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SOUTH PACIFIC COMMISSION

A rapid fisheries reconnaissance in the Tokelau Islands

August 18th - 25th, 1971

prepared by

V.T. Hinds, B.Sc.

Fisheries Officer - South Pacific Commission

2 November 1971

Noumea - New Caledonia

C O N T E N T S

SECTION		PAGE NO.
I	Introduction	1
II	Assignment	1
III	Background information	1
IV	Acknowledgements	2
V	Work programme	2
VI	Feasibility of transplanting pearl oysters and trochus shell to the Tokelau Islands	3
VII	Crown of thorns starfish (COTS)	5
VIII	Turtle rearing and turtle farming	5
IX	Improvement in local fishing techniques	6
X	Recommendations	7
APPENDICES:	I Fisheries development:North Island (Atafu)	
	II Fisheries development:Middle Island (Nukunonu)	
	III Fisheries development:South Island (Fakaofu)	
	IV Fisheries development:Main points raised at fishermens' meetings	

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SECTION I

INTRODUCTION

In response to an original request from the Administrator of the Tokelau Islands in May 1970, the Secretary-General of the South Pacific Commission agreed to a visit to the Tokelau Islands by the Commission's Fisheries Officer and Mr V.T. Hinds joined the Motor Trawler "PAKEINA", operated by the Tonga Shipping Agency, under charter to the Tokelau Administration, between August 18th and 25th, 1971, accompanied by Mr A. Banner, U.S. Peace Corps Fisheries Technician. The purpose of the charter was to transport New Zealand Education Officers with their families and stores to the three islands in the Tokelau Group. During the eight days of the charter it was only possible to spend one day each at ATAFU and NUKUNONU islands and one and a half days at FAKAOFU Island.

SECTION II

ASSIGNMENT

The objectives originally specified for this brief reconnaissance were briefly summarised as follows :

- (1) to assess the feasibility of introducing the Black Lip mother-of-pearl shell (Pinctada margaritifera)
- (2) check the extent to which the crown-of-thorns starfish (Acanthaster planci) has affected the reef and lagoon environment
- (3) to make recommendations on the possibility of establishing turtle rearing and turtle farming projects in suitable locations
- (4) to recommend improvements in local fishing techniques.

SECTION III

BACKGROUND INFORMATION

Detailed information may be found in the following reports which should be closely studied in relation to this short reconnaissance report:

- (1) A survey of fisheries in the Tokelau Islands - by H. van Pel, Fisheries Officer, South Pacific Commission, (1958), 15 pages, 3 maps and list of fishes. This report is the result of a five-day visit to Fakaofu and nine days spent at Atafu.
- (2) Reports of Niue and the Tokelau Islands, published by the Maori and Island Affairs Department for the year ended 31 March 1970..

SECTION IV

ACKNOWLEDGEMENTS

Messrs. Jim Sheedy, Atafu, Alan Barris, Nukununu and Derke Mackay, Fakaofu, New Zealand Education Officers, gave considerable assistance in arranging local introductions and providing boats, engines, guides and, last but not least, lunch ashore with their respective families. Dr Tony Hooper, anthropologist of the University of Auckland, added to these generously given services, by providing overnight accommodation at Fakaofu and assisting in arrangements for a well-attended fishermen's meeting. Mr I.E. Tinielu of Atafu, his uncle, Dr Ioina Tinielu of Fakaofu, and Hosea Kirifi, head-teacher of Fakaofu, all gave invaluable advice and assistance as chairmen of various fishermen's meetings.

SECTION V

WORK PROGRAMME

During the day ashore at each of the three islands the following programme was adopted.

- 08.00 - 12.00: Introduction to the Faipuli, the Pulenu'u and the Village Elders - arrangements for meeting of fishermen - obtaining services of local fishermen guides - preparation of boat, engine and diving equipment - shallow water diving to 4/5 fathoms in selected areas of the lagoon for mother-of-pearl and crown-of-thorns starfish - inspection of limited sections of reef on prevailing wind aspect for trochus - deep diving to 200 feet in lagoon using SCUBA gear.
- 14.00 - 17.50: Free diving in surge channels and inspection of seawards reef slope - inspection of boat channels where possible - preliminary explanatory meeting of Headmen and fisherman - boat, canoe and fishing gear inspection - main fishermen's meeting and discussion on points raised.

SECTION VIFEASIBILITY OF TRANSPLANTING PEARL OYSTERS AND TROCHUS SHELL TO THE TOKELAU ISLANDS

H. van Pel, SPC Fisheries Officer, writing in 1958, clearly indicated suitable sites for the introduction of MOP shell and trochus shell at Fakaofo and Atafu; he pointed out that these shells would have been a steady source of income to Tokelau Islanders after a period of several years for the manufacture of buttons, ornaments, fishing lures, nuclei for cultured pearls, tourist artifacts, etc. Had it been possible to finance and organise the transplantation of MOP shell and ensure careful management during the past fourteen years, it is probable that Tokelau Islanders would, with guidance and instruction, have developed local island crafts using the cultivated shell. Trochus shell, transplanted to Aitutaki in the Cook Islands during 1958 for example, settled very satisfactorily and now is commonly found in good quantity around the 21 mile perimeter of that lagoon.

The transfer of MOP shell, however, is not such a straight-forward affair; difficulties have been found in local transfer of shell between adjacent lagoons in the Tuamotu archipelago in French Polynesia over the years; shell that thrives in one lagoon will not necessarily survive in another - differences in salinity, temperature, depth, food supply and other factors may stunt development or even wipe out whole transplants of several thousand shells. Initially pilot transplant programmes are required under the careful supervision of an experienced marine biologist supported by local staff and logistical facilities. Live healthy shell must be collected by divers and concentrated in sufficient numbers for shipment to the Tokelau Islands from such areas as Tonga (MOP), Fiji (trochus), Cook Islands (MOP), New Caledonia (trochus), French Polynesia and perhaps Gilbert and Ellice Islands. A suitable vessel fitted with holding tanks and circulation pumps to ensure the survival of the shell would be required for charter, or, alternatively, a large flying boat since some 5,000 MOP shells would be required and 3,000 trochus shells.

Further diving surveys would be required in the three lagoons of the Tokelau Islands to clearly mark the sites selected and it would be desirable to introduce a spat collection system in the initial stages. Underwater pipe frame platforms where the live MOP shell would be suspended on ropes to provide optimum growth conditions and freedom from sedimentation and predators would also be required. Diving equipment air compressors and other machinery would be needed with supporting maintenance facilities; at least three large punts with outboard engines would be used as work boats. Bad weather at the Tokelau Islands could delay the putting ashore of live shell in open surf boats for transport to transplant areas. Accommodation for a marine biologist and inter-island transport at frequent intervals to ensure supervision of locally trained assistants in the early stages would be essential. The basic logistics of the project would require careful study

and timing. The funds required for the actual transplant exercise could vary from 6,000 to 10,000 dollars, and the cost of qualified supervisory staff, accommodation, equipment, field laboratory facilities, boats, etc. would add several thousand dollars more.

To establish pearl and half pearl culture requires the initial training of local staff at pearl farms for a minimum of one year, possibly at Samarai in Papua/New Guinea under Mr D. George, Pearl Culture Consultant. Such a project would only be desirable after the initial shell transplant had proved successful, with efficient spat collection and shell nurseries established to ensure regular cropping of suitable shell for cultured pearl and blister pearls. Provided conditions were suitable this operation would require 4 to 5 years before regular cropping was achieved.

The writer does not wish to give an unduly pessimistic impression of the logistic difficulties and financial implications involved against the basic needs of the Tokelau Islanders for such development, but at this time, and indeed until a more comprehensive study can be made of all the factors involved, it would, in his opinion, be unwise to initiate such a venture.

The Island fishermen themselves, however, repeatedly expressed their need for a supply of MOP shell for the manufacture of traditional fishing lures. Black Lip MOP shell was shown to the writer but this was of poor, thin quality and, according to local information, the shell is difficult to find, being very sparsely distributed. As a result of enquiries made in Western Australia and Tonga supplies of suitable shell of various species and qualities can be obtained in one hundredweight lots at prices varying from A\$ 50 to A\$ 200 and this does not count freight charges. In the writer's opinion one ton of suitable shell distributed through the three islands would provide each regular fisherman with sufficient material to meet his needs in the skipjack fishery for the next two years at an approximate cost of A\$ 2,000 (or A\$ 5 per man) and this money would be well spent in that it would directly increase the landings of skipjack from the many large schools seasonally reported by local fishermen.

Further reference to MOP cultivation and the production of half pearls may be found in:

- (1) "Etude sur l'Industrie nacrière en Polynésie française" Bulletin technique No. 1, published by the Service de la pêche, Papeete (January 1970)
- (2) "Pearl Cultivation in the South Seas" by Denis George. SPC Bulletin, Fourth Quarter 1968.
- (3) "Techniques of Pearl Cultivation" by Denis George. SPC Bulletin, Volume 19, No. 4, 1969.

[These documents are attached to the original report despatched to the Tokelau Administration Office, Apia]

SECTION VII

CROWN OF THORNS STARFISH (COTS)

In a total of 20 man/hours diving, including dives to a maximum of 200 feet using Self-Contained Underwater Breathing Apparatus (SCUBA), one COTS was observed in a coral patch on the southern side of Nukunonu Lagoon. No evidence of damage to corals was observed in the areas surveyed and this included the seawards slope of the encircling reefs. The survey was, however, extremely limited in the time available and cannot be said to be conclusive. Local information varied from reports of "several" COTS at scattered locations in Nukunono and Fakaofo, to "none at all" in Atafu. A reward of \$10 had been offered for specimens at Atafu, but one specimen only was found after diligent searching over some weeks. Coral growth would seem to be limited to the upper portions of old coral massifs rising from the floor of the lagoon, the main portions of which were barren and desolate, fish life being conspicuous by its almost complete absence within the lagoon area. In the short time available for survey it was not possible to give an accurate assessment of the extent to which COTS have infested the reef and lagoon environment, but it would appear that there are no abnormal features immediately obvious.

SECTION VIII

TURTLE REARING AND TURTLE FARMING

From information received it is clear that Tokelau Islanders eat turtle meat and turtle eggs and consequently it is only to be expected that turtles are a rare luxury item in those islands due to man's depredations and lack of any sense of conservation of the species. Turtle hatchlings are beset by enemies from the moment they emerge from the nest and are readily preyed upon by sea birds, crabs and fish. It is generally accepted that 98% of the hatchlings perish within the first few days, thus there is a pressing need to protect the young until they are better able to fend for themselves. Such a policy entails the protection of turtle nests, the collection and transfer of turtle eggs to enclosures preventing the ingress of predators and the feeding of the young turtles for at least three, better still six, months and the subsequent release of 10-20% of the animals to the wild state once more to ensure the continuation of the species.

Depending on whether Green Turtles or Hawksbill Turtles are the basis of the turtle-rearing programme, distinct feeding patterns emerge, since the Green Turtle is a flesh eater in the first year of its life and then changes to a diet of turtle grass, whereas on the other hand, Hawksbill Turtles require basically a flesh diet. Consequently, it is necessary to have a readily available source of food which can vary from chopped shellfish and fish to kitchen scraps. Balanced pelletised protein-rich food is used by commercial turtle rearing establishments, and thinly sliced fresh coconut meat is also acceptable. Reference may also be made to "Breeding Turtles for Profit" by Ronald Powell, SPC Bulletin July 1957 (copy attached to this original report), which describes floating boxes especially constructed to hold turtles being reared as a food supplement or for the production of preserved animals which can be polished and presented for the tourist trade.

To initiate a turtle hatchery and rearing scheme will require a trained supervisor and it is suggested that either a New Zealand Volunteer be posted to the Tokelau Islands for a year as a Fisheries Technician, and this be part of his duties, spending four months in each island, or that one man be sent from each island to the Aleipata Turtle Ranch on Upolu Island, Western Samoa, for training in the techniques used there, under experienced staff of the Division of Fisheries. Funds for a study visit of this nature may be forthcoming from the South Pacific Commission. Perhaps the VSA/NZ could spend the first year on general fisheries survey and the Turtle Management Trainees be sent to Western Samoa in the latter part of the year, when modifications to that programme are put into operation, following recommendations made by the Marine Turtle Consultant to the South Pacific Islands Fisheries Development Agency in July 1971.

Full-scale marine turtle farming parallel to the husbandry of cattle, pigs, reindeer, sheep and other domesticated animals is still to be achieved. Male and female turtles have yet to breed in captivity and use artificially made nesting beaches and thus remove the life cycle from the wild state. This form of turtle management is for the present beyond the scope of feasible projects for fisheries development in the Tokelau Islands.

SECTION IX

IMPROVEMENT IN LOCAL FISHING TECHNIQUES

The lagoon fisheries of the Tokelau Islands would appear to be limited since the lagoons are enclosed and, compared with those in other island groups which have channels connecting them with the ocean permitting a regular exchange of nutrient-enriched water, the fish population is much lower. Outside, on the seaward slopes of the encircling reef, the Tokelauan fishermen are skilled in the technique of deep handlining for the large castor oil fish (Ruvettus preciosus), drift handlining for yellowfin tuna (Neothumus macropterus), trolling fresh baits for Spanish mackerel (Scomberomerus commersoni), pole-and-line fishing for the oceanic bonito (Katsuwonus pelamis), and lamp fishing with long-handled scoop nets for flying fish (Exocoetidae). Seasonally, the fishermen tap large shoals of breeding parrot fishes (Scaridae) as they move along the reef edge, and even children are able to catch the scad mackerel (Selar cruentum opthalmus and Decapterus sanctae - Helenae). The Islanders are not fish-hungry; according to recent information there are no dietary deficiencies due to shortage of fish protein; the fishing effort is apparently geared to meet minimum requirements at least and, compared to several other island groups, the importation of foreign canned fish products is relatively small.

A large expansion of the local fishing effort is not feasible due to several factors which include the lack of suitable landing sites, anchorages and safe harbours and the consequent lack of facilities for larger craft to work the ocean resources. Regular and sufficient supplies

of fresh bait for tuna longline operations are just not available, nor are there any facilities for the storage and reshipment of tuna landings which would exceed local demand. It would be difficult to find a crew capable of operating a long-line vessel even if there was a safe place to keep her in bad weather.

Any improvement in local fishing techniques will be on a small scale and should be designed to upgrade the methods already established and skilfully used, by making readily available increased supplies of improved items of fishing equipment, outboard engines, and investigating the possibility of designing an improved fishing craft. The supply of fishing gear on a revolving loan credit basis through the village cooperative stores would do much to assist the fishermen. If easy credit can be obtained from Technical Aid Services for outboard engines and spare parts, plus basic training in the maintenance of these power units, then the island fishermen will have much greater opportunity to tap the fast-moving wild bonito schools which are seasonally within easy reach of their home villages.

Lists of fishing gear drawn from notes made during discussions with groups of fishermen are appended and direct application is being made by the SPC Fisheries Officer to the Foundation for the Peoples of the South Pacific for a grant of \$3,000 to provide first quality mother-of-pearl shell for the manufacture of tuna fishing lures, and also some of the other fishing gear needed. These applications take time to be processed however; usually up to twelve months will elapse before the funds are made available.

SECTION X RECOMMENDATIONS

- 1) Arrange purchase of mother-of-pearl shell from Western Australia for early shipment via Apia to Tokelau Island fishermen to enable them to make up fishing lures required. (See Appendix attached.)
- 2) Prepare application to the Foundation for the Peoples of the South Pacific Inc. for assistance in establishing a loan fund for the purchase of other items of fishing gear.
- 3) Request the South Pacific Commission for funds to assist in the training of
 - a) outboard engine maintenance mechanics, and
 - b) small boat building and maintenance workers.
- 4) Request the South Pacific Commission for assistance in funding a study visit for Tokelau Islanders to the Turtle Ranching Project at Aleipata, Western Samoa.

- 5) Investigate the possibility of obtaining the services of a New Zealand VSA Fisheries Engineer to spend a tour of four months in each island in order to assist schemes concerned with turtle rearing and boat construction and also in connection with outboard engine maintenance, purchase and management of fishing gear and collection of further information on lagoon shellfish and seasonal variations in the movement of local fish stocks, including pelagic fishes.

Noumea
2 November 1971



V.T. Hinds
Fisheries Officer,
South Pacific Commission

F I S H E R I E S D E V E L O P M E N T

NORTH ISLAND (ATAFU): Fishing gear requirements (60 men)

1. 5 outboard engines in the 10 - 15 h.p. range + 25% value in spare parts.
2. 1 outboard engine trainee mechanic for course in Apia or Suva.
3. Mother-of-pearl shell required for bonito lures.
4. Trochus shell transplant?
5. Rolls of chicken wire to make live fish holding corrals.
6. Fish hooks for the incurved point type (Uluha) Hawaiian.
7. 2½ to 3 inch Japanese swivels fitted with snap clips.
8. Stainless steel trace wire of various breaking strains between 50 lbs BS and 300 lbs BS
9. Sheet lead for the manufacture of fishing weights.
10. Perlon monofilament nylon line in various strengths but mainly from 200 lbs BS to 300 lbs BS
11. Plates of Hawksbill turtle shell for the manufacture of bonito hooks.
12. Fluorescent wool in red, yellow, green and pure white and assorted trolling lures.
13. Diving masks and snorkels.

Fishing gear requirements may be supplied directly in a crate addressed to the local village co-operative store and the items will be sold as required to the local fishermen through the co-operative store on a minimum profit basis and further orders made to keep up the supply as needed. Initially, funds to start this operation might become available from the **Foundation for the Peoples of the South Pacific Inc.**, New Zealand Development Fund, Freedom from Hunger Campaign, etc. This could be managed from the Village Community Development Office of the Tokelau Administration Office in Apia and regular accounts provided twice a year to the Funding Agency. Combining requirements from the three islands could lead to bulk purchase and direct importation from Japanese suppliers. This would be of enormous value to the Tokelau Islands fishermen who depend so much on importing small items of gear even from friends and relations in New Zealand; fish hooks are even used as a means of barter in the islands.

North Island has approximately 60 fishermen and their individual annual requirements would be about -

- 100 hooks of various sizes
- 20-30 lead weights
- 2 dozen swivels including snap clips
- 200 yards of monofilament nylon (either in blue or clear materiel) in each of the following range: 150 lbs BS, 200 lbs BS, 280 lbs BS, 300 lbs BS and also 30 lbs BS
- 6 rolls of chicken wire, No. 19 gauge, 1 inch mesh, plus a drum of tar and half a cwt of pitch for preserving the galvanized wire when used in a fish corral. Heavy plastic netting would obviate the use of chicken wire.

At a fishermen's meeting, chaired by Mr I.E. Tinielu, some 40 fishermen complained about foreign fishing boats running down tuna stocks in their area and claimed that they definitely did not get the same catches of tuna nowadays as they did 4 or 5 years ago. They wished for further protection by extension of fishing limits round the Tokelau Islands.

They considered long-lining for tuna but, in view of the poor shelter for boats and lack of anchorages outside the lagoon for larger craft, non-availability of long-line bait, lack of knowledge of operation of this type of boat and insufficient capital to invest in this kind of fishing anyway, they eventually dropped the idea.

Mother-of-pearl shell was reported to be present in the lagoon, two having been found in the last couple of years. The shell is desperately required for the manufacture of bonito lures since large schools of bonito are seen close to the island in season.

Conditions would appear to be suitable for the transplantation of the trochus shell, particularly on the southern aspect of the surrounding reef which is well aerated and would appear to provide a suitable environment similar to that found in Aitutaki in the Cook Islands

To transplant a mother-of-pearl shell would mean collecting the shell from Tonga, Cook Islands or Tuamotas and chartering a vessel especially equipped with circulation and holding tanks to carry the live shell, some 10,000 in number, back to each of the three islands of the group. Logistically and financially this would not, in the writer's opinion, be feasible and, from diving surveys and transects in the lagoon, mother-of-pearl shell does not appear to thrive in any part of any of these lagoons. Such a project would be purely on an experimental basis and

would require the support services of a marine biologist specialized in the establishment of mother-of-pearl culture shell farms. Such a project may take anything up to 5 years to come to fruition providing conditions are suitable; since the shell is required mainly for bonito lures, it would be cheaper to find other sources of supply from Western Australia. This can be easily arranged and addresses are now available of suppliers with whom the Fisheries Officer is in contact.

During the months of September, October and November, for about one week during the last moon quarter in each month, the local fishermen report a massive breeding migration of parrot fish (Ufu) from the lagoon across the reef into the open ocean, at which time thickly concentrated schools of docile fish are easily surrounded by shallow seine nets. It was estimated that some 20,000 fish per day could be captured in this manner. The main problem was keeping the fish since there is a limit to the amount of salting and sun-drying which could be carried out. There is no refrigeration and transportation from the Tokelau Islands to any other market, i.e. Apia, is so irregular as to be useless. If it were possible to establish fish corrals using chicken wire fencing, large numbers of these fish could be kept alive in these holding pens until required for local consumption.

Shallow diving in certain selected areas on the south side of the lagoon revealed a light capping of reddish coral close to the surface on massive desolate grey coral heads containing little or no fish life. Tridacna clams, horse-shoe clams and thorny oysters were frequently observed in depths of 4 fathoms, usually in clear conditions on the north-east facing slopes within the lagoon. No sharks were observed. One crown-of-thorns starfish was observed. Local reports indicate that crown-of-thorns starfish are present, but a recent reward of \$10 offered for any crown-of-thorns starfish only realised one specimen after several weeks search. Inspection of the coral flats and channels on the south and south-east of the lagoon and also the seawards face of the ocean reef failed to reveal any trochus shell. Good fish life, mostly surgeon fish, parrot fish, humphead wrasse, milk fish, mullet, jack mackerel, rock cod and snapper were seen on the seaward slope of the surrounding reef down to the 60-70 feet level, but were mostly concentrated where the heavy surf broke on to the reef in the highly aerated area.

The main contact with the fishermen of Atafu has been suggested as the President of the Aumaga, currently Mr I.E. Tinielu of Atafu.

F I S H E R I E S D E V E L O P M E N T

MIDDLE ISLAND (NUKUNONU): Fishing gear requirements (40 men)

1. Nylon multi-filament nets in mesh sizes from $\frac{1}{2}$ " to 3" stretched mesh No. 6 twine, in lengths of 80 fathoms and 2 fathoms deep. Sheet netting only is required as floats and foot-rope weights can be locally produced. These nets should be of green coloured nylon. Since they are to be used mainly as sweep nets or seine nets they should be of strong, hard laid twine. They are intended for fishing scad mackerel and mullet.
 2. Mono filament nylon line in various breaking strains from 30 to 300 lbs.
 3. A selection of fish hooks.
 4. Mother-of-pearl shell for the manufacture of skipjack lures.
 5. An assortment of trolling lures including spoons, feather jigs, whale bone jigs, plastic jigs and small plastic squid.
 6. Sheet lead for the manufacture of sinkers.
 7. Steel trace wire
 8. Rolls of chicken wire netting, 1" mesh No. 19 gauge, three feet wide in rolls up to 50 yards long.
 9. Strong short-bladed knives for detaching shellfish underwater.
-

APPENDIX III

F I S H E R I E S D E V E L O P M E N T

SOUTH ISLAND (FAKAOFU): Fishing gear requirements (90 men)

1. Fish hooks - both straight shank and curved Hawaiian type tuna hooks in a variety of sizes
 2. Nylon monofilament in breaking strains from 200 through 250 to 300 lbs
 3. Stainless steel wire, breaking strains from 50 to 300 lbs
 4. Sheet lead for sinkers
 5. Mother-of-pearl shell for skipjack lures
 6. Hawksbill turtle shell for skipjack hooks
 7. Fishing nets
 - a) knotless nylon netting, $\frac{1}{4}$ " stretched mesh, 20 fathoms long, 3 fathoms deep
 - b) braided nylon netting multifilament twine, 1" mesh by 80 fathoms long, and 2 fathoms deep
 - c) braided multi-filament nylon net, $1\frac{1}{2}$ " stretched mesh by 80 fathoms long and 2 fathoms deep

Only the sheet netting is required; floats and weights could be locally manufactured. These nets should be of green coloured nylon. Since they are to be used mainly as sweep nets or seine nets they should be of strong, hard laid twine. They are intended for fishing scad mackerel and mullet.
 8. Brass fishing swivels, medium and large sizes
 9. Bamboo fishing poles for skipjack tuna fishery, 14-16 feet long.
 10. An aluminium fishing skiff 16' long, complete with 10 h.p. outboard engine
 11. Chicken wire netting or heavy plastic, 1" mesh No. 19 gauge, three feet wide in rolls of 50 yards
 12. Training in the maintenance of outboard engines
 13. Training in the construction of boats
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APPENDIX IV

F I S H E R I E S D E V E L O P M E N T

MAIN POINTS RAISED AT FISHERMENS' MEETINGS

1. They suspect Japanese fishing boats affect fishing in their waters, especially tuna and bonito stock. They noticed the difference since the arrival of the Japanese fishing boats. Can anything be done or said about it.
 2. They would like information about the possibility of pearl shell farming in their lagoons.
 3. They are also interested in turtle farming and would like to learn more about it.
 4. They want people trained in boat building. Could the SPC help? They would like the SPC to train two men from the islands to maintain outboard engines. Could the SPC send trainees from the islands to Tahiti to see the method used there of catching bonito with mother-of-pearl shell lure?
-