contact with the rope until they attach themselves firmly by their own byssus threads. Once attachment has begun to occur, restriction of the growth of the mussels can be avoided by carefully slitting the netting, which is ultimately completely removed or deteriorates.

After binding on the spat, the ropes were each attached by one end to the underside of anchored bamboo rafts, of about 4m x 5m, and suspended vertically. The density of the spat along the rope sections was about 250-275 mussels per metre.

Site 1 : Mulinu'u. Approximately 10,000 spat were attached to one raft, on 18 rope sections each of about 2m in length. The site is a dredged area of about 300 sq.m and a maximum water depth of about 2.25m, set in a shallow bay about 5 times larger, and supporting some local bivalves. Salinity varied from 36 to 38 ppt (parts per thousand), temperature from 27.6° to 29.6°C, and pH from 7.5 to 8.1, during the four months that data was kept.

The mussels on this raft suffered severe mortality in the first month, and by mid-July a mere 170 mussels were left (less than 2%). This was attributed largely to poor handling and binding techniques - dead mussels were found in clumps under heavily and tightly wound netting, and some netting had been cut away before the spat were properly attached to the ropes, allowing the mussels to be swept away. It was clear that there had been human intervention, as some ropes were found stripped of mussels and there was some, but very little, evidence of natural predation. The raft was eventually cut from its anchor and blown ashore in November, 1982 after which it was dismantled and removed. At that time, the average length of the mussels had reached 2.0 cm (range 1.2 - 3.3cm) with only 72 mussels remaining.

Site 2 : Fisheries Harbour. About 30,000 spat were attached on 3m rope sections to two rafts in the same way as at Site 1. The area, located close to the centre of Apia harbour, is open to the influence of oceanic waters through the large passage of Apia harbour, although the rafts themselves are protected by a newly constructed breakwater. The water of the harbour is relatively clear, a Secchi disc still being visible at the bottom, which is 4-5 m deep. Salinity was generally around 36 ppt and temperature varied from 27.2° to 30.6°C, with lower temperatures being experienced in July-August and higher ones in October-April.

Again, there was an initial mortality problem, with overall survival of only 30% after the first month. Heavy sponge and algal settlements occurred on the ropes in the months that followed, possibly hindering food acquisition by the mussels. Growth has been slow, with an average length of 3.3cm (range, 1.9 - 4.7cm) being attained after 10 months, although an increase in growth rate over the warmer months was noted (see fig.2). Meat content is low, and there is no sign of gonadal development. Some human interference also occurred, and only 400-500 mussels remain there now.

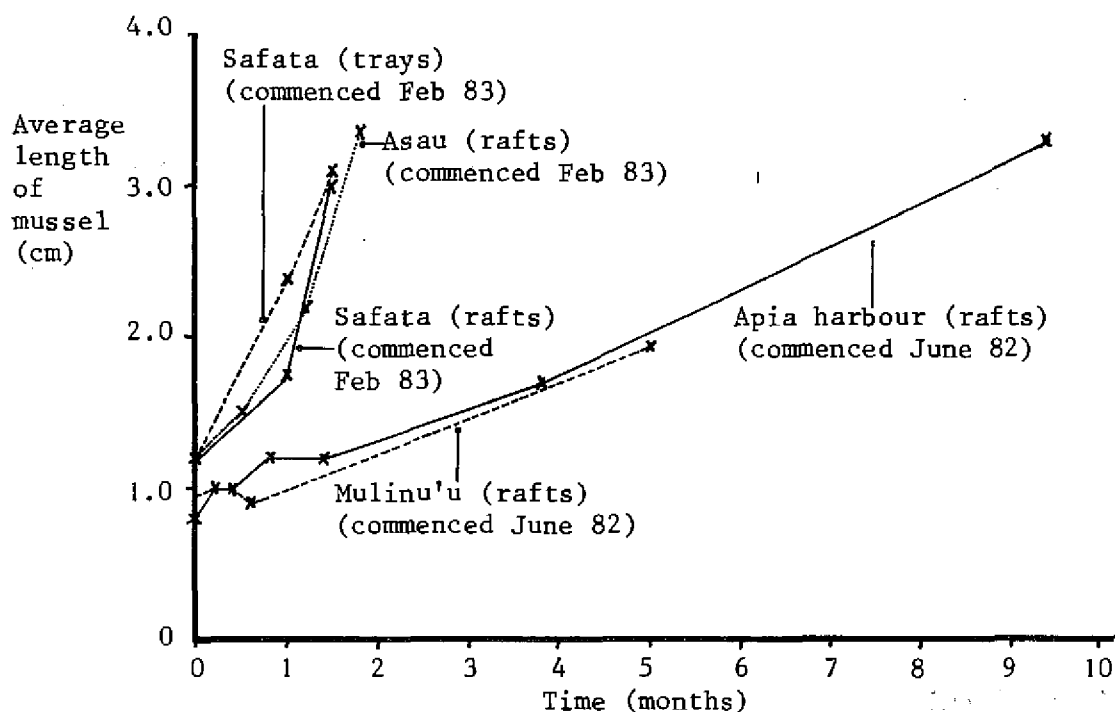


Figure 2: Average mussel growth rates for the two spat importations of June 1982 and February 1983

Phase 2

The second importation of approximately 70,000 spats, 93 days old from settlement and with an average shell length of 12mm, arrived in February, 1983. These were attached to rafts as before, with careful attention directed to spacing the spats more evenly on the ropes, avoiding large clumps of more than 40 in one spot, and binding them more gently with only one layer of netting. Another method of attachment in trays was also attempted at the Safata site.

Site 3 : Asau Bay. Rock oysters and barnacles abound on the rocks around the edges of this large bay, which has an area of 100 hectares estimated as suitable for mariculture (AQUACOP survey, July, 1978). A total of about 30,000 spats were attached to two rafts on growing ropes 3m long hanging below them.

The water is a rich green colour and Secchi disc visibility does not exceed three metres at one of the raft sites. This information combined with the growth rates of the mussels and of other bivalves in the area, suggest a rich supply of plankton. The water is about 10m deep below one raft and 5m below the other. Surface salinity is 30 ppt at the first site, 24 ppt at the second, and temperature in the bay varies from 28.0° to 31.5° C. Temperature drops suddenly 1-2 C and salinity rises to 36 ppt at a depth of 3m. Surface pH readings vary from 7.5 to 8.0. All these parameters will be monitored for evidence of seasonal change.

Mussel growth has been rapid, and their average length is now 3.6 cm, with a range of 2.4 - 4.9 cm. This represents an average growth of 2.4 cm in 1.5 months or 1.6 cm/month. Attachment was rapid and strong, and mortality was estimated at less than 10% (thought to occur mainly in areas of rope which were too crowded with mussels despite attempts to attach them carefully). Barnacles have settled on some mussel shells, but do not appear to be causing any damage. Gonadal development has begun, though mussels are not yet ready to spawn. Bright white and bright orange meat clearly distinguishes between male and female mussels, whereas no such distinction is possible with the Apia mussels, and meat quality and quantity are high.

Site 4 : Safata Bay. This bay is actually a well protected tidal pond lying between the shore and a peninsula parallel to the shoreline, and supports a wide variety of bivalve and crustacean life. Two rafts were placed in deeper areas of the bay (2.25m) with growing ropes 2m long. The salinity at the rafts was recorded as 28 ppt at low tide and 34 ppt at high tide, temperature from 30-31°C, and pH about 8.0. A total of 30,000 spats were attached to these rafts. An estimated 10% of the spats were lost as they apparently did not travel well (they floated when they were put in the water), and about 50% were found dead on one raft when the netting was slit too soon after binding. An additional 10% loss was incurred at this same raft presumably because of weak attachment, being knocked off by floating objects, and by people using the raft as a diving board. The other raft also suffered about a 40% loss due to tight binding. Growth rate of these mussels has been 1.2 cm/month for the past 1.5 months (average length 3.0 cm; range 2.3 - 4.0 cm).

Additionally, about 10,000 spat were placed in 3cm x 1m x 1.5m wooden-framed trays with small-mesh screening on the bottom, set in an area about 1m deep. Several 1m lengths of 16mm reinforcing rod, to which it was anticipated that the mussels would attach themselves, were introduced to the trays. Once attachment is complete the reinforcing rods can be removed and easily transported or hung horizontally for further growing on, a method based on trials in Tahiti.

Predatory crabs and siltation were an initial problem and necessitated separation of the trays (two on one rack and one on another) which also had to be closed in with 2.5 cm wire mesh. The mussels have been left to grow, most now attached to the reinforcing bar, but some to the wooden frame, and a few to the small-mesh screening. These latter will soon be removed as they are causing the accumulation of silt and algae.

Growth of these mussels has been about 1.3 cm/month, with an average length of 3.2cm and a range of 2.2 - 4.2cm. About 20% of the spats on the top tray floated away before attaching due to the current, and about another 40% mortality occurred on the bottom tray, mostly due to predation by the crab Scylla serrata. Puffer fish have also been seen attacking mussels on both the rafts and the trays.

Conclusions And Future Outlook: The growth which has occurred at the Asau and Safata sites clearly show that the culture of green mussels from spat to marketable size is possible in Western Samoa. As shown below, growth rates at these sites exceed those experienced in many other countries which market green mussels, although it must be kept in mind that these rates occurred during part of the warmer season, and may decline somewhat during the cooler part of the year.

Comparative Growth Rates Of Perna Viridis

WESTERN SAMOA	Asau	1.6cm/month
	Safata	1.2cm/month(rafts)
		1.3cm/month(trays)
TONGA		0.5cm/month
TAHITI		0.8cm/month
PHILIPPINES		1.0cm/month(marketed after 4 - 6 months)
INDIA		1.2cm/month(marketed after 5 - 6 months)
INDONESIA		0.8cm/month
SINGAPORE		1.0cm/month(marketed after 6 months).

Data from Fisheries Division Annual Report, Tonga, 1982, and Davy and Graham, 1982.

We conclude that the spat placed in the Apia sites were not handled well, but more importantly that site selection was not optimal with respect to the nutritional requirements of the mussels. The question still remains as to whether the Asau or Safata mussels will spawn. Current plans call for continued data collection on the gonadal development of the mussels and preparation of settling ropes and plankton sampling when spawning seems likely to occur. Future plans will include expansion of these sites and investigation of other suitable areas for mussel culture.

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A GLOSSARY OF JAPANESE FISHING TERMS

by

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The following glossary is not intended to be definitive or comprehensive, but has been designed as a practical tool to facilitate communication between fisheries workers and Japanese personnel.

English/Anglais	Japanese/Japonais	French/Francais
<u>Fish/Marine Life</u>		<u>Poissons/Faune et flore marines</u>
Fish	- Sakana	Poisson
Skipjack (<u>Katsuwonus pelamis</u>)	- Katsuo	Bonite à ventre rayé
Yellowfin (<u>Thunnus albacares</u>)	- Kihada maguro	Thon jaune
Bigeye (<u>Thunnus obesus</u>)	- Mebachi maguro	Thon obèse
Small bigeye (<u>T. obesus</u>)	- Daruma	Petit thon obèse
Mackerel tuna (<u>Euthynnus affinis</u>)	- Yaito, Suma	Bonite à dos rayé
Bullet tuna (<u>Auxis rochei</u>)	- Marusodakatsuo	Auxide
Frigate tuna (<u>Auxis thazard</u>)	- Hirasodakatsuo	Auxide
Northern bluefin (<u>Thunnus thynnus</u>)	- Kuromaguro	Thon rouge
Southern bluefin (<u>Thunnus maccoyii</u>)	- Minami maguro	Thon rouge austral
Dogtooth tuna (<u>Gymnosarda unicolor</u>)	- Isomaguro	Thon à dents de chien
Longtail tuna (<u>Thunnus tonggol</u>)	- Koshinaga	Pas de nom en Français
Albacore (<u>Thunnus alalunga</u>)	- Tonbo, Bincho	Germon
Rainbow runner (<u>Elegatis bipinnulatus</u>)	- Okiburi, Tsumuburi	Coureur arc-en-ciel
Triggerfish (Fam. <u>Balistidae</u>)	- Kawahagi	Baliste (balistidés)
Common dolphinfish (<u>Coryphaena hippurus</u>)	- Shiira	Coryphène
Barracuda (<u>Sphyrna spp.</u>)	- Onikamasu	Bécune, barracuda (sphyrenidés)
Trevallies, jacks (Fam. <u>Carangidae</u>)	- Aji	Carangues (carangidés)
Shark (Order <u>Lamniformes</u>)	- Same	Requin (ordre des lamniformes)
Wahoo (<u>Acanthocybium solandri</u>)	- Sawara, Okisawara	Thazard du large
Swordfish (<u>Xiphias gladius</u>)	- Mekajiki	Espadon
Sailfish (<u>Istiophorus platypterus</u>)	- Bashokajiki	Voilier
Black marlin (<u>Makaira indica</u>)	- Shirokawa	Marlin noir
Blue marlin (<u>Makaira nigricans</u>)	- Kurokawa	Marlin bleu
Striped marlin (<u>Tetrapturus audax</u>)	- Makajiki	Marlin rayé
Shark mackerel, double-lined mackerel (<u>Grammatorcinus bicarinatus</u>)	- Nijosaba	Maquereau saumon
Whale	- Kujira	Baleine
Flying fish (Fam. <u>Exocoetidae</u>)	- Tobi Uo	Exocet (exocoetidés)
Turtle	- Kame	Tortue marine
Porpoise	- Iruka, Eoto kujira	Marsouin
Bait	- Esa	Appât, boëtte
Jellyfish	- Kurage	Méduse

Saury(Fam. Scomberesocidae)

Sardine(Fam. Clupeidae)

Herring(Fam. Clupeidae)

Seaweed

Seal

Crustacea

- Sanma

- Iwashi

- Nisin

- Wakame

- Azarashi

- Kokakurui

Orphie

(scomberesocidés)

Sardine (clupéidés)

Hareng (clupéidés)

Algues

Phoque

Crustacés

Types of Vessels

Pole-and-liner

Longliner

Purse-seiner

500 tonne seiner

116 tonne seiner

Net boat

Search boat

Carrier boat

Patrol vessel

Mothership

Scientific research ship

- Ippon zurisen

- Haenawasen

- Makiamisen

- Kaigaimakiamisen

- Kinkaimakiamisen

- Amisen

- Gytansen

- Katsuosen no upansen

- Patrolsen

- Bosen

- Kagukuchosasen

Types de bateaux

Canneur

Palangrier

Sennneur

Sennneur de 500
tonneauxSennneur de 116
tonneaux

Bateau à filets

Bateau de recherche

Bateau transporteur

Patrouilleur

Bateau - mère

Navire

océanographique

Types of Schools

School

Log school

Whale school

Rippler

Boiler

Payao school

Porpoise school

- Gyogun no shurui

- Gyogun, Tsumure

- Kizuki

- Kujirazuki

- Mizumochi

- Shirawaki

- Jinkoryuboku

- Irukazuki

Types de Mattes

Matte

Matte sous épave

Matte sous baleine

Balbaya

Brisant

Matte sous payao

Matte sous marsouins

Parts of Purse-Seine Vessel

Cabin

Bathroom

Wheelhouse

Upper deck

Galley

Mess/saloon

Engine room

Forecastle

Fish hold

Power block

- Shitsu, Heya

- Furoba

- Senkyo, Burizi

- Jokohan

- Makanai shitsu

- Shokudo

- Kikan shitsu

- Kohansoko

- Gyoso

- Ami sabaki,
Pawaburokku

- Pasu uinchi

- Lekko boto, Ichigotei

- Nigotei

- Sangotei

- Speedboto

- Kaizu shitsu

- Omote, Senshu

Cabine

Salle de bains

Timonerie

Pont supérieur

Cuisine

Carré

Chambre des machines

Gaillard

Cale à poisson

Palan mécanique

Treuil à senne

Skiff principal,
annexe

Skiff No.2

Skiff No.3

Vedette, glisseur

Chambre de veille

Proue

No.2 skiff

No.3 skiff

Speedboat

Chart room

Bow

Stern
Port
Starboard
Hull
Radio Room
Propeller
Mast
Deck
Tow rope

- Tomo, Sembi
- Torikaji
- Omokaji
- Sentai
- Museinshitsu'
- Propera
- Masto
- Kohan
- Ote

Poupe
Bâbord
Tribord
Coque
Central radio
Hélice
Mât
Pont
Câble de remorquage

Parts of Net

Net
Floats
Rings
Wire ring line
Mesh
Net needle

Net twine
Netting
Sinkers, leads

- Ami
- Aba
- Kan
- Kosaku, Wire rope
- Amime
- Abari

- Ito
- Amichi
- Omori

Parties du filet

Filet
Flotteurs
Anneaux
Ralingue
Maillage
Aiguille à filet,
navette
Fil à filet
Filet
Plombs et lests

Mechanics of Setting

Standby
Set
Let go
Rings up
Stacking
Drying up
Brailing
Net roll up
Net mending

- Junbi, Stanbai
- Tomo
- Lekko
- Kanmaki shuryo
- Yomo
- Ami okoshi
- Sakana no torikomi
- Bomaki
- Ami shuri

Opérations de pose des filets

Paré
Pose (coup de senne)
Larguage
Fermeture du filet
Rangement du filet
Virement
Salabardage
Filet emmêlé
Remaillage,
ramendage,
du Filet.

Gear

Gaff
Hook
Rope
Binoculars
Brailing scoop
Boots
Hard hat
Gloves
Oar
Bamboo
Anchor
Payao
Small line

- Kagi
- Tsuribari
- Tsuna
- Sogankyo
- Tamo
- Nagagutsu
- Herumeto
- Tebukuro
- Kai
- Take
- Ikari
- Payao
- Himo

Accessoires

Gaffe
Hameçon
Filin
Jumelles
Puisette à décharger
Bottes
Casque
Gants
Aviron
Bambou
Ancre
Payao
Petite ligne

Oceanography

Current
Seamount
Current meter
Sea surface temperature

Salinity
Border between currents

Crew

Vessel Owner
Captain
Fishing Master
Chief Engineer
Bosun
Crew list

Navigation

Degree
Minute
Second
GMT
Speed
Fishing port
Island
Archipelago
Lighthouse
Wharf
Territorial sea
Reef
Course
Direction
Noon position
Chart
Latitude
Longitude
Radar
Satellite navigation
Set position
Current
Sonar
Offshore
Steaming
Drifting
Calm
Rough
Storm
Fishing ground

- Choryu
- Yanjin
- Choryukei
- Kaisuion, Kaisui no ondo

- Enbun
- Shiome

- Senin

- Senshu
- Sencho
- Gyorochō
- Kikancho
- Bosun
- Senin meibo

- Kokai

- Do
- Fun
- Byo
- GMT
- Husoku, Sokuryoku
- Gyoko
- Shoto, Shima
- Gunto
- Todai
- Futo
- Ryokai
- Ansho
- Shinro, Cosu
- Hoko
- Shogo ichi
- Kaizu
- Ido
- Keido
- Radar
- Eisei koho
- Tomo ichi
- Choryu
- Sonar
- Okiai
- Kokai
- Nagashi
- Nagi
- Arai
- Arashi
- Gyojo

Océanographie

Courant
Haut-fond
Courantomètre
Température de la mer
en surface
Salinité
Frontière entre
courants

Equipage

Armateur
Capitaine
Patron de pêche
Chef mécanicien
Maître d'équipage
Role d'équipage

Navigation

Degré
Minute
Seconde
GMT
Vitesse horaire
Port de pêche
île
Archipel
Phare
Wharf, quai
Mer territoriale
Récif
Route
Direction
Position à midi
Carte
Latitude
Longitude
Radar
Navigation satellite
Position de pêche
Courant
Sonar
Au large
En route
Dérivant
Bonace, mer calme
Mer houleuse, grosse
Tempête
Lieu de pêche,
pêcherie

Scientific Terms

Species	- Shurui
Male	- Os
Female	- Mes
Length	- Nagasa
Weight	- Omosa
Gonads	- Seishokusen
Stomach	- I
Fin	- Hirei
Fish scale	- Uroko
Gill	- Era
Weighing scales	- Hakari
Measuring board	- Monoshashi
Stomach contents	- I no naiyobutsu
To measure lengths	- Nagasa o hakaru
To weigh	- Omosa o hakaru
Biologist	- Kagakusha
Fish tag	- Hyoshiki
Tagged fish	- Hyoshiki-gyo
Otolith	- Jiseki
To estimate	- Mitsumoru
Specimen	- Hyohon

Other

Full moon	- Mangetsu
New moon	- Shingetsu
Too much current for set	- Ami o ireru niwa ahio ga hayai
Too rough for set	- Ami o ireru niwa nami ga arasugiru
Fisheries co-operative	- Gyogyo Kiyodokumia
Fresh fish	- Seigyo
Dried fish	- Kangyo
Canned fish	- Kakogyo utsu
Fishing catch	- Gyokakubutsu
Purse seine fishery	- Makiami gyogyo
Longline fishery	- Haenawa gyogyo
Fishing permit	- Gyogyo kyokasho
Call sign	- Call sain
Base	- Kichi
Vessel name	- Senmei
Incidental catch	- Konkaku

Termes Scientifiques

Espèce
Mâle
Femelle
Longueur
Poids
Gonades
Estomac
Nageoire, aileron
Écailles
Ouïes, Branchies
Balance
Planche graduée
Contenu stomacal
Mesurer la longueur
Peser
Biologiste
Marque à poisson
Poisson marqué
Otolithe
Estimer
Specimen, échantillon

Divers

Pleine lune
Nouvelle lune
Courant trop fort pour larguer le filet
Mer trop grosse pour larguer le filet
Coopérative de pêcheurs
Poisson frais
Poisson séché
Poisson en conserve
Prise de poisson
Pêche à la senne tournante
Pêche à la plangre
Permis de pêche
Indicatif
Base
Nom du bateau
Prises fortuites.

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AIR-SHIPPING OF FRESH FISH FROM AMERICAN SAMOA TO MARKETS IN HAWAII

by

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Often circumstances arise in marketing that will directly stimulate changes in the manner in which products are sold or handled. One such circumstance that has arisen in American Samoa is competition to established fresh fish producers from new sources. The change, exporting of fresh fish by air.

Although retail prices for fresh fish in American Samoa, usually around \$1.75 per pound at the Fagatogo Public Market, are high by Pacific Island standards, competition for the limited number of consumers in the relatively small local community has become quite substantial, limiting income. This competition comes from harbour traders dealing in frozen miscellaneous catch from tuna longline vessels, and from the increasing casual sales of "trash fish" from tuna purse seiners. Together these two sources of supply have virtually eliminated sales of fresh bottomfish to restaurants and most retail stores. The resultant task of marketing a volume adequate to make a living, even at \$1.75 per pound, has become more and more time consuming and frustrating for local fishermen, turning them into fishmongers two to three days out of the week.

In 1982 the Office of Marine Resources, Government of American Samoa, received funding from the Pacific Tuna Development Foundation to investigate, and if possible develop, alternative markets and means of marketing for the fish landed by the small fishermen of American Samoa. The following is a summary account of the results of these efforts, managed and conducted by the author, which has resulted in the establishment of an air-shipped fresh fish trade to Hawaii.

We realised early on that the prices of locally landed fish could not sustain lowering to be competitive since the competition fish was being sold casually by vessels for pocket money at between 50c and \$1.00 per pound. These prices could drop even further without difficulty if fresh fish prices become competitive, so it was decided to minimise the need for local marketing by exporting as much catch as possible.

Since I had previously been able to initiate the air-shipping of high value fresh fish from Guam to Hawaii in 1981, leading to a substantial trade there, we felt that successful demonstration of air-shipping of small lots could apply equally in the American Samoa situation.

Before embarking on such a venture, however, several basic criteria indicating feasibility had to be met. These were:

- (1) Are the local fishermen landing or are they capable of landing species of high enough value and demand overseas to warrant the shipping and related costs?
- (2) Are there means available to send air-shipments directly or with limited transshipment on a regular basis?
- (3) Is the quality of the fish presently landed high enough to be readily acceptable to the market, or, if not, are training means available to upgrade quality?
- (4) Is there sufficient land transport, ice-making capacity, cold storage, etc., available at local ports to handle fish without degradation or long delays?
- (5) Is there interest amongst fishermen to possibly increase income by producing a high quality product? Will they take the extra care?
- (6) Can the market overseas be conveniently entered without incurring excessive costs or duties?
- (7) If stock sizes are known are they adequate to warrant substantial exploitation?

In the case of American Samoa, most of the criteria could readily be met. The fishermen involved with capturing deep-water snappers were fairly adept thanks to SPC training in the late 1970's, and were landing fish with a much higher potential value on an export market. They were being hurt locally and they were eager for change, ice was available, transport was adequate, air freight was direct to Hawaii and a chill store of modest proportions was located at the terminal. Entry to the United States was not difficult, duty was not charged and airport handling charges were such that customs brokerage fees could be borne without difficulty. The stock sizes of deep bottomfish were not known, but were believed in a near virgin state due to low effort in the past; in future catch per unit of effort would be carefully monitored.

The only drawback to immediate initiation of the trade, which is a drawback in almost all areas of the Pacific facing export, was the quality of the fish being considered for sale. However, working initially with a small group of fishermen, training sessions and demonstrations were conducted, and quickly enhanced overall quality to the market standards mandatory for the Hawaii consumer. We instructed fishermen in a number of basic set procedures that must govern the manner in which they handle fish at sea. Briefly speaking, it is imperative that all fish be killed by penetration of the brain by a sharp instrument from beneath the gill cover: they must then be placed in a salt water/ice slush until they are completely chilled, straight and firm; and finally repacked in crushed or flake ice with good drainage after four to eight hours in the slush and held with as little handling, motion or transferring as possible until flight time. Simple as the procedures may seem they require care and practice so that the all-critical slush medium is of optimum chilling capacity, fish killed do not lose scales through motion in the brine, discoloration is avoided, especially at the bottom of the pack, etc.

The landings of fish at the beginning of the project indicated to me that there were a good number of species that did indeed have high market potential in Hawaii, especially the deepwater snappers. The species that have been exported during this project are presented in table 1, with names customarily applied in Hawaii.

Table 1 : Species airshipped to Hawaii

<u>SCIENTIFIC NAME</u>	<u>MARKET NAME (HAWAII)</u>
<u>Etelis corruscans</u>	Onaga, ula
<u>Etelis carbunculus</u>	Ehu
<u>Aprion virescens</u>	Uku
<u>Pristipomoides flavipinnis*</u>	Yelloweye Opakapaka*
<u>P. filamentosus</u>	Opakapaka
<u>P. multidens</u>	Lineface Opakapaka*
<u>P. zonatus</u>	Gindai
<u>Aphareus rutilans</u>	Lehi
<u>Paracaesio stonei*</u>	Stone's Snapper*
<u>P. kusakarii*</u>	Kusakar's Snapper*
<u>Epinephelus morrhua*</u>	Striped grouper*
<u>Caranx lugubris</u>	Gunggang
<u>Coryphaena hippurus</u>	Mahi mahi
<u>Acanthocybium solandri</u>	Ono

*Does not occur in Hawaii.

The fish that are exported are sold by consignment at the Honolulu Wholesale Auction. Buyers who trade here are very particular with regards to flesh quality and appearance since many fish, such as Etelis corruscans can command extremely high prices throughout the year based on their desirability as a gift of high prestige. The buyers are very well schooled from years and generations of experience so that the highest attainable quality cannot be substituted for if one expects a proportional return. Each fish sold is judged according to its individual merit, the ideal condition being a fish such as that in figure 1.

The project commenced with the shipping of the catch from a single fisherman, a 'highliner' of considerable skill, through a single buyer, who helped foster the project by providing shipping information, boxes and contacts. He also paid freight and offered a set, year-round FOB price. The shipping was accomplished by packing pre-chilled fish in wetlock type fish shipping cartons, the fish being wrapped in insulating papers. We could not consider shipping cartons or other containers of fish with ice due to the weight aspect, so we shipped dry. At first this may seem risky, but it is not if care is taken to ensure constant refrigeration. After the fish are packed they are placed into the chill box until flight time, when they are carefully loaded into a non-controlled atmosphere space in the planes belly, such as the general cargo bay. Since the temperature will soon drop as the aircraft comes to flight altitude, the space effectively becomes a refrigerator until landing, when the cartons are removed and placed in another airport chill until being delivered to the consignee.

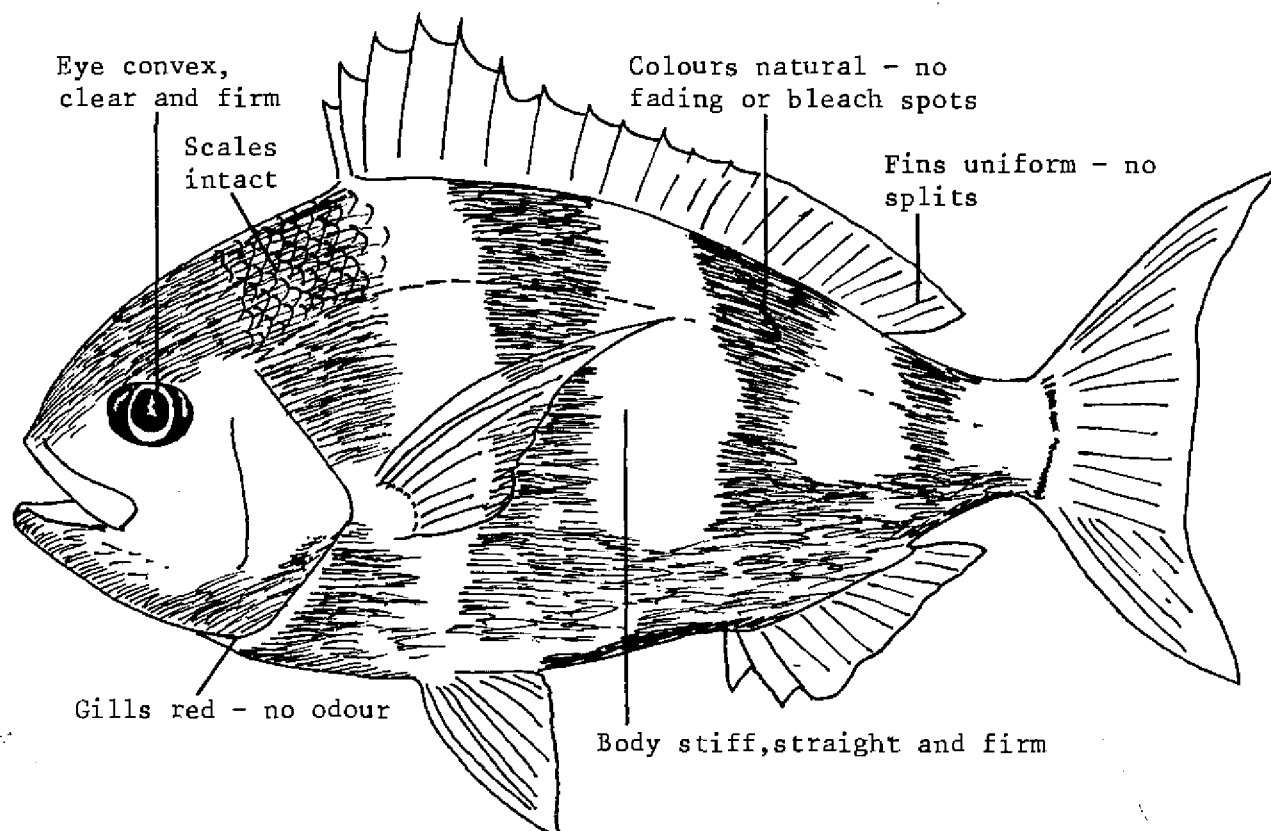


Figure 1: Some Quality Indicators

Using this arrangement we shipped over 9,000 pounds of fish during the year without a single loss. The tare weight was usually between 5% and 7% of the gross weight as opposed to up to 50% with containers of fish and ice, a very important factor. The shipping commenced in May and by September we had shipped 2,000 lbs of selected fish to the buyer. In September we decided to switch to marketing directly via the Honolulu Wholesale Auction for the following four reasons: firstly, the Auction acts on a percentage-of-sale basis, so it actively engages in selling fish, which influences prices accordingly; secondly, a great variety of tropical species that have demand in Hawaii can be marketed there daily; thirdly, through this exposure the fisherman can establish a reputation among fifteen to twenty buyers which can enhance his market security; fourthly, since the auction is regular, deals in volume, and markets a wide variety of species, the variable nature of the Island fisherman's catch can be accommodated best by this form of market, which absorbs quantity and variety. Between September 1982 and May of 1983 more than 6,000 pounds of fish were marketed through the Auction with a sales value of \$US21,811 or an average sales price of \$3.60 per pound for all species combined. Table 2 gives the species, poundage, total sales value, price range and average price for these sales.

Table 2 : Fish Sales

<u>SPECIES</u>	<u>POUNDS SHIPPED</u>	<u>TOTAL SALES</u>	<u>AVERAGE SALES PRICE</u>	<u>PRICE RANGE</u>
		<u>\$</u>	<u>\$/LB</u>	<u>\$</u>
<u>Etelis corruscans</u>	1,911.0	9,274.34	4.85	2.50 - 9.55
<u>E. carbunculus</u>	1,407.8	3,812.64	2.54	1.50 - 5.45
<u>Aprion virescens</u>	1,011.5	4,649.00	4.59	2.00 - 8.00
<u>Pristipomoides spp</u>	292.5	1,105.15	3.77	1.00 - 8.40
<u>Aphareus rutilans</u>	850.5	1,930.91	2.27	0.75 - 5.45
<u>Epinephelus morrhua</u>	153.5	239.07	1.55	1.25 - 2.30
<u>Coryphaena hippurus</u>	53.0	208.35	3.93	3.25 - 5.15
<u>Acanthocybium solandri</u>	64.0	253.55	3.96	3.30 - 4.35
<u>Caranx spp</u>	113.5	219.32	1.93	1.65 - 2.15
<u>Tropidinius zonatus</u>	28.5	64.79	2.27	1.25 - 3.05
Misc.	53.5	54.82	1.02	0.50 - 2.45
Total	6,029.30	21,811.94	3.60	

As time goes on adjustments are being made to make the sales at auction more rewarding. For instance: groupers (Epinephelus spp.) and trevallies (Caranx spp.) have never risen in price or volume, and, since these are not valuable enough to ship in small lots, shipping may be discontinued; the low volume of mahi mahi (Coryphaena hippurus) and wahoo (Acanthocybium solandri) indicates our recent start with these. Effort will increase here, since the demand is heavy; of the miscellaneous fish, we have begun to receive good feedback and a rising market price on test lots of Paracaesio stonei and P. kusakarii, and we anticipate considerable impact from the introduction of these species to Hawaii's consumers.

The results of these developments on the small fleet of deep-water bottom fishermen in American Samoa has been dramatic. Before the export effort commenced, as noted earlier, fishermen were facing increased competition by low value fish in their markets and the sale of valuable fresh fish had become a tedious task. The difficulty of their plight became clear when we realized that they were attempting to sell large (sometimes exceeding 20 pounds) fish such as Etelis corruscans and E. carbunculus, outside of a constricting, limited, restaurant trade, in a marketing situation where whole fish in the one to five pound range are generally favoured. As it stands now the six fishermen who are routinely shipping to the auction can sort their catch as to market, pack and despatch it in one or two hours, and sell the excess small fish without problems.

The long term prospects for the fishery seem bright provided that the stocks are not overfished. A reputation for excellence in quality has been established and long term prices are trending steadily upward. This could well provide a very good income to the nucleus of professional fishermen in American Samoa for the foreseeable future.