

17 FEVR. 1976

SOUTH PACIFIC COMMISSION

EIGHTH REGIONAL TECHNICAL MEETING ON FISHERIES

(Including the Report of the Expert Committee on Tropical Skipjack)

Noumea, New Caledonia

20 - 24 October 1975

(16 - 17 October 1975)

REPORT

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I. INTRODUCTION

1. Following recommendations of the Sixth Regional Technical Meeting on Fisheries held in Suva, Fiji, in July 1973 that Fisheries Technical Meetings be held annually and that an Expert Committee on Tropical Skipjack be formed, also to meet annually, the Expert Committee met in February 1974 in Tahiti and the Seventh Regional Technical Meeting on Fisheries was held in July in Nuku'alofa, Tonga. The concept of these two annual Fisheries meetings was again supported and funds were allocated by the Fourteenth South Pacific Conference held in Rarotonga, Cook Islands, in September 1974.
2. At the Seventh Regional Technical Meeting on Fisheries in Tonga, the Cook Islands delegate extended a formal invitation from his Government to hold the Eighth Technical Meeting in Rarotonga, Cook Islands, and this invitation was gladly accepted by the Meeting. However, due to budgetary constraints which developed in 1975 it was not possible for the Commission to finance the Meeting in the Cook Islands and it was held at the Commission's Headquarters in Noumea, New Caledonia.
3. For a number of reasons the Meeting was held in October instead of its usual place in the SPC calendar of meetings in July. In order to reduce costs the Expert Committee on Tropical Skipjack was held immediately prior to the Fisheries Technical Meeting, thus avoiding duplication of travelling costs for those participants who attend both meetings.
4. For the same reason, and in order to be able to take advantage of the presence of various fisheries personnel present in Noumea, the International Centre for Living Aquatic Resource Management (ICLARM) sponsored a Small Boat Workshop to follow the Technical Meeting.
5. Delegates were officially welcomed by the Secretary-General of the South Pacific Commission, Mr G. F. D. Betham.
6. Mr Robert Stone, Principal Fisheries Officer in the Ministry of Agriculture, Forests and Fisheries, Fiji, was unanimously elected Chairman of the Meeting and Mr Tom Marsters, Director of Fisheries and Marine Development, Cook Islands, was elected Vice-Chairman.
7. The provisional agenda was approved and adopted.

II. AGENDA

1. Appointment of Chairman and other Office Bearers
2. Approval of Agenda
3. Country Statements: Recent Developments and Future Plans
4. Recommendations of Expert Committee on Tropical Skipjack with special reference to Survey and Stock Assessment Project
5. Progress Reports on SPC Special Projects
 - (a) Outer Reef
 - (b) Turtles
 - (c) Lobsters
6. Report by UNDP Regional Fisheries Co-ordinator
7. Report by Director ICLARM
8. Development of Aquaculture, with particular reference to hatcheries, to natural seed supply and economic assessments in SPC area:
 - (a) Fish
 - (b) Crustacea
 - (c) Molluscs
9. Fisherman Training
10. Effectiveness of Acoustic Lures
11. Future Projects
12. Other Business
13. Conclusions and Recommendations

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IV. SUMMARY OF DISCUSSIONS

COUNTRY STATEMENTS: RECENT DEVELOPMENTS AND FUTURE PLANS

AMERICAN SAMOA

8. The Office of Marine Resources sustained its efforts to define, develop and manage the aquatic resource potential of American Samoa. Although budget constraints resulted in staff reduction, alternative measures were implemented to achieve major programme goals.
9. A major deficiency in the local small craft commercial fleet was corrected by the re-engining of eighteen boats, substituting diesel engines in place of troublesome high-speed gasoline units. These alterations resulted in lengthy tie-ups for a number of boats, but by the end of the fiscal year, effort and catch per trip increased substantially.
10. Total landing exceeded 200,000 pounds with an average catch of 181 lbs/trip.
11. The final segment of an extensive three-year skipjack tuna survey was completed in February 1975. The 50 ft. survey vessel "Alofaga" undertook 110 day-trips, with pole-and-line catch (using minimal amounts of bait) averaging 1577 lbs. per trip.
12. The baitfish culture programme progressed rapidly in 1975 with production exceeding 10,000 fry per day.
13. Definitive fishing trials and small-scale commercial production will become feasible in early 1976.
14. Other activities include the collection of longline fleet catch and effort data, surveys of sportfishing potential, cataloguing of the reef fish fauna, and construction of docking facilities.

COOK ISLANDS

15. In the middle of 1974 the new Department of Marine Resources was set up. It has a staff of six consisting of Director, Principal Fisheries Officer, Skipper, Engineer, Mechanic and Clerk. The staff is assisted by four boat crew, four casual workers and two watchmen. The Department's budget for the current fiscal year is \$NZ59,760. Outside assistance is provided by an FAO/UNDP Fisheries Adviser and an SPC Project Officer working on turtles.
16. It is proposed that the Government fishing vessel "Ravakai" will work in conjunction with four 28 ft. fishing boats which had been purchased by the Government in 1972, to develop the FAO/UNDP fisheries programme.
17. Trochus niloticus was introduced into Aitutaki in 1956. A "Trochus Shell Act", providing for controlled fishing of trochus was passed in 1975 and the first harvesting will take place early in 1976. It is estimated that there are now approximately 12 tons of marketable (over 2-1/2 inches) shells from the 120 individuals originally planted.

18. Mother of Pearl Shell (*Pinctada margaritifera*) was fished in the Manihiki lagoon in 1974 for the first time since 1969, producing a crop of more than 100 tons in the 3-month season.

19. One 28 ft. boat makes 7 to 8-day commercial fishing trips to the islands of the Southern group near Rarotonga and Palmerston Islands has a "small unit" programme with a 2-1/2-ton freezer provided by the Department. Fish is picked up by the G. F. V. "Ravakai" together with fresh fish caught during the boat's visit.

Experimental Fishery Projects

(a) SPC Turtle Farming Project

20. A detailed report has been submitted by the Project Officer, Mr Brandon and the project will set up a new base in Aitutaki in the near future.

(b) SPC Outer Reef Fisheries Project

21. This project moves to the Cook Islands early November 1975. The island of Aitutaki lying about 140 miles north of Rarotonga has been selected as the project site and as this report was being prepared, the necessary preparatory contribution by the Cook Islands Government had already started.

Conclusion

22. The past six months have been a rather active period for the department. This has mainly come about following the arrival of Mr Cyril N. Edwards - FAO/UNDP Fisheries Adviser. Although actual fishing has not as yet started, the feeling within the department is one of confidence in the Adviser's plans and with such a confidence instilled from the start the harmonious operation of the programme appears more or less guaranteed.

FJI

23. During the last five years some essential infrastructure in the form of freezers, and ice-making facilities were constructed at Lami, Lautoka and Labasa. The National Marketing Authority assumed responsibility for the marketing of fish in 1974 while the Fisheries Division continued to maintain and staff the refrigeration facilities, fish carrier service and extension work in villages. Efforts to assist fishermen were further strengthened during 1974 with the availability of subsidised loans through the Fiji Development Bank.

24. The UNDP/FAO Skipjack Tuna and Live-Bait Fishery Survey, which began in 1971, completed its work in late 1973. It demonstrated that appreciable quantities of bait fishes and skipjack tuna were available to supply a sizeable tuna fishery. Government in late 1974 eventually decided that local people will exploit the skipjack tuna resources primarily for the local fresh fish market and use surpluses for canning. An agreement was signed between Government and the Pacific Fishing Company (PAFCO) in 1974, whereby the latter was to construct a cannery capable of processing 15,000 tons of tuna by 1980 (including 5,000 tons of skipjack).

25. Training of fisheries technicians in a three-year Diploma in Tropical Fisheries began in 1972. The first graduates of the diploma courses will graduate this year. The need for the training of fishermen also increased, especially with the Government's decision to exploit the prospects of skipjack.

26. Fish farming in reclaimed mangrove areas was undertaken, with the expansion to 20 acres of inter-tidal ponds at Raviravi in 1973. Oyster culture, shown to be not feasible at Bilo Bay, was moved to Laucala Bay where growth and fattening indicated good commercial potential, first on a pilot commercial scale in 1974 and then on a much larger scale in 1975. Consumer acceptance was also good.

27. Working papers were presented on the aquaculture programme.

FRENCH POLYNESIA

28. Late 1974 and 1975, the period during which CNEXO finally commenced operations at Tahiti, was of the greatest significance for fisheries in French Polynesia.

29. Continued efforts are being made in four main fields:

- (1) Skipjack project: A 71 ft. live-bait craft has been jointly acquired by the Territory and CNEXO. In 1976, it will be used firstly for assessment of live bait resources, and then for crew training. In addition, it will take part in the IATTC tagging project in the Marquesas Islands.
- (2) Multi-purpose small fishing: With the take-over by private interests of the construction of cold-storage facilities in the Tuamotu Islands, it has become possible to project the commissioning of a fleet of 10.5 m multi-purpose boats, based on the cold-storage centres, which will fish the outer slopes of atoll reefs.
- (3) Mother-of-pearl: This traditional industry is being reconverted into pearl-oyster farming. However, there yet exist difficulties in collecting spat in order to renew overfished stocks of Pinctada margaritifera.
- (4) Aquaculture: Substantial progress has been made here. Economic feasibility studies are being carried out on the Macrobrachium rosenbergii freshwater shrimp in a pilot plant of commercial proportions.

30. Good results have been achieved in the breeding of live bait fish (Mollies). Production will be substantially raised to match needs as defined by fishing experiments.

31. Oyster farming has expanded and should cover local needs as of 1976.

32. The results of fish farming trials involving species (jacks, milk-fish, rabbit fish, etc.) are highly encouraging. Large-scale operations will be carried out commencing next year.

33. The breeding of sea shrimps (P. artecum, P. japonicus and P. merguensis) is now running smoothly.

34. Shrimp farming is undertaken both at Tahiti (Pacific Oceanological Centre) and at AQUACAL (Baie de St. Vincent, New Caledonia).

Conclusion

35. Two essential problems remain:

- the technique of gathering spat of mother-of-pearl;
- food supply for aquaculture, derived from low-price local products.

GILBERT ISLANDS

36. The main emphasis in fisheries during the coming three years will be directed towards the culture of milkfish (Chanos chanos) for use as a skipjack bait fish. Investigation will also be undertaken into the availability and identification of natural bait in the lagoons and reefs of the islands.

37. It is hoped that funds for a new research vessel will be obtained during the coming year. The vessel will be primarily used to survey the skipjack stocks.

38. Experiments with "Bêche-de-mer" on the outer islands of the Colony have met with encouraging success.

39. At Christmas Island in the Line Group, the pilot project for Brine Shrimps (Artemia) harvesting that commenced in 1973 has now entered the first phase of commercial production.

40. The four-boat dory project has now been abandoned due to the unsuitability of the vessel design and the unacceptable costs of operating and maintaining the vessels.

NEW CALEDONIA

41. The focal points of the fisheries programme of the territory of New Caledonia are small-scale (lagoon) fishing, industrial tuna fishing, aquaculture and oyster farming.

42. The lagoon is fished by 150 professionals, but also by 5,000 owners of pleasure craft, either as a leisure activity or as a means of supplementing their income. This is at variance with the principle of rational use of the resources of the lagoon, and the authorities concerned have therefore decided to concentrate on the creation of producer groups and co-operatives, the improvement of distribution circuits, increased monitoring of resources, and, with the help of ORSTOM, the study of the biology of certain species. Industrial tuna fishing has, for several years, been at project stage. These are well under way; reclaimed land in the Port of Noumea has been prepared for the construction of a tuna base. However, the international crisis on the tuna market has for the moment led the American, Japanese and French companies intending to invest in New Caledonia to proceed slowly.

43. Aquaculture is represented by "AQUACAL"; this association has been studying larval breeding and the growing of Penaeid shrimps. Reproduction of Penaeus merguensis and Metapenaeus ensis has been achieved. AQUACAL now intends to commence a larger-scale growing programme, and to make technical feasibility studies with particular reference to feeding.

44. Oyster farming is continuing to develop, since Crassostrea gigas has been shown to flourish in the excellent conditions existing in New Caledonia. The main objective here will be to obtain spat settlement.

NEW HEBRIDES

45. Since the 1974 Fisheries Conference in Tonga, the New Hebrides have made a sustained effort in two fields; oyster farming and small-scale inshore fishing.

46. Oyster farming activities were moved to a new site, and have finally reached commercial level. After a trial period of one and a half years, the Lamap centre was closed, since the development of Crassostrea gigas proved to be unsatisfactory. On Santo (Northern District), however, a private oyster farm had better results. An initial lack of finance was remedied when the Union of French Co-operative (Syndicat des coopératives françaises) formed a joint public/private company with the resultant injection of capital. Monthly production was stepped up from a few hundred to several thousand dozen. From December onwards, average production will be 4,000 dozen/month, marketed in Luganville and Vila. Two problems remain: irregular supplies of spat and the control of the predator Pseudo-Stylochus.

47. Over the latter half of 1974, and up till March 1975, the SPC Outer Reef Fisheries Team worked at Lamap on Malekula Island. In May, the French Residency enlisted a Polynesian fisherman who, despite the as yet inadequate means at his disposal, immediately began teaching the islanders the arts and skills of fishing. Appropriate fishing-gear (lines, nets, lures, etc.) is being obtained in small quantities; by next month a 28-foot dory-type fishing craft will be ready, thus enabling the fishing centre to work as planned towards its objective of training young fishermen, who will subsequently be able to return to their villages and set up small fishing companies.

PAPUA NEW GUINEA

48. The rapid expansion in total fisheries production continued through 1974, with a record skipjack (Katsuwonus pelamis) catch of 40,200 tonnes. 1975, however, has seen a significant decline in production with a poor skipjack season compounded by the depressed state of the world tuna market. The skipjack catch to August of approximately 11,500 tonnes represents a 60% reduction on the catch for the same period last year. Negotiations for the establishment of a cannery in Papua New Guinea are continuing, while the projected expansion of the Kavieng based alibushi plant should increase the annual throughput tenfold to 9,000 tonnes of skipjack by the end of 1976.

49. Prawn catches from the Gulf of Papua trawl fishery have stabilised at the 700-tonne level. This fishery again trawled significant quantities (113 tonnes) of the ornate crayfish (Panulirus ornatus) and a research programme is under way to gauge the effect of these trawl catches on traditional fisheries and to determine the origin, magnitude and migration patterns of crayfish stocks in Papua New Guinea. Catches from the barramundi (Lates calcarifer) fishery remained relatively constant and will remain so until improved fishing and handling methods are adopted by the industry.

50. Tilapia (Tilapia mossambica) has become a major source of fish protein for the local inhabitants of the Port Moresby area and constitutes a major, yet untapped resource in the Sepik-Ranu River Basin complex with sustainable yield estimates ranging from 20,000 to 30,000 tonnes. Investigation coupled with consumer acceptability surveys are being undertaken to determine the feasibility of producing non-freezer storable fish products including canned tilapia and smoked and/or salted mixed reef and fresh water fish.

51. A pilot project to test the feasibility of establishing in remote coastal areas, a local fishery based on small mobile village freezers and transportation barge is to be commenced in 1976. Ways and means of increasing local participation in the production of half pearls and pearl shell in suitable areas are also being researched.

SOLOMON ISLANDS

52. Commercial activity of Solomon Taiyo Ltd. increased in 1974 with the final commissioning of the fish cannery and the opening of the arabushi smoking plant. Fleet catch was nearly 11,000 tonnes from a maximum of 11 vessels. 25% of the catch was canned and a smaller quantity smoked. Early in 1975 a start was made on construction of a second shore base in the Western Solomons which will have a freezing centre and also a processing plant. Completion is due in December 1975 and when the shore capacity is thus increased further expansion of the fleet can take place. A third base is due to open in the Shortland Islands in 1977. Targets as set down in the Joint Venture Agreement have been met to date.

53. Production of Traditional Sea products declined in 1974, this in some part due to the high price of copra on the international market and the corresponding increase of local effort put into copra production.

54. In late 1974 the Fisheries Department was re-constituted within the Ministry of Trade, Industry and Labour and has since been moved to the Ministry of Natural Resources. These changes within the new ministerial system have benefited Fisheries development.

55. The National Development Program (1976-1980) has a high Fisheries content and projects so far identified include:

- (a) Bait fishing localisation and research into population dynamics;
- (b) turtle conservation, stock assessment and trial growing experiments;
- (c) fish smoking trials;

- (d) fish preservation (largely through ice) projects;
 - (e) fish ensilage project for production of animal feed.
56. Ongoing projects having a commercial backing are:
- (a) Purse-seining
 - (b) long-lining
 - (c) gem-coral fishing
 - (d) prawn trawling
 - (e) marine shell investigation.
57. The department is also involved in routine work in the fields of statistics and resource management, conservation and pollution control, and training.

KINGDOM OF TONGA

Landings

58. An estimated 726 tonnes of fish was landed by local fishermen, and by the Government's fishing vessel, "Ekiaki", which contributed 66 tonnes of this total. A further 700 - 1,000 tonnes of fish will be required to meet local consumption demands for fresh fish.

Fishermen's Loans Scheme

59. This credit facility for fishermen was established in January 1975 with an initial input of \$5,000.00. Thirty-six applications for small outboard engines and fishing nets have been approved involving an expenditure of \$4,592.00. The scheme is administered by the Fisheries Division, and provides loans at a low interest rate of 3%. All equipment purchased through the scheme, is exempt from import tax, providing very advantageous terms for fishermen.

UNDP Marine Resources Survey

60. This resource survey got under way in June of this year, with the arrival of the 40-ft. dual purpose vessel "Tropac" and support workshop barge. Both facilities are chartered from the Tropical Pacific Fisheries Research Corporation, registered at Pago Pago, American Samoa. The survey will serve to evaluate the demersal and pelagic resources, at present within the catching capability of the local fishermen. Particular emphasis will be placed on the seasonal skipjack (Katsuwonus pelamis) and on studies into the availability of suitable live bait.

Bivalve cultivation

61. The experimental oyster project started in February 1973, with the assistance of the UNDP oyster culturist in Fiji, was continued throughout the year. Poor growth rates were recorded in the Fanga'uta Lagoon area, due to heavy siltation. The rafts were removed to the Pangoaimotu Island area, off Tongatapu, and to the Vava'u group,

150 miles North of Tongatapu. The oysters showed a monthly growth increment varying from a low of 0.77 mm to a high of 6.6 mm. The project was severely curtailed by the difficulty in obtaining suitable seed. Two consignments from U.S. and Japan respectively, were lost en route, due to delays resulting from missing airline schedules to Tonga. The inability to obtain suitable mussel seed curtailed plans to assess the suitability of this mollusc to conditions in Tongan waters. The New Zealand Government's complete ban on the exportation of the green-lipped mussel Perna canaliculus has also been discouraging to Tongan efforts to promote the raft suspension culture of this species.

TRUST TERRITORY OF THE PACIFIC ISLANDS

62. The Marine Resources Division, Department of Resources and Development, located in Saipan, Mariana Islands, is the Headquarters for the fisheries programmes in the Trust Territory of the Pacific Islands. There are District offices in Palau, Yap, Truk, Ponape and one will be established in the Marshalls in the near future. In addition, the Marine Laboratory (Micronesian Mariculture Demonstration Center) in Palau is primarily concerned with the mariculture research for the entire territory.

63. The major developmental programmes for the marine resources are:

- (a) The development of commercial offshore fisheries for skipjack tuna (Katsuwonus pelamis);
- (b) development of inshore resources to meet and satisfy local demands for fish protein;
- (c) the mariculture programmes to develop and promote cultures of high commercial valued species for export and hopefully will culture species that will supplement the heavily exploited species.

64. With the procurement of seven new 25 gross tons fibreglass re-inforced plastic skipjack vessels for Japanese style live bait pole-and-line fishing and with the Van Camp Sea Food Co. operation in Palau, the skipjack tuna fisheries will play a major role in the territory's economy. In addition, construction of reefer plants in the Marshalls and Yap, and more complex fisheries compounds being presently planned for Truk and Ponape will certainly help expand the entire fisheries programmes.

65. The inshore reef fisheries have been progressing relatively well, but inadequate storage facilities in the districts and poor preserving methods have hampered a more successful development of the inshore fisheries.

66. The Marine Laboratory (Micronesian Mariculture Demonstration Center) is concentrating its efforts on culture of Siganus canaliculatus, Chanos chanos, Macrobrachium rosenbergii, Penaeus monodon, Crassostrea sp. and has established other pilot projects. Ponds have been constructed in Palau, Yap and additional ponds are presently being constructed in Ponape and Kusaie.

WESTERN SAMOA

67. In the Government's Five Year Development Plan 1975 - 1979, three projects in the field of fisheries have been included:

Village Fisheries Project

68. At the end of 1974 there were about 80 motorized fishing units consisting of traditional outrigger or doublehull canoes fitted with outboard engines mainly around 25 Hp. The aim of the project is to increase the number of units to 450 by the end 1979 using outboards and diesel engines. The following progress has been made so far in 1975:

- (a) Direct import of 100 standardized outboard engines and spareparts together with fishing gear and boat building materials;
- (b) 80 loans for fisheries purposes provided through the Development Bank;
- (c) two workshops established for repair of outboard engines with assistance of 8 Peace Corps Volunteers and one Japanese Volunteer;
- (d) a boat-building unit established which by the end of the year will have produced 25 boats of 18 ft. and 28 ft.
- (e) a demonstration and training team with two boats visiting the villages and testing prospective applicants for the loanscheme. Methods demonstrated by the SPC Fisheries Project and the FAO Snapper Consultant are being modified for village-level fisheries.

Commercial Fisheries Development

69. After several years bait survey, the FAO Tuna Fisheries Project has ended with a negative conclusion. It seems at present that only cultured live bait will provide a basis for profitable operation of larger boats for pole-and-line fishing. Limited experiments with bait fish culture will be started in 1976.

Turtle Hatchery Project

70. This is a small project with the main aim of conservation of the hawksbill turtle found around the Samoa Islands. Over the last 4 years about 10,000 hatchlings of 1 to 3 months have been released.

RECOMMENDATIONS OF EXPERT COMMITTEE ON TROPICAL SKIPJACK WITH
SPECIAL REFERENCE TO SURVEY AND STOCK ASSESSMENT PROJECT

71. The Report of the Committee was presented to the Meeting and is attached to the Report as Appendix I. The Meeting expressed its support for the proposal for a Skipjack Survey and Assessment Programme with the following recommendation:

Recommendation No. 1

The Meeting recommended that highest priority be given to implementing the Skipjack Survey and Assessment Programme Proposal developed by the Expert Committee on Tropical Skipjack and urged the SPC to take immediate action to obtain funds to allow this to be undertaken.

72. Further discussion followed and resulted in the following recommendation:

Recommendation No. 2

The Meeting recommended that close liaison occurs between the project and countries and territories to be visited by the project vessel, both well before and during any visits, and that all interim and final reports be circulated to all member countries and funding agencies.

73. The Meeting discussed other topics in the Expert Committee Report and the import of the Committee's recommendation on baitfish utilization is incorporated in Recommendation No. 8.

PROGRESS REPORTS ON SPC SPECIAL PROJECTS

(a) Outer Reef

74. The Report of the Project Manager is attached to the Report as Appendix II.

75. After some discussion on the objectives and achievements of the project, the following recommendation was passed by the Meeting:

Recommendation No. 3

The Meeting recommended that:

- (i) the project be continued;
- (ii) more comprehensive reports covering gear, catch/effort, catch composition, marketability, etc., and general recommendations on development of the fishery be presented at the end of each phase of the project;
- (iii) closer liaison and consultation take place between countries scheduled for survey and project officers so as to more effectively define programmes for each phase of the project;
- (iv) SPC should seek funds for the necessary travel.

(b) Turtles

76. The SPC Fisheries Adviser summarized progress on the SPC's Turtle and Lobster Projects and the Meeting noted with pleasure that Recommendation 8 (a) of the Seventh Technical Meeting on Fisheries (i. e. to form a turtle data bank) had been implemented by Dr Uday Raj at the University of the South Pacific. After some discussion the Meeting approved the following:

Recommendation No. 4

The Meeting commended SPC on the progress in studies on turtle biology and recommended that studies continue on these animals and their conservation as a valuable food and cash crop. The Meeting stressed the importance of tagging and urged both wide and effective publicity and prompt acknowledgement of receipt of returned tags.

(c) Lobsters

77. Discussion followed on growth rates and the problems of holding live lobsters. The large research effort on Panulirus ornatus in Papua New Guinea was noted and liaison encouraged.

Recommendation No. 5

The Meeting recommended that the SPC project on lobster holding and biology should continue.

REPORT BY UNDP REGIONAL FISHERIES CO-ORDINATOR

78. The UNDP Regional Fisheries Co-ordinator reviewed UNDP projects and activities in the South Pacific area. Details of his report are given in Appendix III.

79. He reported that the UNDP Regional Headquarters will be moved to Suva, Fiji, early in 1976 from its interim locale of Manila, Philippines.

80. During discussion of this report the following recommendation was passed:

Recommendation No. 6

The Meeting recognised and approved the increased assistance being given to fisheries development in the Pacific by UNDP/FAO. It recommended that this continue and that all aid sources continue to communicate and co-operate in order to ensure that future fisheries development programmes in the region are complementary and not competitive.

81. The Meeting welcomed the publication by FAO of the Species Identification Sheets for fish in the Eastern Indian Ocean and Western Central Pacific region and, noting their value in the Pacific, urged members to obtain copies (from FAO, Rome), and make full use of the Sheets. In addition, members should help to make the Sheets of maximum value to the SPC region by informing FAO of omissions and any errors to be taken into account in the planned continuing improvement of the Sheets.

82. The importance in fishery development of loan finance for the purchase of new gear and vessels and of reductions of duty and tax on gear, fuel and vessels was stressed in the discussion and the various conditions presently occurring in the SPC area were reviewed, together with examples from developing fisheries elsewhere. After this discussion, the following recommendation was approved:

Recommendation No. 7

Recognising the importance of loan and incentive schemes in development and technological improvement in the catching and marketing sectors of fisheries and while bearing in mind that conditions and scale vary markedly throughout the region, the Meeting concluded that a survey of loan and incentive schemes throughout the South Pacific would be valuable as comparative material and therefore recommended that SPC carry out such a survey and publish the results.

REPORT OF THE DIRECTOR OF ICLARM

83. This report was presented by the Project Co-ordinator, ICLARM, and is attached to this report as Appendix IV.

84. The Meeting expressed its appreciation and its hopes that ICLARM's work will continue in the area.

DEVELOPMENT OF AQUACULTURE WITH PARTICULAR REFERENCE TO
HATCHERIES, TO NATURAL SEED SUPPLY AND ECONOMIC ASSESSMENTS

(a) Fish

85. The FAO Aquaculture Consultant to Fiji presented a report on work with rabbit fish (Siganids), Tilapia, milkfish (Chanos chanos), prawns and other species in Fiji and a lively discussion followed in which the need for economic assessment of aquaculture was stressed. The most promising area was in polyculture with the possibility of including low density prawn stocking with the fish. Supplementary feeding was expensive and generally not recommended although fertilization of the ponds with cheap locally available fertilizers could increase yields. On the basis of Fijian work, unfed but fertilized polyculture in sea-water ponds under appropriate management could give yields of 1.0 to 1.5 tonnes/ha/year as opposed to 3.0 tonnes/ha/year in fresh water.

86. A representative of the Hawaiian Institute of Marine Biology, reported on ongoing baitfish culture trials using Poecilia mexicana in Hawaii and American Samoa. Work was proceeding on numerous aspects of this project including facility design and management regime, nutritional requirements, genetics and behaviour.

87. The Meeting was encouraged to learn of the progress being made in the culture of various food fish, prawns and baitfish in the SPC region and supports further research. The following recommendation was passed:

Recommendation No. 8

The Meeting recommended that detailed economic surveys should be carried out before any commercial scale aquaculture projects are initiated and pointed out that such surveys should include the economics of alternative use of both the land to be developed and the investment capital. Further, the Meeting requested that SPC facilitate such surveys whenever possible.

(b) Crustaceans

88. Recent development in prawn (Penaeus spp.) culture at Baie de St. Vincent in New Caledonia (AQUACAL) and in French Polynesia (CNEXO) were described. Programmes were being developed both to produce quantities of post-larvae for prawn farmers and to improve methods of prawn culture. Trials with Macrobrachium rosenbergii in French Polynesia were also described.

89. The Meeting discussed the possibility of transferring prawn post-larvae throughout the area and were told that this presented few technological difficulties if supplies of larvae were available. The following recommendation was then passed by the Meeting:

Recommendation No. 9

Recognizing the potential value of prawn-rearing, either in high density or as part of a polyculture programme, the Meeting recommended that SPC assist in assessing the feasibility of developing a post-larval supply service.

(c) Molluscs

90. The UNDP/FAO Oyster Culturist, Fiji, described results of Crassostrea gigas, C. iredalei, Mytilus smaragdinus trials in Fiji and the Meeting was impressed by the results obtained. However, economic assessment of the results was stressed as an essential part of any mollusc culture experimental or development programme.

91. Fiji will carry out C. gigas spawning trials in an attempt to avoid the need for repeated importations, however, there are now various sources of spat from Japan, the United States of America and Europe. Further trials with C. iredalei and Mytilus smaragadinus are proposed.

92. The Meeting then approved the following recommendation:

Recommendation No. 10

The Meeting, having heard with interest the promising results obtained from the introduction of the Philippine green mussel (Mytilus smaragdinus) and the oyster Crassostrea iredalei and Crassostrea gigas into Fiji, recommended that the feasibility of introducing these species into other areas be investigated.

Recommendation No. 11

The Meeting further recommended that, in view of the interest of CNEXO in Tahiti in the possibility of breeding these species, the SPC Fisheries Adviser be asked to collaborate with the Philippines Fisheries Service and the Administration and AQUACAL in New Caledonia, in order to import sample batches of the two species (M. smaragdinus and C. iredalei) into New Caledonia. After a recovery period in New Caledonia sub-samples can be forwarded to Tahiti and other territories for experimental purposes.

93. The Meeting also briefly discussed the possibility of other forms of aquaculture including various algal species.

FISHERMEN TRAINING

94. This topic engendered much lively discussion. Several points were stressed: the difference between generalized fisheries training and fishermen training and the need to be aware of the relative values of training fisheries officers to high levels and relatively simple fishermen training.

95. Fishermen training does not lend itself to generalizations but should be geared in scale and content to the local conditions and the value of in-service training, where possible, was stressed.

96. The cost of both fisheries and fishermen training should be weighed against the suitability of the training to local conditions and the employment and development opportunities available to the trainees. The Meeting went on to re-affirm its support for the USP Fisheries Training Programme.

97. The following recommendation was passed by the Meeting:

Recommendation No. 12

The Meeting recognized the problems of fisheries training in the SPC region and recommended that member countries give priority to assessing and identifying these problems.

EFFECTIVENESS OF ACOUSTIC LURES

98. The New Zealand representative outlined some reasons for the failure of the commercially produced acoustic tuna lure and stressed that the lack of success with this model should not condemn the concept of attraction or repulsion of fish by sound.

FUTURE PROJECTS AND OTHER BUSINESS

99. The Assistant Director of the Fisheries Management Division, New Zealand, re-affirmed New Zealand's desire to participate in fisheries development projects in the South Pacific and expressed his interest in meeting with country delegates to discuss possible avenues for New Zealand aid to ongoing and proposed fisheries programmes.

(a) SPC Environmental Programme

100. The SPC Regional Ecological Adviser summarized aspects of his programme that were relevant to fisheries, including legislation for environmental management and conservation; research on coral reefs, mangroves and lagoons; techniques for simple environmental monitoring, information on ecological aspects of development planning, preparation of a Regional Ecosystem Survey and other assistance in environmental education and scientific and technical information. The availability of an SPC Environment Newsletter was drawn to the attention of the Meeting.

(b) Fish-poisoning

101. The SPC Programme Director (Health) described the SPC project on Fish Poisoning. The Meeting passed the following recommendation:

Recommendation No. 13

The Meeting commended SPC on the work of its Health sector on fish poisoning and in view of the importance of this project to fisheries in the area urged SPC to continue this work and recommended that Fisheries Administrations throughout the area do all they can to facilitate this research.

(c) Pearl Shell Lure

102. As in previous meetings, this topic was discussed at some length. The Meeting passed the following recommendation:

Recommendation No. 14

The Meeting noted that the art of pearl shell lure fishing is being lost in much of the Pacific and yet this traditional tool can be effective in tuna fishing: the Meeting therefore recommended that SPC arrange demonstrations and training by an experienced pearl shell lure fisherman within the region.

(d) 200-mile Limit

103. The Meeting was reminded of the real likelihood of the introduction of 200-mile territorial fisheries jurisdiction within the near future and of the fisheries management implications and responsibilities this would bring.

(e) Status of Albacore Stocks

104. The Director of the National Marine Fisheries Service Laboratory in Honolulu informed the Meeting that studies at his laboratory indicated that the South Pacific albacore stocks could sustain an average mean sustainable yield of 30-35,000 tonnes. This had been exceeded in recent years. He would be interested to learn of sources of catch/effort and size composition data of albacore and other tuna catches in the Western and Central Pacific.

(f) Intermediate Technology

105. The trials with intermediate technology food preservation techniques such as drying and smoking in Papua New Guinea were described and generated much interest. The Papua New Guinea delegate will arrange for an article on these trials to be prepared for the SPC Fisheries Newsletter. The attention of the Meeting was drawn to the week-long seminar on this topic to be held by the Tropical Products Institute in London in July 1976.

106. It was agreed that this subject should be included in the Agenda of the next meeting.

(g) Library Facilities

107. It was suggested that territories should establish official fisheries libraries as this would facilitate publication exchange.

108. Attention was drawn to the short recommended library list on fish identification produced by the FAO/DANIDA Workshop on Fish Taxonomy in Thailand. Copies of this list would be available from FAO, Rome (Walter Fischer). The SPC Skipjack Project Coordinator mentioned his intention of preparing a bibliography on Skipjack which would be available to fisheries officer in the region. He appealed for information on the more obscure references which refer to skipjack in the region.

(h) SPC Newsletter

109. The Meeting agreed upon the great value of the SPC Fisheries Newsletter to the region and passed the following recommendation:

Recommendation No. 15

The Meeting commended SPC on the production of the SPC Fisheries Newsletter and strongly recommended that its publication continue. It further suggested that the SPC be instructed to seek funds (should this become necessary) to maintain and further improve its production.

(i) Future Meetings

110. The Chairman commented on the value of having representatives of funding countries present at the Meetings. The Meeting then discussed the need and value of in-depth discussions on fisheries topics of high priority and interest in the SPC area and the following recommendation was approved:

Recommendation No. 16

The Meeting recommended that one day of the 1976 Meeting be devoted to a Symposium on the resources and fisheries associated with the outer reef, (island) slope and near-shore pelagic areas and agreed that the 1976 symposium focus on this subject.

111. The Meeting adopted a proposal that Mr R. Stone (Fiji) serve as chairman of the symposium with the responsibility for organizing the session. Mr R. Shomura (Hawaii) agreed to assist Mr Stone by preparing various background documents.

V. SUMMARY OF RECOMMENDATIONS

Recommendations of the Expert Committee on Tropical Skipjack

Recommendation No. 1

The Meeting recommended that highest priority be given to implementing the Skipjack Survey and Assessment Programme Proposal developed by the Expert Committee on Tropical Skipjack and urged the SPC to take immediate action to obtain funds to allow this to be undertaken.

Recommendation No. 2

The Meeting recommended that close liaison occurs between the project and countries and territories to be visited by the project vessel, both well before and during any visits, and that all interim and final reports be circulated to all member countries and funding agencies.

Progress Reports on SPC Special Projects

(a) Outer Reef

Recommendation No. 3

The Meeting recommended that:

- (i) the project be continued;
- (ii) more comprehensive reports covering gear, catch/effort, catch composition, marketability, etc., and general recommendations on development of the fishery be presented at the end of each phase of the project;
- (iii) closer liaison and consultation take place between countries scheduled for survey and project officers so as to more effectively define programmes for each phase of the project;
- (iv) SPC should seek funds for the necessary travel.

(b) Turtles

Recommendation No. 4

The Meeting commended SPC on the progress in studies on turtle biology and recommended that studies continue on these animals and their conservation as a valuable food and cash crop. The Meeting stressed the importance of tagging and urged both wide and effective publicity and prompt acknowledgement of receipt of returned tags.

(c) Lobsters

Recommendation No. 5

The Meeting recommended that the SPC project on Lobster holding and biology should continue.

Report by UNDP Regional Fisheries Co-ordinator

Recommendation No. 6

The Meeting recognised and approved the increased assistance being given to fisheries development in the Pacific by UNDP/FAO. It recommended that this continue and that all aid sources continue to communicate and co-operate in order to ensure that future fisheries development programmes are complementary and not competitive.

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Recognising the importance of loan and incentive schemes in development and technological improvement in the catching and marketing sectors of fisheries and while bearing in mind that conditions and scale vary markedly throughout the region, the Meeting concluded that a survey of loan and incentive schemes throughout the South Pacific would be valuable as comparative material and therefore recommended that SPC carry out such a survey and publish the results.

Development of Aquaculture with particular reference to hatcheries,
to natural seed supply and economic assessments in SPC area

(a) Fish

Recommendation No. 8

The Meeting recommended that detailed economic surveys should be carried out before any commercial scale aquaculture projects are initiated and pointed out that such surveys should include the economics of alternative use of both the land to be developed and the investment capital. Further, the Meeting requested that SPC facilitate such surveys whenever possible.

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Recommendation No. 9

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The Meeting, having heard with interest the promising results obtained from the introduction of the Philippine green mussel (Mytilus smaragdinus) and the oyster Crassostrea iredalei and Crassostrea gigas into Fiji, recommended that the feasibility of introducing these species into other areas be investigated.

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The Meeting further recommended that, in view of the interest of CNEOX in Tahiti in the possibility of breeding these species, the SPC Fisheries Adviser be asked to collaborate with the Philippines Fisheries Service, the Administration and AQUACAL in New Caledonia, in order to import sample batches of the two species (M. smaragdinus and C. iredalei) into New Caledonia. After a recovery period in New Caledonia sub-samples can be forwarded to Tahiti and other territories for experimental purposes.

Fishermen Training

Recommendation No. 12

The Meeting recognized the problems of fisheries training in the SPC region and recommended that member countries give priority to assessing and identifying these problems.

Future Projects and Other Business

(b) Fish poisoning

Recommendation No. 13

The Meeting commended SPC on the work of its Health sector on fish poisoning and in view of the importance of this project to fisheries in the area urged SPC to continue this work and recommended that Fisheries Administrations throughout the area do all they can to facilitate this research.

(c) Pearl Shell Lure

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The Meeting commended SPC on the production of the SPC Fisheries Newsletter and strongly recommended that its publication continue. It further suggested that the SPC be instructed to seek funds (should this become necessary) to maintain and further improve its production.

(i) Future Meetings

Recommendation No. 16

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APPENDIX I

REPORT OF THE EXPERT COMMITTEE ON TROPICAL SKIPJACK

I. Introduction

1. The second meeting of the Expert Committee on Tropical Skipjack was held at SPC Headquarters from 16 to 18 October 1975. It was formally opened by the Secretary-General of the South Pacific Commission, Mr G. F. D. Betham.
2. Mr R. Baird, SPC Fisheries Adviser, replied to the Secretary-General's welcoming comments and reiterated the role of the Expert Committee which includes formulation, implementation and evaluation of the skipjack resources assessment and fishery development programmes at all levels in the South Pacific Commission area.
3. Dr D. Eggleston was appointed Chairman of the working sessions.

II. Agenda

4. The Committee adopted the following agenda:
 1. Review of Current and Proposed Projects
 2. SPC Survey Programme
 3. Collection of Statistical Data
 4. Baitfish Utilisation
 5. Joint Ventures
 6. Other Business.

III. Review of Current and Proposed Projects

5. Reviews of current and proposed projects were given by representatives of New Zealand, United States, Japan, Inter-American Tropical Tuna Commission (IATTC), Papua New Guinea, New Caledonia, French Polynesia, FAO/UNDP South China Sea Fisheries Development and Coordinating Programme, Fiji and American Samoa. These reports emphasised the rapid and continuing development of skipjack fisheries in the area and the importance of understanding the structure of skipjack stocks in the region, their migrations and the interaction between areas of the region.

IV. SPC Survey Programme

6. The Status of the proposed SPC Skipjack Survey and Assessment Programme was presented by the Programme Coordinator. It was moved and adopted that the present proposal and amendment be redrafted into a single document by a sub-committee of the Expert Committee. The present proposal and amendment were then reviewed and detailed recommendations made to the redrafting sub-committee. The final document is appended to this Report for submission to the Eighth Regional Technical Meeting on Fisheries.

7. In support of the proposals the Committee made the following recommendation:

Recommendation No. 1

The Committee firmly believes that the proposed programme will succeed and that its objectives will be achieved. The Committee therefore strongly recommends that the Eighth Regional Technical Meeting on Fisheries adopt the proposal as submitted, and re-affirm its acceptance as a project of the highest regional priority. Further, the Committee recommends that every effort be made by the South Pacific Commission to assist the Programme Coordinator in procurement of required funding.

V. Collection of Statistical Data

8. The Committee re-emphasised the need for standardisation of catch effort data and size frequency information, and reviewed the progress made in the development of a uniform data collection system as recommended by the first meeting of this Committee.

9. A form for pole-and-line fisheries has been prepared and distributed to Fiji and the Solomon Islands. Copies of this form are available from the National Marine Fisheries Service, Honolulu Laboratory.

10. The Committee recognised the recent development of purse seine fisheries in the Western Pacific and suggested the development of a standard log book form. Dr D. Eggleston, Fisheries Research Division, New Zealand, and Dr R. Francis, IATTC, La Jolla, California, agreed to collaborate on a suitable format.

11. The Committee recognised the need for more accurate baitfish effort data and expressed interest in the separate baitfish form being developed in Papua New Guinea.

VI. Baitfish Utilization

Recommendation No. 2

The Committee discussed the quantity of baitfish required to establish a viable commercial fishery and, with reference to the culture of baitfish, recommends that comprehensive economic studies be undertaken before major development programmes are initiated and emphasises the importance of taking fully into account the conditions applying in each area.

VII. Joint Ventures

12. The Committee drew attention to the FAO publication "Joint Ventures in Fisheries" and suggested that countries considering joint venture agreements avail themselves of the FAO advisory service.

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A PROPOSAL FOR A SKIPJACK SURVEY AND ASSESSMENT PROGRAMME
IN THE CENTRAL AND WESTERN EQUATORIAL PACIFIC OCEAN

I. INTRODUCTION

1. Catches of skipjack tuna (*Katsuwonus pelamis*) already account for more of the world's total tuna landings than any other single species. Skipjack is the only species, marketed as light meat tuna, which is considered to be appreciably underexploited; estimates of future yields from the Pacific as high as 1,000,000 tonnes have been projected (Otsu 1974). The significance of skipjack in any consideration of the world's tuna resources is therefore obvious. Unfortunately the dominance of tuna landings by skipjack has not been paralleled by equivalent research effort; the result is that much less is known about skipjack than many tuna species of less economic significance.
2. Most of the increase in skipjack landings since 1970 has been a result of rapid expansion of fisheries in the Western Pacific Ocean. The total skipjack catch from the region has increased from approximately 250,000 tonnes in 1970 to about 400,000 tonnes in 1973; this increase is largely due to a substantial expansion in the geographical distribution of the Japanese southern water skipjack pole and line fleet.
3. The developing nations of the region have increased their efforts to develop expert fishing industries as foreign exchange earners. The success of the skipjack fisheries in Papua New Guinea and the Solomon Islands has inspired other nations to consider the development of similar industries. In several of the smaller island groups (e.g. the Gilbert Islands) a skipjack fishery is considered to be the most likely basis for a substantial export industry, and in all countries there are opportunities for import replacements. Additionally, there has been an increase in the demand for fresh fish by the island communities.
4. While there has been an increase in the research effort in the region, largely due to the initiation of a comprehensive research programme by Papua New Guinea, the present status of knowledge is by no means adequate for future development or management of skipjack fisheries.
5. The importance of skipjack is appreciated by the countries of the central and western Pacific. At the Sixth Regional Technical Meeting on Fisheries, sponsored by the South Pacific Commission and held at Suva, Fiji, in July 1973, an Expert Committee on Tropical Skipjack was formed. This Committee was convened for the first time at Papeete, Tahiti, in February 1974 with the objectives of reviewing the present and proposed status of skipjack fisheries in the central and western Pacific and recommending procedures for the scientific study of the resources.
6. After considering all available alternatives for the study of skipjack in the area, the Expert Committee recommended a regional survey and tagging programme in which approximately 100,000 skipjack would be tagged and released over a three-year period.
7. The need for a major regional tagging effort cannot be over emphasised; however, the programme as proposed should not be considered as a substitute for existing tagging or survey programmes. It is essential that this programme be co-ordinated with other projects in the Pacific.

8. The SPC Seventh Regional Technical Meeting on Fisheries held at Nuku'alofa, Tonga, in July 1974, endorsed the Expert Committee's proposal as a "project of the highest priority and urgency". It was also strongly supported by the Sixteenth Session of the Indo-Pacific Fisheries Council, Jakarta, Indonesia, November 1974, and the Fourth Session of the Indian Ocean Fisheries Commission, Mombasa, Kenya, July 1975. The countries and territories of the South Pacific Commission area are therefore unanimous in their desire to see the project carried out and support has been expressed by many of the South Pacific Commission Participating Governments and international organisations.

Objectives

9. The survey and assessment programme will provide
- (a) a better understanding of the migrations and stock structure of skipjack, thus determining the degree to which fisheries in different areas exploit the same stock, and hence interact with each other;
 - (b) valuable survey information on the general distribution and availability of skipjack and baitfish as the basis for further development and management of these resources within the region;
 - (c) better knowledge of the population parameters (growth, mortality, etc.) of each skipjack stock, thus enabling better assessment of the current status of these stocks and of the effect of fishing on them.

Benefits

National benefits

- (a) Estimation of the magnitude of the available stocks of skipjack occurring in coastal waters and indications of fluctuations in abundance with season and other environmental factors.
- (b) Description of the available natural baitfish stocks and their probable relative value as skipjack bait.
- (c) Determination of the best method for capturing and handling the natural baitfish in each area.
- (d) Evaluation of the effectiveness of alternative bait resources (e.g. cultured bait). The programme is geared for the testing of many different bait species.
- (e) Indications of the type and scale of operation best suited for the exploitation of the skipjack resources in each area.
- (f) Training of fisheries officers from each territory in the practical, technical and scientific aspects of skipjack fisheries and their research.
- (g) A better understanding of the possible effects should extended jurisdiction over fisheries resources be introduced.

Regional benefits

- (a) An increase in the total yield of skipjack from the region and a great decrease in the likelihood of over-fishing the resource or of over-capitalisation of the various fisheries.
- (b) A description of the various skipjack stocks occurring in the region.
- (c) Delineating migration patterns and determining the degree of intermingling of the stock and determination of which countries are exploiting common stocks.
- (d) Estimation of growth rates, natural and fishing mortalities and other biological parameters for population dynamics and stock assessment purposes.
- (e) Estimation of which populations are being exploited by various types of gear (e. g. pole and line, purse-seine, pearl shell lure, etc.). The fishing pressure from each gear will be estimated by a comparison of total catches and respectively tag recoveries.
- (f) Discovery of areas of good skipjack concentration in international waters outside the declared fishing zones of any nation.
- (g) Increased co-operation between countries on general fisheries matters as a result of involvement in a common project of regional importance.

II. THE PROGRAMME

11. As the project is to be coordinated through the South Pacific Commission, the area in which most of the research will be carried out will be primarily that designated as "The area of the South Pacific Commission"; however, it is appreciated that the skipjack is a wide-ranging oceanic species whose distribution and migrations are completely independent of national or international boundaries. To limit research purely to a predetermined area may well be shortsighted and result in the failure to gain vital information on the immigration and emigration of skipjack in the general region. The limits of the area should therefore be flexible but governed primarily by the total distribution of the skipjack stocks common to the countries and territories of the South Pacific Commission. The exact location of the research effort will be determined by the Programme Coordinator in consultation with the Expert Committee on Tropical Skipjack and will be under constant review depending on the results from the project as it progresses. Cruise timetables will be developed in accordance with information provided by fishermen and fisheries officers in the countries concerned.

12. The following guidelines (not in order of priority) will be considered when determining the areas for the initial expenditure of greatest research effort:

- (a) Those areas in which the skipjack resources have not previously been surveyed or for which the available information is obviously inadequate to give even a preliminary estimate of the potential.
- (b) Localities in which tagging will facilitate the description of the boundaries of the different stocks proposed for the central and western Pacific (Kearney, 1975). In this regard there may be a tendency for considerable effort to be concentrated in the regions where the boundaries between the various stocks are thought to exist.
- (c) Areas which are thought to be the centres of high spawning activity.
- (d) Areas where it is known that the resource is underexploited.
- (e) Areas currently not being fished because the known bait resources are inadequate.

13. It is planned that 30,000 tagged skipjack will be released each year with releases covering the entire area of the South Pacific Commission and being well distributed in time.

14. The tagging schedule will also be governed to a large extent by the need to elucidate certain specific anomalies which may be detected as the programme progresses.

15. It is assumed that the schedule for the second and third years would be revised in the light of the findings from year one, keeping in mind the necessity to examine seasonal variability.

III. SURVEY TECHNIQUES

Skipjack and other Tuna

16. The project has been designed to increase the understanding of the skipjack resources in the survey area with a view to future development and management of these resources. Tagging has been accepted as the primary research technique but concurrently many survey procedures and other research activities will be pursued as outlined.

17. The searching effort will be geared toward the location and exploitation of the areas of greatest concentration of skipjack. Rather than adhering to a predetermined grid type searching pattern, areas in which skipjack are known or thought to occur will receive particular attention.

18. All observed fish schools will be recorded and identified whenever possible by school type, species composition and estimated size in tonnes. The chumming success rate and other characteristics of the school behaviour will also be recorded where possible.

19. Priority will be given at all times to the tagging operations rather than the taking of commercial catches. Even so the hooking rates from each area will be determined and together with the sightings, reports will be used in comparing catches made by commercial vessels in the same time/area strata.

20. The tagging activities will be governed by the following guidelines:
- (a) Skipjack will remain the target species at all times but other tuna species taken incidentally to skipjack catches will be tagged and released whenever practicable.
 - (b) A general priority will be given to the release of small fish.
 - (c) Double numbered yellow dart tags will be used.
 - (d) Initially, at least, all fish released will be measured in the tagging cradle.
 - (e) Two tagging teams will operate on the vessel simultaneously.
 - (f) A number of fish will be double-tagged until reliable estimates of slippage rates and comparative mortalities between single and double-tagged fish have been obtained. Probably of the order of 3,000 fish will be double-tagged in an area where the recovery rate is anticipated to be high and cover a long time period.
21. From the skipjack which are poled but not tagged and released the following data will be collected:
- (a) Length frequency distribution of each school fished (a minimum of 50 individuals to be measured from each school).
 - (b) Length weight relationship for estimating condition factors (20 weights of measured fish).
 - (c) Sex, stage of maturity and gonad weight of 20 individuals from each school and samples to be taken from selected individuals for fecundity studies.
 - (d) Stomach contents of 5-10 individuals from each school.
22. Appreciating the importance of stock identification large numbers of blood samples will be taken from skipjack and other tuna species and forwarded to the appropriate laboratories. Other biological samples will be collected if required.
23. Although the study of tuna species other than skipjack will remain a minor adjunct to the project, much valuable information will undoubtedly be collected.

Baitfish

24. Although the baitfish resources of several countries in the survey area are currently being exploited for skipjack fishing, little information has been accumulated on the area as a whole. The information accumulated from past research in the central and western Pacific has made it possible, from an examination of the detailed nautical charts, to determine which areas are most likely to harbour good stocks of baitfish. As the number of good fishing sites on any coastline is normally quite small it should be possible to survey most probable areas in all of the island regions to be investigated. The methods of survey will be based on the following:

- (a) Numerous methods of baitfish capture will be tried but it is anticipated that most fishing will be done with stickheld dipnets or beach seines.
- (b) Identification of the abundant species in each area:
Many species will be encountered on an occasional basis but detailed research will be limited largely to those of possible economic significance.
- (c) Each of the common species will be assessed as a baitfish according to the following criteria:
 - (i) abundance,
 - (ii) catchability,
 - (iii) attractiveness to skipjack; gauged from the comparative chumming success with each species,
 - (iv) hardiness and longevity when transferred into the bait tank,
 - (v) capacity to be crowded in a bait tank.
- (d) The proximity of the bait resource to areas of occurrence of skipjack will also greatly influence future development. A great deal of experimentation with carrying baitfish long distances is planned for the survey period.

IV. ADVANTAGES IN THE USE OF A SINGLE RESEARCH VESSEL

25. The international sponsorship of the project through the South Pacific Commission should enable the vessel to catch both skipjack and baitfish in areas not accessible to a vessel of a single nationality. The advantages from a comparative viewpoint of such a programme are numerous.

Skipjack Fishing and Survey

26. Survey work will be possible in all island regions of the research area. Many of these regions currently have neither the finance nor expertise to undertake such surveys but, as indicated at the Seventh Regional Technical Meeting on Fisheries, all are extremely anxious to have such surveys carried out.

27. By using a single vessel the catch rates and fishing information (school sightings, etc.) from the different areas will be comparable, thus enabling countries planning skipjack fisheries to compare their prospects with those of a country with an existing fishery.

28. The search for concentrations of skipjack can be made in national and international waters.

29. When good concentrations of skipjack are detected, it will be possible to follow and study them even though they may traverse the declared fishing zones of several nations.

30. By operating in different areas the vessel will provide a unique opportunity for the fisheries officers from the various countries or territories to participate in survey and tagging studies and thus gain invaluable experience in skipjack research.

31. Because the tagging will be carried out by a single group of biologists experienced in the techniques and using uniform tags and methods, it can be anticipated that the survival rate of tagged fish will be maximised and the results obtained from the different regions will be directly comparable.

Baitfish capture, handling and utilisation

32. A variety of baitfish catching techniques, successful in other island regions, will be utilised and will undoubtedly prove of great value in many areas, particularly the less developed regions where little or no information on baitfish abundance is currently available.

33. A vessel with international status should be able to catch bait in any country or territory of the designated research area and would therefore not be limited by the restrictions inherent in carrying bait from a single source.

34. Tropical Pacific waters harbour many species of baitfish with potential as skipjack bait. Most of these species have been the subject of few, if any, studies to investigate their suitability for forming the basis of a commercial skipjack fishery. Many of these baitfish require specialised capture and handling techniques, peculiar to the species, before their potential as a baitfish can be fully realised. Undoubtedly the operation of the proposed research vessel would result in improved methods for the efficient utilisation of the more common species.

35. Recent research has shown that several of the most abundant baitfish species in the western Pacific, can contrary to previous thinking, be transported long distances without excessive mortality. The programme will afford an excellent medium for further research on methods of bait transportation.

V. THE ANALYSIS OF RESULTS

36. During the survey the accumulated results will be constantly monitored to assist in the direction of further operations within the terms of the project. The most modern data processing techniques will be used and it is hoped that additional expertise will be available on a part-time basis from the nations and international organisations supporting the programme. Progress reports will be provided on a timely basis.

VI. REFERENCES

Kearney, R. E. , The stock structure of the skipjack resources and the possible implications on the development of skipjack fisheries in the central and western Pacific.
FAO Fish. Tech. Pap. , FIRS/T 144.

Otsu, T. , Translator's note. In Atlas of skipjack tuna fishing grounds in southern waters, 1973 fishing season (July 1973 - May 1974). Translated by T. Otsu, Honolulu. NOAA/NMFS Southwest Fisheries Center.

B U D G E T
VESSEL AND OTHER REQUIREMENTS

The major expense of the programme will be the charter of a modern 250-ton Japanese live bait and pole vessel. The approximate cost of such a vessel, including essential crew will be of the order of \$A400,000 per annum (i. e. 250 days at \$A1,600).

The research and non-specialised staff would be as listed in the staff requirements or could be seconded from the fisheries staff of the countries involved in the project.

Essential vessel specifications (other than those of a typical 250-ton long-range pole vessel):

- (a) A minimum of 6 bait wells,
- (b) suitable accommodation to enable 3 scientists and 2 technicians to work on board simultaneously,
- (c) a small dry laboratory,
- (d) a small wet laboratory.

Staff

1 Project Officer	A\$ 35,000*
4 Biologists	120,000*
3 Technicians	75,000*
4 Research Assistants (which may be supplied by the fisheries staff of the countries in whose region the tagging is being carried out)	 20,000*
Total	<hr/> 250,000

Back-up facilities

- (a) Computer Programmer (part-time only)
- (b) Data Processing, as required
- (c) Access to a computer and funding for computer time
- (d) Appropriate secretarial and typing facilities
- (e) Publication facilities

These services will be made available by the South Pacific Commission and other organisations.

* These figures include recruitment, establishment and support costs and are based on current employment costs by the South Pacific Commission and FAO.

Additional major items* (preliminary estimates only)

	A\$
(a) Tagging equipment (includes 100,000 tags, applicators, cradles, etc.)	19,500
(b) Reward on tags (4,000 at A\$2.00)	8,000
(c) Biological sampling and analysis equipment (includes field microscopes, balances, glassware, chemicals, etc.)	9,000
(d) Nets (includes scoops and bait keeper pens)	4,500
(e) Fishing gear (poles, lures, lines, etc.)	4,000
(f) Travel (relocation of scientific staff, etc.)	16,000
	<hr/>
Total	61,000

TOTAL YEAR ONE A\$711,000

TOTAL YEAR TWO A\$671,000

* Most of these items would be purchased in the first year of operation but there would be some continuing expenses, for new or improved equipment, and recurring expenses.

APPENDIX II

SOUTH PACIFIC COMMISSION OUTER REEF FISHERIES PROJECT

Progress Report - October 1975

by

H. R. Hume
SPC Project Manager

On completion of operations in the New Hebrides the project chartered a local interisland vessel and shipped boats and equipment to Asau, Savaii, Western Samoa. In contrast to the New Hebrides, where the project operated without any local fisheries organization and in an area with very little fishing tradition, we found in Western Samoa a strong fishing cultural background and a fisheries development programme co-ordinated by the FAO Fisheries Adviser to the Western Samoan Government. In addition to the SPC project, an active boat-building programme is underway and a Peace Corps outboard motor mechanic project has been in operation for three months.

Catch records for Western Samoa up to the end of September:

- Bottom Fishing

Total Catch 14079 lbs

Av. catch/trip 182 lbs

<u>Main species</u>	<u>No.</u>	<u>Wt. lbs</u>
<u>Etelis carbunculus</u>	145	2820
<u>Epinephelidae</u>	123	2410
<u>Apion microlepis</u>	538	1787
<u>Lutjanus malabaricus</u>	276	1280

- Trolling

Total Catch 1916 lbs

Av. catch/trip 61 lbs

Fishing operations will continue up until the end of October.

The aims of the project in Western Samoa have centred on deep bottom fishing outside the reef in depths down to 200 fathoms, an area which has been largely neglected in the past, and the training of local fishermen in reel fishing techniques. Trolling for skipjack yellowfin and other fast-moving fish was given a reduced priority as the Samoan village fisherman has a long tradition of this type of fishing using outrigger canoes powered by outboard motors and it was felt that our contribution here would be a limited one.

The project has been considerably strengthened by the addition of Mr Noel Nicoll, Marine Mechanic from New Zealand.

A second Pago Pago 24-ft. dory has been acquired by the project powered by a 70 h.p. Chrysler-Nissan diesel engine with a shaft drive and propellor. A fourth boat, an Apia-built 28-ft. of FAO design, is under construction and should be delivered before the project departs from Samoa.

The completion of the project operations in Western Samoa coincides with the offer of aid money for fisheries development from Denmark and the possibility of further aid from New Zealand. In discussions with FAO, Department of Agriculture and Development Bank representatives it was agreed that the main priorities for aid should be:

- (i) the building of FAO design fishing boats;
- (ii) loans available for village-level fishermen for purchasing boats and equipment;
- (iii) a readily available supply of ice at the village level.

The vessel chartered to move the project from Asau to Aitutaki in the Cook Islands was reef-bound at the entrance to Suva harbour for 3 weeks and as a result is expected to arrive in Asau 10 days behind schedule. Boats and equipment should arrive in Aitutaki in mid-November.

There is an obvious need for flexibility in the project's approach to the different problems and requirements of each country visited. In a country as widespread as the Cook Islands an element of mobility would be useful for maximum effect. It is anticipated that the project will operate in Fiji and the Solomon Islands on completion of work in the Cook Islands. Where possible the project should move in a geographical sequence from country to adjacent country to reduce the large costs involved in moving from one end of the South Pacific region to the other.

APPENDIX III

Abstract of the Report of the UNDP/FAO Regional Fisheries Co-ordinator

by

Harry Sperling

The UNDP/FAO Regional Fisheries co-ordinator post was set up in December 1973. At that time the post was directly concerned with the countries and territories endorsing the project namely Cook Islands, Fiji, Gilbert and Ellice Islands, Solomon Islands, Tonga and Western Samoa. Mr Erling Oswald, the first incumbent of the post, drew up fishery profiles of these countries, identifying constraints upon developments and areas of most useful assistance - see Appendix III of the Report of the SPC Seventh Technical Meeting on Fisheries.

With the recent entrance of the US Trust Territories into the scope of UNDP assistance, FAO and UNDP are considering a separate Regional Small-scale Fishing Project proposal which could provide strong consultancy and group training components. Such a project would be co-ordinated to complement and follow up the various multi-lateral and bilateral aid and SPC programmes.

Mr Oswald transferred to the FAO/UNDP South China Sea Development and Co-ordinating Programme and subsequently took up post in April 1975. The main task to date has been travel to all the South Pacific countries and territories for familiarization and discussions, review of on-going UNDP country projects and identification of new development possibilities. Discussions have also been held with the Australian Development Assistance Agency in Canberra in company with the Principal Fisheries Officer of Tonga, consultations with FAO Headquarters in Rome and with UNDP in New York. Visits have been made to ICLARM, US National Marine Fisheries Service and Oceanic Institute in Hawaii and the 'Service de la pêche' in Tahiti. Further visits have been made to the projects in Tonga, Cook Islands and Fiji and the recent FAO inter-regional conference in Bangkok.

A pilot baitfish culture project in the Gilbert Islands under the supervision of Mr Gopalakrishnan, GEI/71/004, has progressed quite successfully and preliminary economic and stocking density data should be available soon. Milkfish was selected for culture in the Gilbert Islands because of an apparently adequate supply of natural fry for stocking and it has been successfully used as a tuna baitfish in other areas. Subsequently a draft project document has been prepared for a fairly large-scale baitfish culture and skipjack fishing feasibility project. This draft has been approved in principle.

In the Solomon Islands two new projects have been identified. One is a simple consultancy to advise on the amendment of an existing joint venture skipjack fishing and processing agreement. This consultancy has already been approved. The second project is on a much larger scale and is concerned with the development of distribution and marketing facilities in conjunction with off-shore exploratory fishing to supply domestic markets. This project is at present being negotiated.

Chiefly through the efforts of the FAO Senior Fisheries Adviser in Western Samoa, Mr Oyving Gulbrandson, a DANIDA/FAO project for the development of small-scale village fisheries which will include boat building, provision of engines and of vehicles for fish distribution. Considerable input into the project will be provided by US Peace Corps and Japanese overseas volunteers, mainly in the repair and maintenance of outboard motors. The data and assessments provided by the SPC Outer Reef Fisheries Project will contribute a great deal towards the village fishery programme.

The Fishery Adviser Project for the Cook Islands, CKI/74/002, became operational in April 1975 with the arrival of the expert Mr Cyril Edwards. Considerable effort has been made to overhaul and rehabilitate two government fishing vessels. Parts, gear and equipment have been ordered and the 55-ft. GFV "Ravakai" was launched in late October after installation of a good quality echo-sounder. A second echo-sounder has been ordered for a government 28-ft. boat. Consideration is being given to the employment of a pearl-shell-lure consultant from Tahiti for catching skipjack and tuna since the relatively high speed 28-ft. boat is available.

In Tonga the Marine Resources Development Project - TON/74/004 - became operational in July with the arrival of Mr Alan Chapman the Acting Project Manager, a chartered 41-ft. FRP fishing vessel "Tropac" and a support barge facility. Most of the effort will be directed towards live bait pole-and-line fishing and trolling for skipjack and tuna in season and bottom fishing at other times of the year. Project and contract personnel repaired the Government ice plant so that an adequate supply of ice is now available. Catch results have been promising and it is felt that the potential for fishery development for self-sufficiency is excellent; that for an export-orientated industry remains to be seen.

The UNDP/FAO fish and oyster culture projects being supervised by Messrs Popper and Ritchie in Fiji both progress well as witnessed by the published accounts prepared for SPC Fisheries Newsletters and working papers for this Meeting.

Introduction of Fisheries Subjects at Primary and Secondary School Levels

In order to educate youth in village primary and secondary schools to be aware of fishing and its potential it is thought that UNDP might be able to provide a consultant to work with Ministries responsible for education and fisheries on a scheme for training of teachers to teach fishery subjects in village schools. The consultant would be requested to work out a detailed syllabus for the approval of the Ministries of Education and Fisheries Department in the region.

Incentives for Fishermen

Since all Governments have given a high priority to achieving self-sufficiency in fish and fish products, some incentives should be granted to fishermen. Incentive possibilities could be the elimination of import duties and taxes on fishing gear, equipment and petroleum products to be used by bonafide commercial fishermen.

Credit and Finance

In the near future the efforts of the SPC Outer Reef Project as well as those of FAO's development activities will begin to bear fruit in that resources will have been sampled, economic guidelines will have been established, vessel design and gear criteria will have been recommended for various locales and there should be a nucleus of fishermen trained to use more modern methods and equipment. This development will need financing, consequently proposals for action and measures to make available credit and finance should be considered now.

In conclusion, I should like to thank SPC for the opportunity of attending this Meeting, my colleagues in the region for their many hours of briefings and assistance, and most particularly the Fisheries Officers of the various governments for their wholehearted co-operation and efforts on my behalf during these past five months. I have been most pleasantly surprised and pleased to see the enthusiasm and momentum achieved in fishery development activities in most of the Fishery Departments or Divisions. Thank you.

APPENDIX IV

REPORT ON THE INTERNATIONAL CENTER FOR LIVING AQUATIC
RESOURCES MANAGEMENT

by

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In early 1974, the Rockefeller Foundation initiated discussions on the concept of the establishment of an International Center concerned with the development and management of aquatic resources. Dr Garth Murphy, presently Head of fisheries research, CSIRO, Cronulla, Australia, was sent on a preliminary assessment trip through the Pacific and South-East Asia. Based partly on Dr Murphy's recommendations, Dr John Pino, Director of Agricultural Sciences for the Foundation, authored a document proposing the establishment of such a Center. This document was widely circulated in the Pacific Basin and suggestions for the development and implementation of the programme were solicited.

A Consultant for the Rockefeller Foundation travelled to several countries in the Pacific region, including Australia and New Zealand, to meet with key individuals in the various Governments to present the ICLARM programme and to seek their endorsement and participation.

The Rockefeller Foundation formally initiated ICLARM on January 1st, 1975. Dr Philip Helfrich, formerly the Associate Director of the Hawaii Institute of Marine Biology, was appointed Director. The initial area of interest of the ICLARM programme was to have been the islands of the South Pacific Basin. However, the scope of the programme now has been expanded to include South-East Asia.

The goal of ICLARM is to assist people to rationally develop and manage their aquatic resources for their own nutritional needs. Implied in this goal is the exclusion, in most instances, of large scale, commercial export fisheries. ICLARM is more concerned with programmes that primarily benefit local consumption.

ICLARM is similar in many respects to the other international agricultural development institutes, such as the International Rice Research Institute in the Philippines, or the International Laboratory for Research on Animal Diseases located in Africa. To date, there are approximately nine of these institutes. ICLARM is the first to be concerned with the development of aquatic resources.

The ICLARM office is presently located in Honolulu, but because of the international nature of the programme, the office will be moved from Hawaii to a site within the region. Final selection of an office site will depend on its location in relation to ongoing ICLARM programmes, as well as adequate communication and transportation facilities.

Funding at this time comes primarily from the Rockefeller Foundation. However, it is anticipated that future support will also come from other foundations and international institutions.

Unlike the other international institutes, ICLARM will not develop a large physical plant. Instead, it will have a small staff who will be responsible for developing and supervising programmes in response to identified needs. The policy of programme development will be to work through "lead centers". These lead centers will be established institutions or agencies that have the capability of developing a particular programme. ICLARM will have no in-house programmes that it will manage directly. A lead center may be a university, a government agency or department (such as a fisheries division), or a regional body such as the SPC.

ICLARM is interested in supporting programmes in which its initial financial input may act as a catalyst to attract additional aid funds. An example of this type of programme is the Skipjack Tuna Assessment Project. ICLARM is supporting Dr R. Kearney's position as Skipjack Programme Co-ordinator within the scope of the SPC special project on Skipjack Tuna Assessment.

There are four main areas in which ICLARM will develop programmes: integrated research and development of culture fisheries, improvement of small-scale rural fisheries, development of post-harvest technology (including the improvement of preservation, distribution and marketing systems) and the improvement of education, training and information services in the marine sciences.

The principle objectives of all projects developed within these four main programme areas are to:

- (i) provide for improved aquaculture techniques through an integration of research, development, and extension services, with an emphasis on labour intensive systems to aid employment and low energy systems to keep costs at a minimum;
- (ii) develop methods to improve small-scale rural subsistence and market fisheries by building on traditional practices and emphasising low-capital investment, low-dash energy, artisanal methods of fishing.

Because of the nature of the ICLARM programme, there is a built-in flexibility that allows it to respond to immediate needs or specific constraints to the implementation of a particular project. An example of this type of flexible response was the provision of the services of Dr Robert May of the University of Hawaii to work with Dr Dan Popper at the FAO-supported project on culture fisheries in Raviravi, Fiji.

Examples of current programmes which ICLARM is supporting in the Pacific Basin are the Skipjack Assessment Programme in association with the South Pacific Commission, Curriculum Development for the Marine Sciences at the University of the South Pacific, Suva, Fiji, Small Boat Designs Appropriate for Artisanal-Level Fisheries, and the Small Boat Workshop held here in Noumea on 27 - 28 October 1975. The purpose of the workshop is to provide a forum for both ideas and past experiences on small boat fisheries development.

In South East Asia, ICLARM is developing programmes concerned with rural coastal fisheries development in Malaysia and the Philippines in conjunction with the FAO South China Sea Fisheries Development and Co-ordinating Programme. In addition, a culture fisheries programme is being initiated which will concentrate on the artificial spawning of mullet and milkfish. A training film on the spawning of mullet is now available through the Oceanic Institute, Makapuu, Hawaii. A Conference will be held in conjunction with the East-West Center in July 1976 which will discuss the major social, cultural and economic constraints to, and implications of fisheries development programmes in South East Asia and the Pacific Basin. It is hoped that this conference will provide research teams which will work in conjunction with on-going development projects in both of these regions.

ICLARM would welcome receiving programme proposals from the participants of this Technical Meeting on Fisheries so long as they fall within one of the three main programme areas that have been outlined above.

APPENDIX V

LIST OF WORKING PAPERS

- SPC/Fisheries 8/WP. 1 Acoustic Lures in New Zealand, by Fisheries Management Division, Ministry of Agriculture and Fisheries, Wellington, New Zealand.
- WP. 2 Country Report - Kingdom of Tonga, by W.A. Wilkinson.
- WP. 3 ORSTOM Projects on Fish and Fishing in the Caledonian Lagoon, by G. Loubens.
- WP. 4 Development of Skipjack Tuna Fisheries in the Tropical Pacific with Cultured Baitfishes, by Wayne J. Baldwin.
- WP. 5 Second Generation Siganus canaliculatus (Pisces: Siganidae) reared from hatching in Palau, by Patrick G. Bryan.
- WP. 6 Skipjack around New Zealand, by D. Eggleston.
- WP. 7 Purse-seining around New Zealand, by D. Eggleston.
- WP. 8 Diploma in Tropical Fisheries, by Neil Bourne.
- WP. 9 AQUACAL Experimental Centre for Marine Cultures, by Michel Autrand.
- WP. 10 South Pacific Commission Lobster Project - Progress Report - September 1975, by James Prescott.
- WP. 11 Gilbert and Ellice Islands - Country Statement, by D.H. Gibson.
- WP. 12 American Samoa - Country Statement, by Dr S. Swerdloff.
- WP. 13 Fiji - Country Statement, by R. Stone.
- WP. 14 The Present Status of the Papua New Guinea Tuna Fishery, by M.A. Wilson and G.J. West.
- WP. 15 The Role of Intermediate Technology (Cottage Industry) in the Development of some of Oceania's Fisheries, by Joe Glucksman.
- WP. 16 Country Statement - Papua New Guinea, by B.R. Smith.
- WP. 17 Development of Aquaculture in the South Pacific Tropical Island and Coral Environment, by AQUACOP, French Polynesia.
- WP. 18 Experimental Commercial Production of Crassostrea gigas in Fiji, by Theodore P. Ritchie.
- WP. 19 Experimental Introduction of the Philippine Oyster, Crassostrea iredalei and Philippine Green Mussel, Mytilus smaragdinus in Fiji, by Theodore P. Ritchie.
- WP. 20 Cook Islands - Country Statement, by T.J. Marsters.
- WP. 21 Report of the Expert Committee on Tropical Skipjack.
- WP. 22 Raviravi Experimental Fish Pond Project: Progress Report, by D.M. Popper and T. Lichatowich.

SPC/Fisheries 8/WP.23 USP-Based Turtle Research: Progress Report 1974-75
Breeding Season, by Dr Uday Raj.

WP.24 An Attempt to Grow Hawksbill Turtles (Eretmochelis
imbricata) in Fish Ponds in Fiji, by N. Gundermann
and D. M. Popper.

Information Documents

The Pole and Line Fishery of the Solomon Islands (Limited
distribution).

Report to the South Pacific Commission - Aquaculture in
the Solomon Islands, by K. Crean, Fishery Officer, Solomon
Islands.
