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EVALUATION OF THE DEEP SEA FISHERIES DEVELOPMENT PROJECT

by

Dr I. Walkden Brown
Fisheries Biologist
Queensland Fisheries Service
Australia

The 1980 SPC Planning and Evaluation Committee selected the Deep Sea Fisheries Development Project for critical evaluation in 1982. Dr I. Walkden Brown was seconded to SPC from the Queensland State Fisheries Service (Australia) to assess the impact of the project on the development of deep bottom fish resources in the region.

His report concludes *"There is no doubt that in terms of its objectives (viz. to identify the existence of a deep bottom fish resource, to demonstrate appropriate fishing methods, to train local personnel and to evaluate the commercial viability of deep bottom fishing under local conditions), the Project has been an immense success."*

This evaluation was endorsed by the 1981 Planning and Evaluation Committee following strong statements of support from a number of Island Governments. This report is attached for consideration by the Technical Meeting.

Attach.

RESTRICTED

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ORIGINAL : ENGLISH

SOUTH PACIFIC COMMISSION

PLANNING AND EVALUATION COMMITTEE, 1981
(Noumea, New Caledonia, 18 - 22 May 1981)

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1. INTRODUCTION

Traditional South Pacific Island fisheries have been concerned primarily with harvesting the resources of the lagoon and reef, although in some instances a secondary fishery has existed for pelagic species in oceanic waters outside the reef. Increasing demand for seafood in growing non-rural population centres, combined with traditional subsistence fishing needs, has placed heavy pressure on inshore shallow water fish stocks. In some areas these stocks are presently considered to be over-exploited.

In an attempt to identify alternative fishery resources and to stimulate an interest in their exploitation, the South Pacific Commission initiated an Outer Reef Artisanal Fisheries Project (ORAFP) which visited the New Hebrides, Cook Islands, Western Samoa, Tuvalu and the Solomon Islands between 1974 and 1977. ORAFP conclusively demonstrated the widespread existence throughout the South Pacific region of a deep water resource (comprising red 'snappers', jobfish, amberjacks, trevallies and several other groups) which had previously been fished to a significant extent only in Hawaii. In many areas the deeper water species were quite unknown to local fishermen. In its original form this project was designed to demonstrate a variety of fishing techniques, and to be almost totally self-sufficient in terms of vessels and ancillary equipment. In practice, however, the project tended to concentrate on deep bottom fishing because this method yielded the highest catch rates, and in many areas local fishermen already had a good working knowledge of trolling and shallow handline fishing methods. The transportation of large volumes of project equipment to the more remote locations was expensive, and posed considerable logistic problems. It also became apparent that in some areas the electrically-powered fishing reels and other gear in use was too sophisticated given the relatively low level of technical back-up facilities available.

Recognising these difficulties, SPC modified the project so that it concentrated specifically on the deep water demersal resource (in depths exceeding 120 m), made use of vessels provided by the host country, and generally employed cheap and reliable fishing equipment such as the Samoan design wooden hand reels. The modified project became known as the Deep Sea Fisheries Development Project (DSFDP).

At the time ORAFP was operating in Western Samoa, the local fisheries authorities were setting up a FAO/DANIDA-funded boat-building project to support their Village Fisheries Project. The standard 28' mono-hull and catamaran craft proved suitable for both inshore and deep water fishing operations and have become adopted (sometimes with modifications to meet local needs) by a number of other South Pacific Island countries. The availability of standard fishing craft and gear has facilitated the operation of DSFDP, and has enabled some gross comparisons of catch rates and operational costs to be made between the different countries. There is little doubt that, as a result of this process of simplification of objectives and equipment, the DSFDP is much more mobile than its predecessor. Moreover, the reduction in preparative and maintenance work has led to a marked improvement in fishing and demonstration time.

The demand for visits by the SPC project from countries in the region has been considerable, and to cater for this demand the project now has three teams operating independently, each under the control of a Master Fisherman. A very good indication of the level of interest in the project can be gained from the fact that ORAFP and DSFDP have between them been asked to visit fifteen of the twenty countries and territories in the SPC region at least once (see Annex 1).

2. PROJECT EVALUATION

The SPC Planning and Evaluation Committee (Noumea 1980) selected the Deep Sea Fisheries Development Project for critical evaluation during 1981. Dr I. Walkden Brown was seconded by SPC from the Queensland State Fisheries Service (Australia) to assess the impact of the project in a representative selection of countries, viz. New Caledonia, Tonga, Western Samoa, Cook Islands, Fiji and Vanuatu. Time and financial constraints precluded visits to all of the countries in which the project has been or is currently operating.

3. PERSONS CONTACTED

3.1 NEW CALEDONIA

L. Devambez (previously Fisheries Adviser, New Hebrides)
R. Munch (Administrateur des Affaires Maritimes)
P. Rosenberg (Adjoint du Chef du Service, Charge des Questions de pêche artisanale)
P. Fourmanoir (Biologist, ORSTOM)
T. Fusimalohi (SPC Master Fisherman)

3.2 TONGA

C. Ratcliffe (Chief Fisheries Officer)
T. Hopson (Research Officer)
J. Martin (Peace Corps Volunteer)
T. Simiki (Director, MAFF)
P. Mead (SPC Master Fisherman)
B. Hosie (Foundation for the Peoples of the South Pacific)
D. Wilder (Foundation for the Peoples of the South Pacific)

3.3 WESTERN SAMOA

A. Philipp (Chief Fisheries Officer)
D. Popper (FAO Aquaculture Adviser)
W. Travis (Commercial Fisherman)
"Boatcraft" staff

3.4 RAROTONGA (COOK ISLANDS)

J. Dashwood (Chief Fisheries Officer)
C. Friberg (Principal Fisheries Officer)

T. Williams (Commercial Fisherman)
T. Marsters (Chief Executive Officer, MAFF)
K. Tama (Secretary, MAFF)
T. Simiona (Minister for Agriculture and Fisheries)
R. Powell (Prev. Chief Fisheries Officer)
D. Brandon (Commercial Fish Retailer)

3.5 FIJI

Dr P.C. Hunt (Chief Fisheries Officer)
M. McGregor (Principal Fisheries Officer)
R. Yarrow (Permanent Secretary, MAF)
C. Evening (Senior Fisheries Officer, Western Division)
Research/Assessment Section Staff
National Marketing Authority (NMA) staff.

3.6 VANUATU

J. Crossland (Chief Fisheries Officer)
T. Reuben Seru (Minister for Lands; prev. Minister for Primary Industry)
I. Young (Central Planning Office)
K. Calvert (Central Planning Office)

4. ASSESSMENT

The following assessments provide an overview of the fisheries situation (both historical and current) in each of the countries visited so that the impact of the Project can be interpreted in proper perspective. The aim of the evaluation is not so much to report on actual numerical results of the Project operations (data of this type are already available in the SPC DSFDP publication series listed in Annex 2), but rather to provide insights into how well the Project has been received, what impact it has had in the local situation, and how the potential deep water bottom fishery is seen in the context of general fisheries development in the countries concerned.

4.1 NEW CALEDONIA

4.1.1 Perspectives

Despite the extensive system of lagoons and reefs around New Caledonia, the region's apparent fishery potential and the high local demand for fresh fish, very few fishermen in this country are full-time commercial operators. Most fishing activities around the main island involve the use of mesh nets and handlines within the lagoon, but at certain times of the year (November to March) some expatriate Polynesians fish with pearl-shell lures for skipjack and yellowfin outside the barrier reef.

Many of the more serious New Caledonian fishermen operate vessels produced by a Government subsidised boatbuilding scheme. These boats are cabin runabouts in the 5-8 m length range, and are powered by either outboards or inboard diesel motors. The high price of fuel, which can constitute more than 50% of the running costs of a fishing operation, is a significant factor to fishermen based on the main island where the reef is a considerable distance offshore. Although there are some areas (e.g. the Loyalty Islands) where barrier reefs are lacking and deep sea-floor slopes are quite close to the shore, local fishermen had, until recently, been unaware of the existence of a deep demersal fish resource.

4.1.2 Project Operations

The DSFDP was stationed in New Caledonia between April and September 1979, during which time the team operated at three sites: Lifou (Loyalty Islands), the west coast in the vicinity of Noumea, and at the Isle of Pines.

Twelve different boats, ranging in length from 5.1 to 13.5 m, were used by the Project. Most were privately owned, but the two used at Isle of Pines belonged to the Government organisation FADIL. In general wooden hand reels (manufactured at the FADIL workshop) were used, although the two largest vessels were equipped with hydraulic reels.

Excellent catch rates (exceeding 7 kg/reel/hr) were obtained at Lifou and Isle of Pines, and fishermen were generally very keen to learn the deep water fishing techniques.

4.1.3 Impact of the Project

The Project was very well received both by private fishermen and Government administrators. At present one vessel regularly fishes the outer reef slope, and two or three do so periodically. Another 6 or 7 fishermen are capable and equipped to fish the deep water stock but apparently lack the incentive.

The Project techniques were rapidly assimilated, but many of the fishermen trained by the team began to lose interest in deep water fishing as a full-time occupation after the Project left New Caledonia. However a very positive result of the Project can be seen in the formation of a co-operative fishing group on Lifou. This group has acquired a 15 m^3 prefabricated cold storage facility which is periodically used to manufacture ice.

Previous problems associated with marketing whole large fish in Lifou have been overcome by sending a truck on a regular run around the island selling iced fish pieces and fillets.

The Project report has been put to good use by local fisheries authorities who have reprinted extracts of the report for circulation to fishermen in an attempt to stimulate more interest in the deep bottom fishery.

4.1.4 Deep Bottom Fishing in the Context of Development Plans

Half the population of the Loyalty Islands live on Lifou where the local demand is such that fresh fish often has to be imported from Noumea. Loyalty Islanders are relatively well off in terms of income and seem prepared to pay the prices asked for deep bottom fish. Government policy is (at least in the short term) to develop fisheries aimed at satisfying the local market. If and when that is achieved provision will be made to export any excess product to the Noumea market.

The Loyalty Islands appear the most suitable areas for such development: fishermen on the Isle of Pines are skilled at catching lobsters and are unlikely to maintain an interest in any less lucrative fishery, and mid west coast fishermen are faced with the problems of long distances to the fishing grounds, a very steep drop-off, and a complete lack of shelter from the weather.

Cold storage facilities (35 m^3) are already available for the use of fishermen at Ouvea, and the Government intends to install a 0.2 - 0.4 T/day ice making plant later this year at Lifou. Fisheries personnel are also considering a training course in vessel and engine maintenance for fishermen in the Loyalty group.

The New Caledonian Government has requested that the DSFDP team visit the Loyalty group again, the current suggestions being to operate at Ouvea as well as Lifou. A second experience for the Lifou fishermen would be valuable in terms of re-kindling an interest in bottom fishing, and providing insights into the finer points of the technique. Some exploratory work in areas different from those fished during the first visit would be beneficial, as the fishermen have tended not to investigate different areas and depth ranges of their own volition.

4.1.5 Comments

a) The fact that a return visit of the Project team to New Caledonia has been requested indicates the importance that local authorities attach to the development of a deep bottom fishery in that country.

b) The authorities were interested to know whether seasonal changes in the abundance and/or distribution of the deep bottom fish fauna are likely to be important factors in the development of such a fishery. Concern was expressed about the general lack of available information on the dynamics of the deep water stock, and

it was suggested that SPC might consider a synthesis and analysis of all the data obtained during the course of the Project in an attempt to provide some indication of the effects of depth and season on the size and composition of the catch.

4.2 TONGA

4.2.1 Perspectives

The majority of Tonga's estimated 2000 T/yr fish production is derived from shallow water (< 60 m) artisanal fishing operations involving vessels in the 6-8 m range, some of which are diesel-auxiliary sailing craft.

In addition to the handline fishery there is a significant gill net fishery, the nets being variously used for hauling, trapping and meshing. Some of the more successful net fishermen can catch up to 100 T of shallow water fish per annum. Fish fences, of which there are more than 100 along the northern shore of Tonga'tapu, are directed primarily at the seasonal mullet run between July and November. Spear fishing makes a small contribution to the total catch, and a seasonal (summer) skipjack fishery involving the use of traditional pearl-shell lures exists in the Vava'u area.

Historically there has been no significant fishery for deep demersal species, although the numerous sea mounts and submerged reefs in the area undoubtedly support a very considerable deep water fish resource.

A Government-owned 200 GT longliner fishes albacore and yellow-fin close to the main port, and currently lands about 100 T/yr. The Taiwanese distant water fleet is estimated to catch around 4000 T/yr from Tongan waters.

One of the main reasons why commercial fishing operations have not developed to any great extent in the outer islands (e.g. the Vava'u and Ha'apai groups) has been the lack of a suitable product distribution and marketing infrastructure. Only with the recent installation of an ice machine and cold storage facilities in Vava'u and the use of a Government vessel for fish transport has there been the means for holding and shipping excess catch to the Nuku'alofa market.

4.2.2 Project Operation

The DSFDP has already completed two visits to the Kingdom of Tonga (in 1978 and 1979) and is currently based there for a third time. On the first occasion the Project made use of three Government owned vessels (ranging from a 6 m canoe to a 16.5 m GRP pole boat) and a privately owned 7.4 m vessel, and demonstrated conclusively that good catches could be made using hand reels in deep water. During the second visit two boats were used - an Australian built 15.4 m multi-purpose craft and a standard FAO design monohull. Catch rates were considerably higher than during the initial visit, probably because fishing was concentrated in more productive areas.

The activities of the Project during the current tour have largely centred on evaluating the effectiveness of sailing boats in the deep bottom fishery. The use of motor sailers as fishing boats is being promoted by the Government, as it offers a means of substantially reducing the operating costs of a fishing enterprise in a country where fuel is expensive but labour cheap. Initial trials with a small sailing trimaran were unsuccessful as the boat was not a suitable fishing platform. However an enlarged "alia" type catamaran constructed at the Fisheries boatyard by a UN boatbuilder using funds provided by the Foundation for the Peoples of the South Pacific (FPSP) has proven much superior. This 33' craft performed well under sail but has required some time-consuming modifications to make it operational. The time available to demonstrate deep water fishing techniques from this vessel has consequently been limited. Nevertheless, Fisheries staff and Project personnel believe that the time and effort spent on improving handling, safety and fish storage characteristics has been worthwhile, and expect that it will prove to be a very cost-effective fishing craft.

4.2.3 Impact of the Project

The Project has clearly demonstrated the existence of potentially valuable deep water resource, particularly around the outer islands, and has introduced the techniques to a number of commercial fishermen and Fisheries staff. As a direct result, the Government has assigned high priority to the promotion of deep bottom fishing around Tonga.

A commercial fisherman trained during one of the earlier visits has consistently increased his usual catch by 300%, the Government tuna boats have begun to supplement their catches in the "off season" by fishing the deep water stocks, and several commercial boats have also started to operate in deeper water. The fishing community has expressed great interest in the deep line fishing methods, and there is a growing demand from purchasers of Government-built vessels to have them fitted with wooden hand reels. Two boats in Vava'u are successfully engaged in deep bottom fishing at the end of the skipjack season (i.e. between April and September). The Government is keen to encourage this type of diversification to ensure that vessels (particularly the larger ones) do not become uneconomical outside the tuna season.

4.2.4 Deep Bottom Fishing in the Context of Development Plans

Development of a deep demersal fishery is an integral component of Tonga's current 5-year development plan. It seems likely, however, that fishermen in outer areas such as Vava'u will continue to exploit the pelagic resource during the tuna season, as a small boat operator can catch up to $2,000 worth of skipjack on a good day.

The Fisheries Division is about to start an experimental program which will enable interested fishermen to undertake deep water fishing trips on a commercial scale but without having to invest money in boats and equipment. The Division's 15.4 m "Kahikahi" is

to be chartered out at a nominal rate to groups of fishermen who will share 50% of the proceeds of the catch.

As part of the 5-year plan ice making and cold storage facilities are to be installed on Tonga'tapu, Ha'apai and Vava'u using funds supplied by FPSP and the Australian and Japanese Governments. A 38' catcher/carrier motor sailer is planned for use in the Ha'apai group, and subsidiary UNDP boatyards are to be set up in Ha'apai and Vava'u to assist in the planned production of 60 boats over the 5-year period. Provision has been made to recruit a fisheries development officer, marine engineers and other technical personnel.

4.2.5 Comments

a) The Government is very pleased with the results of the Project, and believes that it has already made a significant contribution to the development of the fishing industry in Tonga.

b) Recommendations included in the last Project report were greatly appreciated, and it was suggested that future reports might include more interpretation of the results as well as the specific recommendations.

c) Diversification of the Project to include the demonstration and assessment of alternative fishing methods is considered highly desirable. Some suggestions appropriate to the situation in Tonga include bottom longlining, methods for exploiting the "plateau" shark stock, deep gill netting around Ha'apai, the use of hydraulic or mechanical line haulers for use in deep areas, and the possible use of short pelagic longlines.

d) Fisheries personnel are aware that, in a number of South Pacific countries, some highly specific fishing methods have evolved which may be of great interest to fishermen in other countries. In some instances the techniques and experiences have been described in publications (including SPC Newsletters etc.), but much information may be available from the files of Fisheries offices thoughout the region. The collation of such material into a single volume or compendium could well provide very useful ideas for the diversification of existing artisanal fishing operations. The Commission is urged to consider the feasibility of producing such a document.

4.3 WESTERN SAMOA

4.3.1 Perspectives

Western Samoan fishermen have a long history of exploiting pelagic fish stocks (mainly tuna) outside the reef. Traditional methods of catching surface fish from small outrigger canoes using pearl shell lures were effective and highly specialised, and although larger outboard powered craft have now replaced many of the canoes, the basic trolling techniques are still in use. Other artisanal methods, including net fishing and spear fishing within the lagoon, and handlining to a depth of 100 m, have also been in use for a long time.

Although the Commission's DSFDP has not visited Western Samoa, its predecessor (ORAFP) was based at Asau on Savai'i Island for seven months in 1975, at which time the local fisheries authorities were developing a Village Fisheries Project aimed at supplementing the surface tuna catch with deep bottom species. Co-operation between the SPC team, Government officials, FAO Fisheries Adviser Gulbrandsen and Boatbuilder Overa led to a valuable interchange of ideas and techniques, and led to the establishment of an FAO/DANIDA-funded boatbuilding yard to produce low cost seaworthy single and double hulled boats suitable for night fishing in Samoan waters. A cheap and effective wooden hand reel was designed for deep bottom fishing, and this has subsequently become "standard equipment" for use in the Deep Sea Fisheries Development Project.

4.3.2 Deep Bottom Fishing in the Context of Development Plans

As a result of the ORAFP visit and the local Village Fisheries Project, some 240 "alias" (28' catamarans) have been produced at the Boatcraft yards. The twin-hull design was far more popular amongst local fishermen than the inboard diesel powered monohull (cf. the situation in Fiji), partly because of its resemblance to the traditional double-hulled canoes, and partly because of its greater speed and suitability for trolling skipjack. Boatcraft now fabricates alias exclusively from aluminium. Currently about 160 alias and a small number of monohulls are fishing more or less regularly around Upolu and Savai'i primarily for tunas but, when conditions are favourable, also for bottom fish in depths to 250 fm.

There are several reasons why the deep bottom fishery has been, and is likely to remain of secondary importance to the artisanal tuna fishery. Tuna are abundant around Western Samoa and are amenable to capture by small scale operations. This situation is being enhanced by the installation of fish aggregating devices, seven of which have been in use with considerable success for 18 months. The Government is about to deploy another 7 FADs in the near future, within range of selected villages around the coast. Trolling and midwater fishing for tuna is far less demanding work than deep bottom fishing with hand reels. Steep outer reef slopes and strong currents necessitate the use of heavy sinkers for deep fishing, and the location of suitable fishing depths without the aid of an echo-sounder also appears to be a problem.

Fewer than 30% of the alias carry ice, and although ice is readily available in Apia from the brewery, there is a need to locate ice machines in some of the coastal villages.

Promotion of deep water fishing does not seem to be a major concern in Western Samoa. The techniques are widely known (the ORAFP and Village Fisheries Projects have, between them, demonstrated the methods to more than 550 Samoan fishermen); many fishermen already exploit the deep demersal stock to supplement their pelagic catches, and a few are in fact primarily dependent upon deep bottom fishing.

4.3.3 Comments

The introduction of mechanical fishing reels or line haulers

powered by electricity, hydraulics or a small diesel engine would undoubtedly make deep bottom fishing a more attractive proposition, as would the introduction of echo-sounders as standard equipment on the 28' boats. However the Government believes that most fishermen at present do not have the capability (because of lack of training and experience) to maintain relatively sophisticated equipment of this sort. The upgrading of technological support services, facilities and training programs does not appear to be a matter of immediate concern in Western Samoa.

On the other hand, some experimental work is being done with the use of a spray system mounted on the stern of an alia for skipjack fishing. If this idea becomes widespread it should not be difficult to run a line hauler from the motor which drives the spray pump.

4.4 COOK ISLANDS

4.4.1 Perspectives

The annual artisanal fish catch in the Southern Cooks (including Rarotonga, Aitutaki, Mangaia, Atiu, Mauke and Mitiaro) has been estimated at between 800 and 1000 T. Although 61% of the population lives on Rarotonga, this island contributes only about 25% to the total landings, the majority (around 60%) coming from Aitutaki. Rarotonga has a very limited lagoon area, the resources of which are heavily exploited and have for many years been subject to agricultural chemical run-off from the island's citrus orchards. Consequently, there is a great demand for fresh fish which is not being met by local supply.

The main artisanal fishing methods are netting, handlining and spear fishing, and the overall catch comprises about 70% reef fish, 10% "ocean" fish (including yellowfin and skipjack), and 20% miscellaneous fish (sharks, mullet, flying fish etc.). Midwater handlining or "down fishing" for yellowfin has been an important traditional method which in the past involved considerable skill and co-operation between groups of fishermen, but the Cook Islanders do not have a tradition of fishing the outer reef slope resources.

A survey in 1979 estimated that the Southern Cook's artisanal fleet comprised some 360 small outrigger canoes, 100 outboard powered boats (including motorized canoes) and 7 "other types" (mainly inboard monohulls). The great majority of fishermen are at best only part-time operators; only one in Rarotonga is considered a full-time commercial fisherman.

Although deep bottom fish have been caught around Rarotonga in the past, there is a widespread belief that only in the more northerly islands of the group is the outer reef slope resource large enough to warrant serious investigation. Partly for this reason the ORAFP was based at Aitutaki, between December 1975 and May 1976. While there has been much criticism of this particular operation, ORAFP did achieve the objectives of identifying a resource with some commercial potential and demonstrating the techniques to some trainees.

It is apparent in retrospect that Aitutaki was an inappropriate site for the Outer Reef Project: although some local people showed interest in the operation, the Aitutakians are primarily an agricultural community and their enthusiasm for strenuous deep water fishing was short lived. Recruitment of suitable trainees was a problem, the Project received little support from Government officials at the time, and the equipment used was too advanced technologically for the local people.

4.4.2 Deep Bottom Fishing in the Context of Development Plans

Despite the ORAFP's lack of success in establishing an outer reef slope fishery at Aitutaki, the Cook Islands Government is optimistic of the prospects of developing the fishery at another site.

A request has been made to SPC for the DSFDP to visit the Cooks, for the first time, in the latter half of 1981. Penrhyn Island in the northern group has been selected as the main project site since there the villagers are much more dependent upon fishing than they are at Aitutaki. Some experimental work has been done around Penrhyn, and an extensive resource comprising Etelis and Seriola species is believed to exist in the 100-120 fm range.

Of the island's 40-odd boats, about half are regularly involved in fishing activities. The heavy planked 14' - 16' outboard powered vessels on Penrhyn are becoming expensive to run as pre-mixed outboard fuel currently costs around NZ$3.50/gallon, and it appears that this figure could double within the next two or three years. The Government is concerned about the high cost of freighting fuel to remote islands, and the diminishing supply of 44 gallon drums required to carry the fuel. Lighter, diesel powered aluminium boats are being considered as alternatives, since diesel fuel can be bulk loaded on inter-island freighters and the volume of dieseline required would be substantially less than that of outboard fuel.

The Fisheries Division plans to install a small blast freezer and a 14 T holding freezer on Penrhyn before August this year, and it is envisaged that once a fishery is established the accumulated catch would be freighted to the Rarotonga market at intervals of approximately 6 weeks. It would be preferable for the DSFDP team to commence operations after this plant is installed and is working satisfactorily.

The Division has deployed two aggregating devices, one off Avarua (Rarotonga) and the other at Penrhyn. The former had been working well until the buoy recently vanished without trace, but the latter has apparently not been used by local fishermen. The Project could perform a valuable service by evaluating the effectiveness of the Penrhyn FAD for "down fishing" and surface and midwater trolling, and comparing the catches with those obtained by local fishermen at their traditional yellowfin fishing sites.

4.4.3 Comments

a) Development of the deep bottom fishery is seen as an important aspect of fisheries development in the Cook Islands, both as a means of increasing the supply of fresh fish to the Rarotonga market, and to generate an alternative source of income to communities in the outer islands.

b) Although the impact of the ORAFP visit to one of the Cook Islands was minimal, there is reason to believe that DSFDP will meet with much greater success because of the change in orientation of the Project, more Government interest and support, a different attitude amongst local fishermen at the new site and the use of local boats and unsophisticated equipment.

c) Fisheries personnel are very keen that the Project should conduct fishing trials using various deep water longlining techniques.

d) Despite the widely held belief that offshore demersal fish stocks around Rarotonga are insignificant, Fisheries staff do not consider that the assumption has been adequately tested, and would like to see the Project carry out a brief assessment in that area before transferring to Penrhyn.

4.5 FIJI

4.5.1 Perspectives

Subsistence-level fishing in Fiji is carried out almost entirely in the very extensive lagoon/reef environment; there is no tradition of deep water bottom fishing anywhere in the archipelago. During the time when ORAFP was producing promising results in other countries, the Fisheries Division initiated a survey of local deep water resources using 12.5 m ferro-cement boats equipped with locally made electrically powered fishing reels. Subsequently it became apparent that the cost of these vessels would be beyond the financial means of most local fishermen, so the boatbuilding program started producing the much cheaper FAO-design diesel powered 28' monohulls and outboard powered catamarans ("alias"), equipped with standard Samoan wooden hand reels. Of the two designs, only the monohull gained acceptance amongst the fishermen, and production of the "alias" was phased out.

Most of the initial survey work done by the Fiji Fisheries Division was concentrated in the areas to the south and east of the main island (Viti Levu), where the existence of a substantial resource was clearly demonstrated. During the next few years more fishermen became interested in deep bottom fishing, and at present some 30 boats produced by the Division's subsidised boatbuilding project are in use in the Central, Western and Northern Division, with an additional 7 completed boats soon to be delivered to Vanua Levu (Northern).

4.5.2 Project Operation

The DSFDP visited Fiji between November 1979 and March 1980 and was based at Lautoka in the Western District. Of the four boats

used for deep water bottom fishing, only one (a Government owned 8.6 m FAO-design monohull) was considered suitable for this type of operation. Most of the fishing and training work was carried out in the Yasawa and Mamanuca Islands which lie to the west of Viti Levu.

4.5.3 Impact of the Project

The DSFDP visit to Viwa Island and the Yasawa and Mamanuca Groups proved highly successful. Not only were very good catch rates experienced, but there was considerable interest in the fishing techniques amongst local fishermen, many of whom had never seen the deeper water species before. The initial successes of the exercise have been followed up; six 28' monohulls are now based in the western island group and are producing very good catches. Not all are engaged full-time in the deep bottom fishery, but outer reef slope species certainly represent a significant proportion of the total catch.

The Mamanuca fishermen have no difficulty in disposing of their product locally to the several island resorts in the area, but those on Viwa have to transport their catch to Lautoka where it is sold primarily to the National Marketing Authority. The NMA experienced some initial buyer resistance against the eteline species because of their superficial similarity to some local toxic fish, but this declined once the fish became better known to the buying public. Fishermen in the southern Viti Levu area, some of whom operate privately built vessels, are also obtaining good catches of mixed bottom fish. A large part of their catch is sold directly to hotels and restaurants at prices around $2/kg, but an increasing proportion is being handled by NMA ($1.20-1.50/kg).

4.5.4 Deep Bottom Fishing in the Context of Development Plans

While the deep bottom fishery presently contributes little to Fiji's total annual fish production, authorities expect that within 2 to 3 years it will have assumed major importance. The infrastructure to support this expansion is already there: five ice making plants (total capacity 42 T/day) are strategically situated in the two main islands; the boatbuilding project is expected to produce 36 new vessels this year (18 for sale to commercial fishermen and 18 for use in a rural training scheme); fishing gear and tackle can be obtained at several centres; and local marketing outlets are available. Further expansion of this type of fishing to the Lau (eastern) group is planned, and the Fiji Government has requested a revisit by the DSFDP team in the latter half of 1981. During that period it is intended that the team should operate from three of the Lau islands - Lakeba, Vanua Balavu and Fulaga. Government plans to equip a number of fishing groups in these outer islands with vessels, equipment and fish storage facilities, and to operate a periodic ice delivery/fish pick-up service using a new vessel to be provided under a current Japanese Aid agreement.

Commercial fishermen wishing to fish within the bounds of the barrier reef usually need to obtain a permit from the local mataqali (tribal) leader. Such permits can be expensive and may be valid for only a year; at present Government authorities have little control

over this system. Consequently there is a considerable need to develop fisheries outside the "demarcated area" of customary fishing rights.

Besides promoting deep bottom fishing operations, Fiji is about to deploy about 60 fish aggregating devices (FADs) throughout the archipelago. Although primarily intended to enhance the industrial skipjack/yellowfin fishery, these FADs should also provide a supplementary surface and midwater pelagic fishery for the outer reef slope operators. Fiji would welcome any advice (including demonstrations of appropriate techniques and gear) from the DSFDP team as to the most productive small scale methods of fishing around FADs.

4.5.5 Comments

a) The DSFDP has been exceptionally well received in Fiji, and the Fisheries Division is very pleased with the stimulus provided by the project in the Western Division. Many of the deep water species previously unknown to the local fishermen now have descriptive Fijian names, which should facilitate further publicity and extension work.

b) While recognising that it is unreasonable to expect a "scientific" report from a Master Fisherman, the Fiji Government would like to see more emphasis in future reports placed on simple analyses of CPUE and catch composition by depth range and general interpretation of the results. The provision of specific recommendations was welcomed and should be continued as it represents a very important aspect of the Project report.

c) Fisheries officers feel the DSFDP should by now have accumulated sufficient data to allow a synthesis of the results throughout the region. Analyses of the total data-base may provide valuable insights into depth distribution, seasonality in abundance, optimum fishing times and the effects of large scale environmental characteristics on the regional distribution of the deep bottom fish resource. The Commission is urged to consider the production of such a document.

d) There is some concern about the lack of knowledge of the effects of consistent heavy fishing pressure in a small area. Fisheries staff, while aware of the difficulties involved, consider it very important that some attempt be made to investigate the population dynamics of the major Etelis and Pristipomoides species. At present no one seems prepared to predict the levels of fishing pressure which the deep water resource can withstand.

4.6 VANUATU

4.6.1 Perspectives

Fresh fish does not rank highly in the subsistence diet of the people of Vanuatu, who are primarily agriculturalists. The main source of dietary protein, apart from festive occasions when pigs are slaughtered, is imported canned meat and mackerel. Consequently there are few serious fishermen in the country, and those who do

supply fish such as tunas and reef fish to the market are, by and large, expatriates from other parts of the Pacific.

Most of the limited fishing effort involves the use of small canoes which, because of their size and general lack of seaworthiness, are restricted to inshore areas and depths not greatly exceeding 20 fm. In the 1950's fishermen in the Port Vila area were introduced to the idea of fishing reels fabricated from bicycle frames and wheels, some of which were modified to fit into the canoes. While this development undoubtedly made line fishing easier, it did not expand the area of fisheries exploitation to any significant extent.

The ORAFP was based at Malekula during the early part of 1975 and stimulated some interest in deep bottom fishing amongst the local villagers, but because of the lack of suitable fishing vessels this activity was not carried on after the Project team departed.

4.6.2 Project Operation

The DSFDP visited Vanuatu between September 1978 and March 1979, when it was stationed on the island of Tanna in the southern part of the group. Two local single-hulled outboard powered boats were used; one a 6 m open plywood craft and the other a 4.5 m half-cabin runabout. On the leeward side of the island catches were rather poor, probably because extensive areas of the sea floor were covered with black sand of volcanic origin. Catch rates were considerably better on the exposed side, but the plywood runabout was not suited to the sea conditions experienced in that area. The lack of available ice on the island also created some difficulties. Despite these operational problems the Project did, once again, identify a new resource (the eteline species had not previously been seen by Tanna villagers), and train nine recruits, one of whom is now on the staff of Vanuatu's embryonic Fisheries Department.

4.6.3 Impact of the Project

In terms of actually increasing the production of fish in Vanuatu, the Project cannot be said to have made much impact so far. The Government, however, is acutely aware that this is due largely to the lack of a basic infrastructure rather than to any failings or shortcomings on the part of the Project itself. The main thrust of the Project at this stage is seen in terms of a much needed evaluation of the country's fish resources, and in this respect it has met with considerable success. Moreover, it has stimulated a great deal of interest at Government level in development of the outer reef slope resources.

The fishing groups set up at Tanna at the time the Project was based there have since collapsed as a result of internal administrative and sociological problems. The four boats are still used for occasional fishing trips, but more frequently for ferrying passengers and copra.

The Vanuatu Government requested a second visit from the Project, and the team is currently operating in the central region of the archipelago. Catch rates in that area are equal to the best experienced by the Project during any of its previous operations in the SPC region.

4.6.4 Deep Bottom Fishing in Relation to Development Plans

In terms of the country's economy, Government planners believe there is a significant need to develop a large scale pelagic fishery around Vanuatu, but realize that this is unlikely to eventuate in the short term. The deep bottom fishery, on the other hand, could be developed more rapidly with the object of supplying the local market and reducing the country's dependence on imported canned fish (although this product will undoubtedly remain an important component of the villagers' diet).

Availability of fishing boats suited to local conditions is seen as the most important constraint to the development of the deep bottom fishery. Because of the general lack of protected lagoons and harbours in the region it is necessary to have boats that are light enough to be hauled out of the water onto a beach. This will probably restrict the initial choice of appropriate vessels to an outboard powered multi-hull craft, possibly along the lines of the Samoan "alia". The Project team has found elsewhere that the alias are seaworthy and comfortable fishing platforms, and if constructed in aluminium would be relatively maintenance free and light enough to be hauled out onto the beach when necessary.

Ten-day courses in outboard motor care and maintenance are being offered as a component of a rural development program administered by the Presbyterian Church in Vanuatu. It is expected that one such course will be held in each of the major islands every year. Government is in the process of setting up a small boatbuilding project at Santo, the staff of which will have received their training in Tonga. It seems likely that this project could play a role in fisheries development by producing appropriate fishing boats, wooden hand reels and associated equipment.

4.6.5 Comments

a) The Government realizes that before even small scale deep water fishing operations can become established effectively, there is a need for considerable effort on the part of the Fisheries Department to advise fishermen on the suitability of different types of fishing vessels, provide a source of supply of boats, fishing gear and materials at realistic prices, organize a system for providing development loan funds to prospective fishermen, and to install ice making plants at strategic sites.

b) The Government considers that it would be unwise for the DSFDP to attempt to introduce alternative deep fishing techniques before the hand-reel based operation has become established.

5. GENERAL ASSESSMENT OF THE PROJECT

At a time when escalating labour and fuel costs are having a noticeable effect on the economic viability of industrial and large scale fisheries throughout the world, it is not surprising that countries in the tropical Pacific should be looking to the development of fish resources which can be exploited using artisanal methods requiring low capital investment and operating costs.

Traditional fishing grounds around the reef and within the lagoon are, by and large, being exploited to the limit; if fisheries expansion is to occur, it must involve pelagic and demersal stocks in the deeper offshore regions.

The initiation of the South Pacific Commission's Deep Sea Fisheries Development Project was timely, and the table in Annex 1 provides abundant evidence of the extremely widespread interest in the Project shown by countries within the region. The successes of the Project are further indicated by the fact that several countries have already requested at least one return visit of the Project team.

There can be no doubt that in terms of its objectives (viz. to identify the existence of a deep bottom fish resource, to demonstrate appropriate fishing methods, to train local personnel, and to evaluate the commercial viability of deep bottom fishing under local conditions) the Project has been an immense success. There has been an understandable tendency for Project staff, in their reports to the various countries, simply to present the numerical results of their operations and devote a large part of the discussion to local operational and logistic problems. While such conservatism in reporting is commendable in the circumstances, by helping local Government personnel appreciate some of the problems and difficulties they may have to face in the process of developing the deep water fishery, it has tended to understate the very significant overall value and achievements of the Project.

In some countries the immediate impact of the Project may not have been as great as was perhaps expected. However it must be realized that by nature fishermen are often very conservative, and major changes to the structure or orientation of a fishery should not be expected to occur overnight. Governments are reasonably aware that for such changes to take place at all they themselves will have to provide continuous stimulation by way of promotional publicity, provision of the necessary supporting facilities and services, and considerable advice and encouragement to individual fishermen. The fact that even a few fishermen are already exploiting the deep water resource as a result of the Project's activities is a clear indication of the success of the exercise.

It is quite obvious that there are two major reasons for this success. Firstly, an urgent need existed for an evaluation of the fishery potential of deep bottom fish stocks using vessels and equipment which were either already available or could be made

available at relatively little expense to the local fishing community. Secondly (and very importantly) the objectives of the Project were simple, succinct, and clearly defined.

6. RECOMMENDATIONS

From the material presented in Section 4 of this report it should be apparent that countries in the SPC region are at different stages in the development of their deep demersal fish resources. The technical and financial ability of the various Governments to undertake independent research and development programs likewise varies tremendously. It is thus not surprising that many of the countries which the Project has visited have different priorities, depending on their particular circumstances. For example, while the Cook Islands and Vanuatu require more basic assessment and training work to be done, Tonga is involved with some interesting experiments using sail powered fishing vessels, and Fiji (where a deep bottom fishery is rapidly becoming established) sees the need for work on stock dynamics and estimation of optimum levels of fishing pressure. The great majority of Government representatives contacted evidently consider it essential that the SPC Project continues its valuable work in one form or another. It is therefore recommended:

6.1 That the scope of the Deep Sea Fisheries Project be broadened to include a "research" as well as a "development" component. These components might take the form of separate sub-projects with the following general objectives:

(i) Development Sub-project

To evaluate the commercial viability of deep bottom fishing under local conditions; to train local personnel; and to assess the effectiveness of alternative fishing methods which can realistically be used as an adjunct to the standard hand reel operation.

(ii) Research Sub-project

To investigate the population dynamics of the most important deep bottom species; to establish the optimum level of exploitation of typical deep demersal fish stocks; and to determine the extent to which population structure changes under conditions of sustained fishing pressure.

6.2 That the Research Sub-project should operate for an initial period of 15-18 months in at least 2 (preferably 3) physiographically different locations. At the end of this period the Sub-project should be subject to critical evaluation and review.

6.3 That countries which have already received visits from the DSFDP team, and which have the necessary technical and financial resources, should be encouraged to initiate their own deep bottom fishery development programs aimed at local resource assessment and training.

6.4 That as soon as possible after an official request for a visit by the Project has been made to SPC, Project staff should consult the appropriate Government representatives and draw up a detailed specific work plan. Such a work plan should contain a set of clearly defined objectives, a brief description of the expectations of the local Government and fishermen's representatives, a description of the type and condition of vessels, equipment and materials to be made available to the Project team, an appropriate time frame for the operation, and comments on any other factors which may influence the operational success of the Project.

Any major proposed departure from the work plan should be documented and endorsed by both the host Government and the Project Co-ordinator or his equivalent.

6.5 That following the completion of the Project's current tour in Tonga, a paper be produced for distribution to all countries in the SPC region on the cost-effectiveness of sailing craft and motor sailers as deep bottom fishing vessels.

6.6 That SPC consider the feasibility of producing a synthesis of the entire Project data base with analyses aimed at determining:

(i) which gross environmental factors are important in influencing the size and composition of the deep demersal fish community.

(ii) which depth ranges generally produce the best economic returns.

(iii) whether seasonal changes in abundance are likely to be an important factor in developing the deep water fishery. If this is not considered feasible (e.g. the existing data may be inadequate), it is suggested that these points might profitably be addressed by the Research Sub-project.

6.7 That SPC consider the feasibility of producing, in a single publication, a collection of reprinted and hitherto unpublished information describing artisanal fishing methods which have evolved in certain countries but which, for one reason or another, have not received wide publicity.

6.8 That the Project's field data (catch record) sheets be reviewed and re-organized in a computer-compatible format.

ANNEX 1

List of the countries within the SPC region which have requested visits by the Outer Reef Artisanal Fisheries Project (1974-77) and the Deep Sea Fisheries Development Project (1977 - present), showing the number of visits completed, currently operational (as at February 1981) and requested.

	ORAFP	DSFDP		
COUNTRY/TERRITORY		COMPLETED	CURRENT	REQUESTED
American Samoa		1		1*
Cook Islands	1			1
Fiji		1		1
Kiribati		1		
New Caledonia		1		1
Niue		2		
PNG (West New Britain)		1		1*
Solomon Islands	1			
Tokelau				1
Kingdom of Tonga		2	1	
Tuvalu	1		1	
Trust Territory:				
Kosrae		1		
Palau		1		
Truk		1		
Yap		1		
Vanuatu	1	1	1	
Wallis and Futuna		1		
Western Samoa	1			
TOTAL	5	15	3	6

* Requests informal at present

ANNEX 2

List of SPC publications relating to the Outer Reef and Deep Sea Fisheries Development Projects.

CROSSLAND, J. and R. GRANDPERRIN. 1980 The Development of Deep Bottom Fishing in the Tropical Pacific. SPC Occasional Paper 17.

EGINTON, R. and P. MEAD. 1978 Report on the South Pacific Commission Outer Reef Artisanal Fisheries Project in Funafuti (Tuvalu).

EGINTON, R. and R.H. JAMES. 1979 Report on the South Pacific Commission Outer Reef Artisanal Fisheries Project in Solomon Islands.

FUSIMALOHI, T. 1978 Report on the South Pacific Commission Deep Sea Fisheries Development Project in Niue.

FUSIMALOHI, T. 1979 Report on the South Pacific Commission Deep Sea Fisheries Development Project in Tanna, New Hebrides.

FUSIMALOHI, T. and J. CROSSLAND (in press) Report on the South Pacific Commission Deep Sea Fisheries Development Project in West New Britain, Papua New Guinea.

FUSIMALOHI, T. and R. GRANDPERRIN. 1980 Rapport sur le project de développement de la pêche profonde en Nouvelle Calédonie.

GULBRANDSEN, G. 1977 Outer Reef Fishery in Western Samoa. Working Paper 9, SPC 9th Reg. Tech. Meet. Fisheries, Noumea, New Caledonia, 24-28 Jan. 1977.

HUME, H. 1975 Report on the South Pacific Commission Outer Reef Fisheries Project in the New Hebrides.

HUME, H. 1976 Report on the South Pacific Commission Outer Reef Fisheries Project in the Cook Islands.

HUME, H. and R. EGINTON. 1976 Report on the South Pacific Commission Outer Reef Fisheries Project in Western Samoa.

MEAD, P. 1978 Report on the South Pacific Commission Deep Sea Fisheries Development Project in American Samoa.

MEAD, P. 1979a Report on the South Pacific Commission Deep Sea Fisheries Development Project in the Kingdom of Tonga.

MEAD, P. 1979b Common Bottom Fishes Caught by South Pacific Commission Fishing Projects. SPC Fish. Newsl. 18.

MEAD, P. 1980a Report on the Second Visit of the South Pacific Commission Deep Sea Fisheries Development Project to the Kingdom of Tonga.

MEAD, P. 1980b Report on the South Pacific Commission Deep Sea Fisheries Development Project in Fiji.

MEAD, P. 1980c Report on the Second Visit of the South Pacific Commission Deep Sea Fisheries Development Project to Niue.

MEAD, P. and J. CROSSLAND. 1979 Report on the South Pacific Commission Deep Sea Fisheries Development Project in Kosrae, Trust Territory of the Pacific Islands.

MEAD, P. and J. CROSSLAND. 1980 Report on the South Pacific Commission Deep Sea Fisheries Development Project in Yap, Trust Territory of the Pacific Islands.

TAUMAIA, P. and J. CROSSLAND. 1980a Report on the South Pacific Commission Deep Sea Fisheries Development Project in Palau, Trust Territory of the Pacific Islands.

TAUMAIA, P. and J. CROSSLAND. 1980b Report on the South Pacific Commission Deep Sea Fisheries Development Project in Truk, Trust Territory of the Pacific Islands.