

IOFC/DEV/72/22

indian ocean fishery commission

INDIAN OCEAN PROGRAMME

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# undp/fao fishery projects in the indian ocean region



UNITED NATIONS DEVELOPMENT PROGRAMME



FOOD AND AGRICULTURE ORGANIZATION  
OF THE UNITED NATIONS

UNDP/FAO FISHERY PROJECTS IN THE INDIAN OCEAN REGION

by

L. I. J. Silva

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

UNITED NATIONS DEVELOPMENT PROGRAMME

Rome, September 1972

#### THE INDIAN OCEAN PROGRAMME

The International Indian Ocean Fishery Survey and Development Programme, or Indian Ocean Programme for convenience, was formally conceived by the Indian Ocean Fishery Commission and its activities are conducted through that body. The Programme is supported by the UNDP and is being carried out by the FAO Department of Fisheries. Put simply, the objective of the Programme is fishery development in the Indian Ocean region.

John C. Marr  
Programme Leader

ABOUT THE AUTHOR

L.I.J. Silva has a B.A. from the University of Ceylon. He entered the Civil Service of Sri Lanka in 1957. He has held a number of important positions in Government Departments and Corporations in Sri Lanka including Chairman and Managing Director National Textile Corporation; Director and Acting Chairman Weaving Supplies Corporation; Director-General Manager Ceylon Fisheries Corporation. He went to Oxford in 1969 as a Queen Elizabeth House Fellow to study the management of public enterprises. He joined the staff of the Indian Ocean Programme in May 1972, as "Senior Fishery Officer - Government".

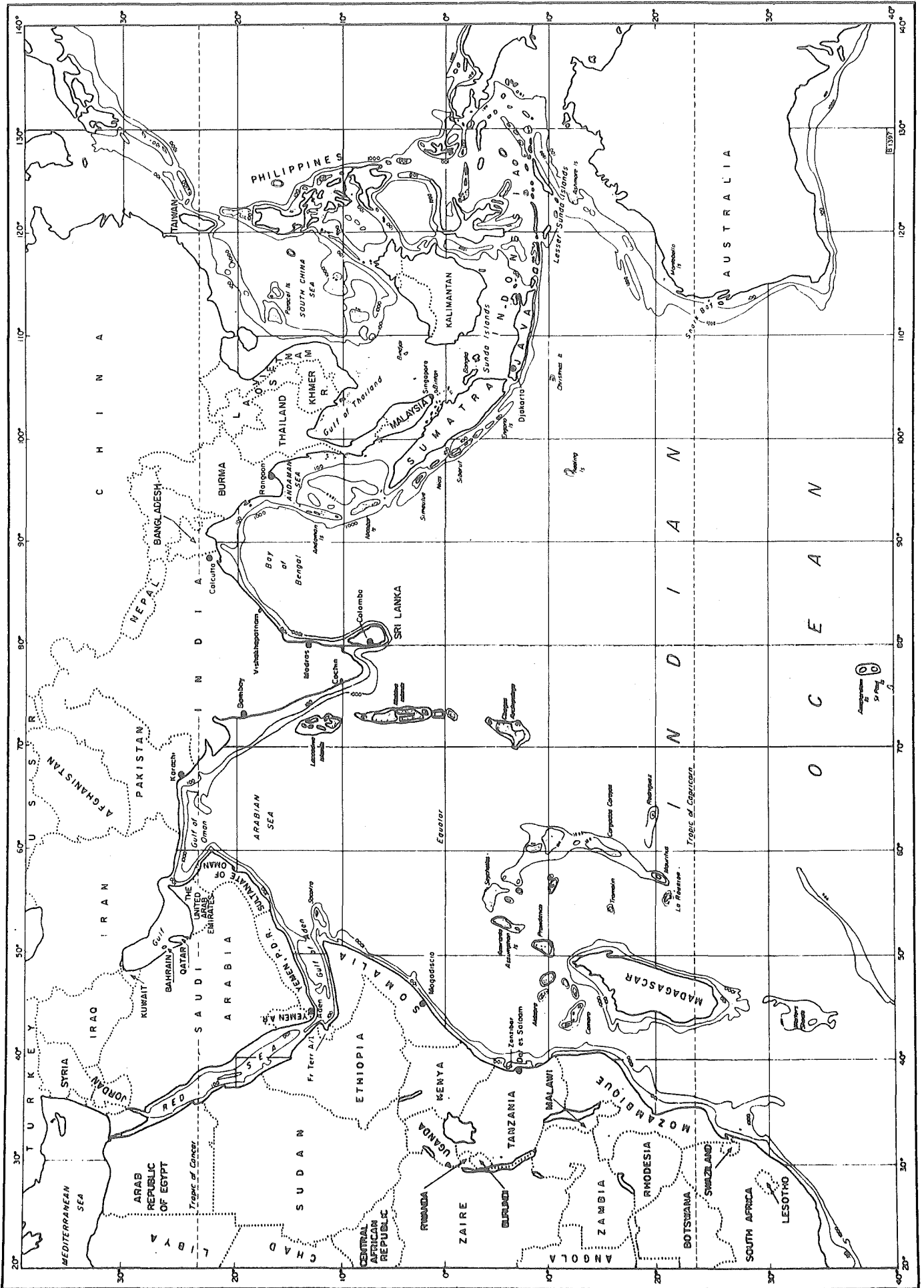


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## UNDP/FAO FISHERY PROJECTS IN THE INDIAN OCEAN REGION

by

L.I.J. Silva

### INTRODUCTION

This report contains summaries of activities in twentythree UNDP/FAO fishery projects in the Indian Ocean region currently in operation or recently terminated. It is based on information contained in Progress Reports, Reports of Review Missions, and in some cases, personal communications. Where projects are still in operation, the status reflected in the reports is that of 31 May 1972. Not all information is incorporated in the reports,

because in some cases information was not available, and in others, for reasons of brevity. A second report will deal with bi-lateral aid projects, about which information is presently being collected. Finally, a third report (being prepared jointly with Mr. John C. Marr) will attempt to generalize, on the basis of the first two review papers, on the problems of project identification and formulation, project execution, and post-project follow-up and investment.

DP/RAS/68/429

ASIA AND THE FAR EAST

Regional Fish Culture - Status Report as at end 1971

D.P. Contribution U.S.\$ 81 300

Regional Fish Culturist - Ling, S.W.

Expended as at 31 May 1972 U.S.\$ 92 789

Mailing Address: c/o FAO Regional Office for  
Asia and the Far East  
Maliwan Mansion  
Phra Atit Road  
Bangkok 2, Thailand

Headquarters Location - Bangkok

### Purpose

To advise and assist Member Governments in Asia and the Far East with respect to all aspects of Freshwater and Brackishwater Fish Culture; research and investigations, practical pond culture and extension work.

The subjects concerned are: (1) Fish nutrition and feeding, (2) Pond fertilization, (3) Fish breeding, including genetic selection, (4) Aquatic weed control, (5) Predator Control, (6) Disease and parasite control, (7) Handling and transport of fish and fry, (8) Selection of fish for



culture, (9) Economics of fish culture, (10) Special forms of fish culture: brackish-water, rice-field, etc., (11) Hatchery and pond siting and construction, and other related matters.

Operational date - 1 January 1965

Termination date - 31 May 1972

### Progress

This post has been in existence since 1965. The following is a brief résumé of the work done up to 1969, in so far as it relates to brackishwater fish culture and prawn culture in the Indian Ocean region.

In India, the expert assisted and advised on the promotion and development of prawn culture and in Sri Lanka he initiated the establishment of a fish farm for Chanos culture. In the latter half of 1968, he advised Singapore and Malaysia on the possibilities of prawn culture and also organized a short training course on practical fish culture at the University of Malaysia, Kuala Lumpur, at which there were fifty participants. In 1969, he visited Thailand (August), Pakistan (October-November) and Malaysia (November-December) in connection with the development of fish and prawn culture.

In March-April 1970, the expert visited Singapore to assist in assessing the feasibility of aquaculture development and to prepare brief project proposals for consideration. Limited availability of land and suitable water dictated that attention should be directed to intensive culture of high priced species. Accordingly, proposals for the intensive farming of shrimp (Penaeids), freshwater prawn (Macrobrachium) and intensive culture (in floating nets) of grouper (Epinephelus spp.) and sea perch (Lates calcarifer) were submitted. During May and June 1970, in addition to other work, the expert advised Thai fishery officers on problems concerning (1)

further development of induced breeding of Pangasius spp. and, (2) improvement of research on and propagation of Macrobrachium. He also continued general field studies on the status of shrimp farming in Thailand. Juvenile Macrobrachium rosenbergii were obtained from Taiwan for experimental purposes. In September-October 1970, the expert delivered a series of four lectures on shrimp and prawn culture to graduate students of Chulalongkorn University; he also visited Malaysia in early October to render technical advice and assistance on problems concerning fish and prawn culture. Plans for a pilot operation on mass production of juvenile Macrobrachium were finalized. In November, the expert participated in the Fourteenth Session of the Indo-Pacific Fisheries Council. The symposium subject was "Coastal Aquaculture" and the expert served as Discussion Leader on the subject "Status of Aquaculture in the Coastal Zones".

In the first quarter of 1971, he advised and assisted in the experiments being carried out in shrimp farming areas around Bangkok, particularly on the effects of fertilizer on the growth of shrimp in the traditional shrimp farm and on the effects of flow of water on shrimp growth. Preliminary results showed that shrimp grew relatively faster during the first 60 days in fertilized ponds. In July-August 1971, he continued to assist and advise the Thai Fisheries Department as well as several private companies interested in starting prawn and shrimp culture.

In December 1971, the expert prepared a Project Proposal for a UNDP/FAO Regional Advisory Service and Coordination Centre on Shrimp and Prawn Culture Research and Development. This project has since been dropped, since it has been taken up under a bi-lateral arrangement.

DP/RAS/68/430

ASIA AND THE FAR EAST

Regional Fisheries Statistics - Status Report as at 31 May 1972

D.P. Allocation U.S.\$ 81 300

Regional Fishery Officer - Yamamoto, T.  
(Statistics)

Expended as at 31 May 1972 U.S.\$ 89 434

Mailing Address: c/o FAO Regional Office for  
Asia and the Far East  
Maliwan Mansion  
Phra Atit Road  
Bangkok 2, Thailand

Headquarters Location - Bangkok

Purpose

To advise and assist Member Governments in Asia and the Far East with respect to all aspects of fisheries statistics. The subjects concerned are:

(1) Fishery Statistical standards and services:

(a) Introduction, regionally and nationally, of standard classifications, standard concepts, standard definition and standard methods (data-collection, data-reporting, data-processing and data-publishing).

(b) Design and use of censal frameworks and methods of the national level throughout this region.

(c) Servicing at the secretarial level of the Indo-Pacific Fisheries Council Standing Working Party of Experts on Fishery Statistics.

(2) Data-collection and data-tabulation required for FAO approved projects:

(a) The follow-up of FAO originated requests for current data (for Yearbooks, Bulletins, etc.) to ensure prompt meeting of all deadlines and adequacy of the replies provided.

(b) The establishment of contact points to be used by FAO and Regional units for correspondence about data-exchange.

Progress

The area of operation of the expert covers both the Indian Ocean countries and those in East Asia. He has been in the post since 25 February 1965. This review will refer, (a) to his activities in the Indian Ocean countries, and (b) in greater detail only to his work

from 1969 onwards. A brief résumé will be given of the work done during the period 1965 to 1969.

The following work, as relevant to this review, was accomplished by the expert during the period 1965-1969. 1965 (second quarter) - Work was carried out in India, Sri Lanka and Khmer Republic (Great Lake Complex). A general study of the fishery statistics of each country in the region was made and a programme to improve the situation was elaborated. 1965 (third quarter) - Field work was carried out in Thailand. 1966 (first quarter) - This period was devoted to work in India, Nepal and Sri Lanka. 1966 (second quarter) - Visits were made to Malaysia and Singapore and the situation in Thailand was investigated. 1966 (third quarter) - The expert visited Burma. 1966 (fourth quarter) - Further work was carried out in Thailand, and the expert attended the Twelfth Session of the IPFC in Hawaii. 1967 (first quarter) - He dealt with the statistical problems of Thailand and supervised the preparation of instructions and questionnaires for the fishery census, which consisted of a statistical survey and an information survey. From September 1967 to August 1968, the expert was posted to Rome, in connection with the study of fisheries in Asia for the Indicative World Plan<sup>1/</sup>. In the last quarter of 1968, he visited Thailand and in the first quarter of 1969, he visited Malaysia to advise on the planning and preparation of a costs and earnings survey on trawl fishery, on the designing of a fishery census and on the improvement of a fisheries production survey to include classification by species, size of fishing unit and a more precise definition of fishing gear.

During the period January 1970 to December 1971, the expert was engaged in (1) the preparation of working papers dealing with statistical standards classification on species, fishing crafts, fishing

<sup>1/</sup> now called Perspective Study of World Agricultural Development (PSWAD).

gears, fishermen and measurement of gross tonnage of small fishing vessels, and (2) assisting and advising Member Governments in the implementation of national fishery censuses in compliance with the resolution of the Eleventh Session of the Indo-Pacific Fisheries Council that a fishery census be taken on a regional basis in or around 1970. The aims of the fishery census were: (a) to provide a comprehensive picture of the economic structure of the fishing industry to enable the formulation of national fishery development plans, and (b) to provide a suitable frame for the design of a sample survey for current fisheries statistics.

In countries where a fishery census had already been implemented, the expert advised on improved methods for collecting data on catch and fishing effort and on the structure of the fishery economy, by using a frame which emerges from the fishery census. In this connection, the expert visited, in addition to some countries in East Asia, India, Indonesia, Bangladesh and Sri Lanka.

In the first quarter of 1971, he prepared a general guideline for the Fishery Census to be conducted in Thailand in 1973. In March-April 1972, he visited Burma to examine the status of fishery statistics and to advise on the implementation of the 1977 Fishery Census. The expert has pre-

pared detailed reports on the status of fishery statistics in the countries concerned and has made suggestions for the improvement of the methods of data-collection, the implementation of fishery censuses and sample surveys to estimate fish production and the preparation of a national list of species. In Bangladesh he assisted the FAO Fishery Statistician in finalizing the design for the Annual Sample Survey of Marine Fisheries in Bangladesh, which was based on the Marine Fishing Village Identification Survey conducted by the FAO/UNDP Fisheries Development Project and advised on the need to collaborate closely with the Population Census that had been scheduled for 1971. This included sampling procedures, estimation procedures for inventory items, estimation of catch and the classification of commercially important species. The method adopted was the double sampling ratio estimate in which a primary sample is drawn from the populations and a secondary sample is drawn from the primary sample.

In Sri Lanka, on his advice, it was decided to take a Fishery Census in close collaboration with the Population Census that was conducted in late 1971 and, in order to assist in this Census as well as to advise on fisheries statistics and systems, a Fishery Statistician was appointed to Sri Lanka in early 1972 under a Technical Assistance Programme.

DP/PAK/65/522

BANGLADESH

Survey for Development of Fisheries

Status Report as at 22 January 1972 (On Termination)

D.P. Contribution	U.S.\$ 2 054 900	Project Manager	- Smart, J.K.
Government	U.S.\$ 1 316 447	Project Co-Manager	- Latif, A.
	<u>U.S.\$ 3 371 347</u>	Mailing Address:	Survey for Development of Fisheries Project
Expended as at 31 May 1971 (D.P. Funds)	U.S.\$ 1 697 349		P.O.Box 234 Chittagong, Bangladesh

Location - Chittagong

Purpose

To assist in the development of the fisheries of Bangladesh through fishing surveys, training of fishermen and marketing

experiments. In particular, the project will: assess the potential for increased fish production by carrying out exploratory fishing trials and biological studies, develop a core of skilled fishermen competent in operating

modern fishing craft gear, examine the current practices of marketing and distribution and initiate experiments for their

improvement develop an efficient statistical recording system, and provide such consultant services as may be required.

Operational date - 23 January 1967  
Termination date - 22 January 1972

<u>Type of Vessel</u>	<u>Name</u>	<u>LOA</u>	<u>G.T.</u>	<u>H.P.</u>	<u>Delivery</u>
Purse-Seiner/Trawler	SAGAR SANDHANI	29.35 m	165	510	January 1967
Trawler	MEEN SANDHANI	18 m		153	October 1967
Launch	ALMARINE	7.5 m		130	1968

The Project has been completed. The Project Manager's draft Terminal Report has been submitted and the technical reports are under preparation. This report, therefore, while giving a brief account of the progress of activities during the life of the Project will, in the main, concentrate on information contained in the Terminal Report of the Project Manager. During the preparation of this Terminal Report, most of the technical reports were also under preparation and were therefore not available in their final form.

(4) Swatch of No Ground - a sub-area east of the mouth of the Ganges.

### Progress

The first Project Manager arrived in Bangladesh in February 1966. He was engaged in pre-operational discussions and preparations with the Governmental authorities till November 1966 when the Plan of Operations was signed. The project was declared operational on 23 January 1967. Between October 1967 and September 1968, a total of 21 cruises were made on the SAGAR SANDHANI and the MEEN SANDHANI of which 15 were for fishing and the rest were for training of crew and for biological investigations. The exploratory fishing in this period indicated the most promising sub-areas for fishing to be within an area of approximately 10 000 square miles north of latitude  $20^{\circ} 40'$  (St. Martin's Island) and south of  $22^{\circ}$ , and bounded on the west by longitude  $89^{\circ} 40'$  and on the east by longitude  $91^{\circ} 80'$  approximately, namely:

In the 1968-1969 season (October to January), the MEEN SANDHANI using a 560 mesh "Star" trawl, average catches of 200 kg per hour, with a maximum catch of 2 000 kg, while the SAGAR SANDHANI, using a variety of fishing gear, averaged 400 kg per trawling hour, with a maximum catch of 2 700 kg per hour. The average catch consisted of 15.7% catfish, 12.7% jewfish 16.2% shark and skate, 8.9% Indian salmon, with mixed varieties making up the balance. The best fishing grounds for bottom trawling were (i) South Patches - 2 400 square miles with depths ranging from 7 fathoms to around 25 fathoms, (ii) southwest of South Patches or "Middling" grounds - 1 800 m<sup>2</sup> - same depth range, and (iii) Swatch of No Ground - 1 500 square miles - the greater part being between the 10 and 20 fathom range, with the southern part getting much deeper. Fishing by gillnets was also carried out on a limited scale, but the results were insignificant.

- (1) South Patches - immediately west of Cox's Bazar
- (2) Southwest of South Patches - a smaller sub-area adjacent but southwest of South Patches
- (3) East of Swatch of No Ground - a sub-area between southwest of South Patches on the east and Swatch of No. Ground on the west

Exploratory fishing continued in 1969, and in 1970 up to November, when activities were hampered by a severe cyclone which hit the Chittagong area and disrupted much fishing and other activities. In the latter half of 1969, exploration of the breeding grounds of Indian mackerel (Rastrelliger kanagurta) was commenced, in addition to biological and oceanographic investigations. During this period, using a mid-water trawl with netsonde equipment, there were Rastrelliger catches of 2 000 kg per hour, indicating a fairly rich source. Shrimp was also located in four areas in November-December 1969 (exact locations not indicated), but the biologist was of the opinion that they were not in sufficient concentrations to be considered promising. Further

investigations were considered necessary. In the meantime, the existing oceanographic data were assembled and analysed and training of the crew both on board and on shore proceeded. The crew for both vessels were drawn from the local fishing community.

The Fishing Gear Technologist, who arrived in March 1967, designed and supervised the construction and repair of fishing gear and trained local recruits. He left the project in September 1969 on completion of his assignment, and the counterpart assumed some of the expert's duties. During this period, 70 gillnets, dredges for shellfish, lobster traps, longlines, bottom longlines and trawl doors were designed and made locally. Modifications were also made on Japanese trawls and "Star" trawls. Advice was also given during the initial production period to the Comilla Nylon Net Factory. The Fish Processing Technologist demonstrated better methods of drying, smoking and canning fish, and a pilot plant for distribution of chilled fish at Cox's Bazar was established. Advice on quality control was given to the private sector shrimp exporters. Plans were also made for a Marine Fisheries Village Identification Survey and the required data were collected. In August 1969, a new Project Manager was appointed.

In early 1970, a joint UNDP/FAO mission reviewed the project. Their main observations were that (a) sufficient attention had not been given to the economic aspects of the project work and it was logical, they said, that the activities of the vessels should develop information which could determine the feasibility of commercial fishing operations, (b) an export economist was needed, and (c) the training programme was too slow, in the main due to the poor educational background of the fishermen. They also recommended that the Headquarters of the project be moved from Dacca to Chittagong, so that there would be more first-hand information on fisheries available and also to ensure better supervision of the vessels.

By November 1970, it was becoming increasingly difficult to conduct the activities of the Project in view of civil disturbances. In April 1971, all the experts were evacuated to Bangkok. Although the Project Manager, the biologist and the statistician returned in August, there was no

change for the better in the internal situation. The trawler MEEN SANDHANI and the launch ALMARINE were requisitioned by the Army in August and no field work was possible. By October-November, civil war broke out and all the experts were evacuated. No exploratory fishing was done throughout 1971, in the early part of the year partly because of engine breakdowns and civil disturbances, and in the latter part of the year entirely because of civil disturbances.

### Results

Exploratory Fishing - Trawling was confined to a 10 000 square mile area north of latitude 20° 40'. Three fishing grounds were identified. There were indications of good concentration of pelagic fish which could be caught during the short spawning period in the "Middling" fishing grounds. The Mexican type shrimp trawl was found to be most effective for shrimp during monsoon fishing, the average catch being 29 kg per hour. It was also demonstrated that in the South Patches, trawlers similar to SAGAR SANDHANI (165 tons) would be able to operate for 270 days per annum.

Fishery Biology - The specialist arrived in May 1967 and stayed for four years. With the masterfisherman he planned the exploratory cruises. His studies indicated that the migration of fish coincided with environmental changes caused by the influx of large quantities of fresh water from the rivers during the wet monsoon (June to September). In the "Middling" grounds Indian mackerel (Rastrelliger kanagurta), horse mackerel (Decapterus russelli) and mackerel scad (Decapterus kurroides) spawn during August to November and provide commercially exploitable concentrations. Spawning concentrations of shrimp (Penaeus indicus) were observed in August in the South Patches fishing ground opposite Elephant Point, but as they occurred in rather circumscribed locations, the biologist was of opinion that they were not indicative of abundance and recommended further studies. It was concluded that the Bay of Bengal was capable of providing sustained catches of at least 40 kg/ha of demersal and pelagic fish. A maximum additional resource of 57 000 tons was thus estimated to be available for capture annually. A Fishery Laboratory and Museum were

established at Chittagong. A working paper on "Fishery Biology" was being prepared and counterpart staff were trained.

Oceanography - Six oceanographic cruises were made and a total of 123 stations worked, which included observations on temperature, salinity, dissolved oxygen, and colour and transparency of water. The most significant factor limiting distribution of demersal fish in the area was the low content of dissolved oxygen in depths of 100 metres and below. There were considerable variations in the upper boundary of this low oxygen zone from 60 metres in February 1966 to 100 metres in February 1971. The effect of the freshwater influx was also observed, but the studies were too limited to draw definite conclusions. Further oceanographic research was recommended.

Fishery Statistics - The work of the fishery statistician was defined as the development and improvement of fishery statistics and the recommendation of measures to introduce an adequate system within the national framework. A Marine Fishing Village Identification Survey (MFVIS) was conducted in 1967-68 and on this basis a Survey on Marine Fisheries and a Fish Market Survey were designed. For the Marine Fisheries Survey, the area was divided into three zones - eastern, western and the remote islands of Katubdia, Sandwip and Hatia. The Survey commenced on 1 November 1970, but the cyclone disrupted the work in zone 3. By October 1971, the replies to the questionnaires for November-December 1970 and January-February 1971 in respect of the other areas, were received and tabulation commenced. The Fish Market Survey on fish landings and prices by species for freshwater and marine fish was confined to Chittagong and Cox's Bazar and commenced on 1 November 1970. Figures up to February 1970 had been compiled. The conclusions are not available.

The project had successful discussions with the census authorities to urge the inclusion of a special stratum for fisheries in the proposed 1972 Agricultural Census. Training was given to counterpart staff and one statistician was sent on a fellowship to the Far Eastern countries to study statistical methodology and field work for a period of six months. It was the project's view that the Marine Fishing Village Identification Survey would provide a satisfactory sampling

frame for future fishery surveys. The project also assisted in the survey for the relief and rehabilitation of fishermen affected by the cyclone of November 1970. A report entitled "Development of Fishery Statistics in East Pakistan" was in the course of preparation.

Fish Processing - Two processing technologists served the project from April 1967 to May 1970. Experiments were carried out to improve the drying of fish. Practical demonstrations were given in fish handling and processing and assistance was provided for the processing of frozen fish fillets which were being flown to Dacca. Civil disturbances interrupted this work. A pilot processing plant was opened in Cox's Bazar. Experiments in fish canning, though successful, were found to be uneconomic owing to the high cost of the cans. The senior counterpart processing technologist was sent on fellowship training to Canada and the Netherlands for 6 months. In May-June 1970, an FAO shrimp quality control consultant visited the project and recommended quality control measures for shrimp. A paper on a "Survey of export shrimp industry and need for standardization and inspection" was submitted to the Government.

Marketing - It was observed that markets for the increased fresh fish production existed in the fast-growing urban areas and in the neighbouring city of Calcutta and for dried and salted fish products in the hill tracts of Chittagong and Burma.

An FAO fishery economist visited the project in January-February 1971, and conducted a course of lectures on investment evaluation techniques. The project also assisted and advised the EPFDC in the preparation of its development plans for the establishment of a fishermen's training centre, freezing plant and cold stores and on the import of inboard engines for the inshore fisheries.

The Terminal Report contains the following conclusions and recommendations:

1. The catch of the near-water fishery could be doubled by the introduction of 30 100-ft trawlers equipped with 650 H.P. engines, phased over a period of five years. Qualified expatriates will have to operate the trawlers and

local masterfishermen and engineers will have to be trained. A Training Centre for deckhands should be established at Chittagong.

2. Larger mechanized boats, more fish carriers and more training should be provided to the inshore fishery. Masterfishermen should be trained at the Chittagong Training Centre referred to above. Small trawlers, preferably of ferrocement, should be introduced to the inshore fishery.
3. Simultaneously action (unspecified) should be taken to raise the efficiency of the artisanal fishery.
4. The feasibility of Bangladesh joining SEAFDEC to benefit from the research and training at their Institute should be explored.
5. The present Government regulations that Masters and Engineers of fishing vessels should serve in the mercantile navy before they can obtain the Skipper's Certificate, should be withdrawn.
6. EPFDC should concentrate on the industrial development of the marine and inland fisheries; all research (excluding

product development) should be transferred to the Department of Fisheries.

7. A statistical division financed by the Government, consisting of six branches - General Fishery, Census, Marine Production, Market Survey, Inland Water Production and Fishery Economics, should be established under EPFDC.
8. A continuous national research programme in fishery biology should be carried out and detailed studies of the spawning and migratory patterns of pelagic fish and a study of shrimp stocks should be started.
9. More exhaustive studies (unspecified) in oceanography should be undertaken and action initiated to recruit and train specialists in physical and chemical oceanography.
10. Quality control should be introduced, both for exports and local sales.
11. A 10-ton per day freezing plant and a 500 ton cold storage (-10° to 15°) at Chittagong and a 50-ton cold storage in Dacca should be installed.

DP/IND/66/555

INDIA

Pre-investment Survey of Fishing Harbours - Status Report as at 30 August 1972

D.P. Contribution	U.S.\$ 1 322 200
Government	U.S.\$ 395 760
	<u>U.S.\$ 1 717 760</u>
Expended as at 31 May 1972 (D.P. Funds)	U.S.\$ 1 025 613

Project Manager - Bogg, A.C.

Project Co-Manager - Bhakta, N.P.

Mailing Address: Pre-Investment Survey of Fishery Harbour Projects  
64 Palace Road  
Bangalore  
Mysore, India

Location of Office - Bangalore

Sub-Contractor - SCANDIACONSULT

Purpose

To assist the Government in conducting the necessary economic and technical studies to identify priority sites for the development of fishing harbours and to prepare preliminary construction plans for these harbours and their supporting facilities.

Operational date - 20 October 1967

Termination date - 19 October 1972

Progress

According to the Plan of Operations, the project was expected to examine about forty sites and submit detailed designs

with plans and estimates for undertaking the construction of 14 harbours on the east and west coast of India.

The Project Manager arrived in Bangalore on 4 August 1967. Up to the end of January 1968 he was busy establishing the headquarters, preparing specifications for the tendering of professional engineering services and equipment and arranging for the assignment of counterpart staff. By January one counterpart officer, the Project Director, had been assigned.

In February 1968, proposals for the engineering services were invited, but owing to various amendments, the proposals had to be recalled. New invitations were issued in September 1968. During this period the Project Manager conducted preliminary investigations and discussions on the proposed sites.

The Engineering Services Contract was signed and the Project Engineer arrived in March-April 1969. All the FAO and sub-contractor's staff had arrived by end of July

and four out of eleven counterpart staff had been assigned.

The first survey at the Malpé site commenced on 4 July and by the end of 1969, engineering and economic surveys and soil mechanics investigations were well under way at Malpé and Honaver (Mysore) and Ratnagiri (Maharashtra). In 1970, surveys and investigations commenced in Jaigarh (Maharashtra), Kakinada, Narasapur and Nizampatam (Andhra Pradesh) and preliminary examination of several sites in Orissa, Andhra Pradesh and Goa were also undertaken. Owing to the late start on surveys and investigations, it was found necessary to extend the contract of SCANDIACONSULT up to October 1972, and in January 1971 UNDP approved an additional allocation of U.S.\$ 510 900 to the project, of which U.S.\$ 430 900 were earmarked for the sub-contractor's work.

Progress was steady through 1971, and the following table gives the position as at 30 August 1972.

<u>Site</u>	<u>Technical Report</u>	<u>Economics Report</u>	<u>Designs</u>
1. Malpé	Completed	Completed	Completed
2. Honaver	Completed	Completed	In progress
3. Ratnagiri	Completed	Completed	Completed
4. Jaigarh	Completed	Not necessary	No designs necessary
5. Kakinada	Completed	Completed	Completed
6. Narasapur	Completed	First report completed, Supplementary report prepared	90% Completed
7. Nizampatam	Completed	Supplementary prepared	In progress
8. Dhamra	Completed	Under preparation	In progress
9. Dighi	Completed	Under preparation	Completed
10. Dahanu	Sent for printing	Being typed	Nearing completion
11. Satpati	Sent for printing	Not required	No detailed work envisaged
12. Chinnamuttom	Completed	Sent for printing	In progress
13. Kodingakkarai	Sent for printing	Nearing completion	In progress
14. Neendakara	Draft ready	First report with printer, second being typed	In progress
15. Ramayapatam	-	Detailed hydrographic survey and soil investigations completed. Preparation of designs before October 1972 (termination date) will not be possible owing to lack of data on wave and littoral drifts.	
16. Mallipatnam	-	Field work completed and engineering report sent to printer. Economics report under preparation.	
17. Iskapalli	-	No separate reports, as this will be included in the Ramayapatam reports.	



Conclusions:

The target in the Plan of Operations was a study of 40 sites and detailed investigations

and reports on 14 harbours. Eighty sites were studied and by October 1972 (termination date), the project will have finalized:

- (a) 13 Economics reports covering 14 sites recommended for development
- (b) 13 Engineering reports covering survey, soil mechanics and designs for 13 sites recommended for development
- (c) Two reports covering investigations at Satpati and Jaigarh which are not recommended for development in the present decade
- (d) Approximately 220 drawings of detailed designs covering civil engineering works for 13 sites, and
- (e) 40 drawings of detailed designs for cradles and transfer systems for 200 and 60 ton slipways.

DP/IND/69/595

INDIA

Pelagic Fishery Investigation on the Southwest Coast - Status Report as at 31 May 1972

D.P. Contribution	U.S.\$ 2 024 700	Project Manager	- Olsen, S.
Government	U.S.\$ 988 247	Co-Manager	- Devidas, Menon
	<u>U.S.\$ 3 012 947</u>	Mailing Address:	Pelagic Fishery Investi- gation on the Southwest Coast Project P.O.Box 1791 Ernakulam Cochin 16, India
Expended as at 31 May 1972 (D.P. Funds)	U.S.\$ 1 083 174	Sub-contractor	- NORAD

Location - Southwest coast of India, southward from Ratnagiri, both offshore and inshore areas

Purpose

To assist through resource surveys in the development of sardine and mackerel fisheries on the southwest coast. In particular the project will:

- (a) Assess the abundance of the stocks of sardines and mackerel and their fluctuations and study their spatial and temporal distribution in relation to the environment and the consequential changes in the availability of the fish to the fisheries.

- (b) Study the life history of sardines and mackerel including migration, reproduction, growth and mortality.
- (c) Study the behaviour of these species with special reference to the efficiency of tactics and methods of fishing.
- (d) Conduct fishing experiments for the purpose of finding efficient methods and gear.

Operational date - 3 February 1971  
Termination date - 2 February 1976

<u>Type of Fishing Vessels</u>	<u>Name</u>	<u>LOA</u>	<u>G.T.</u>	<u>H.P.</u>	<u>Delivery</u>
Stern trawler/Purse-Seiner	RASTRELLIGER	46 m	298	1 200	July 1972
Combination fishing	SARDINELLA	16.5 m	299	150	May 1971

RASTRELLIGER, provided with acoustic equipment, will be used for investigation of the deep waters of the continental shelf, particularly with respect to those resources which can be taken by purse-seining and mid-water trawling. SARDINELLA, similarly equipped but on a smaller scale, will survey shallow inshore waters.

The SARDINELLA arrived in mid-May 1971. International staff were recruited and counterpart scientists were assigned in August. Owing to rough weather in June and July, work was restricted to fortnightly day trips off Cochin, commencing 7 June, for temperature measurement and echo survey. By August with weather conditions improving, purse-seining commenced. In September, the first coastal physical and biological oceanographic survey commenced and surveys continued till the end of the year. By the end of October, the entire coastal belt within 20 miles off-shore from Karwar to Trivandrum was surveyed once. Collection of plankton commenced in early September on all hydrographic stations. The first surveys revealed the scarcity of fish eggs and larvae during this period preliminary. Sampling of commercial catches and the collection of statistics commenced.

In June and July, accumulations of white-bait (Anchoviella commersonii) were located in a belt 5-15 miles off Cochin. They occurred in large schools off the bottom and were easily caught with a mid-water trawl (up to 400 kgs in a ten minute haul). According to the first studies, these appeared to be pre-spawning concentrations and the first conclusions were that these resources in June and July might well support a commercial mid-water trawl fishery for white-bait. Through all this period surface schools were observed in the area of Cochin. From mid-August with improved weather conditions, adult mackerel were caught by purse-seining, confirming similar results obtained previously by the Indo-Norwegian project. In September and October, heavy concentrations of mackerel and sardines were observed in the top 15 to 20 metres of water between 6 to 20 miles offshore. The hydrographic data collected confirmed previous findings that, below a narrow surface layer at this time of year, the waters are so low in oxygen that they are devoid of fish.

By the end of 1971, the project was able to arrive at the following tentative conclu-

conclusions:

- (a) Sardines and mackerel are found in relatively large numbers a few miles offshore prior to the traditional inshore fishing season.
- (b) They are found in the upper layer of the water owing to the low oxygen content of the underlying waters. It is, therefore, a fishery that could be exploited by small vessels during this season without need for expensive investment in boats and berthing facilities. The possibility exists of using part of the existing shrimp trawler fleet, which is completely idle during this period.
- (c) Demersal fishing is not productive during this period, owing to the oxygen stratification referred to above.

In the first half of 1972 the SARDINELLA continued operations and completed 29 hydrographic/plankton transects. In addition, six coastal surveys were completed in the shallow coastal waters (less than 40 metres) between 8°N and 16°N. Sampling of commercial catches and collection of statistics continued throughout the period and the data were being analysed. The larger vessel RASTRELLIGER was under construction and was expected to be delivered in July 1972. The mackerel and the oil sardine during this period (December-May) were not located in consistent and large concentrations anywhere in the coastal waters surveyed. Explanations for this phenomenon will have to be sought when the RASTRELLIGER, capable of operating further offshore, commences operations.

The tentative conclusions reached in the first surveys were now confirmed.

- (a) With the exception of a narrow surface layer distributed all along the coast, the underlying waters are low in oxygen content and immediately after the southwest monsoon (September early October) demersal fishing is not productive.
- (b) A mixed pelagic community, including ribbon fish, silver bellies (Caranx kalla, Ambassis sp.) and white-bait (Anchoviella sp.) exists in the area. The latter is widely distributed all

along the coast from about 9°N to 16°N. An annual yield of 100 000 tons is estimated.

period before the inshore season commences.

(c) Horse-mackerel in significant quantities is found near the shore south of Quilon.

(e) Mackerel and sardine do not occur inshore during May to December.

(d) The sardines and mackerel could be captured with purse-seines during the

(f) There is upwelling of the water over the coastal shelf during the monsoon season.

TF/INS/405  
DP/INS/68/022

INDONESIA

(1) Technical Assistance to Aertembaga Skipjack Tuna Live-bait Fishing  
(in coordination with INS 526 Project) - Status Report as at 30 June 1972

Allocation	U.S.\$ 360 000	Masterfisherman	- Kawakami, Z.
Expended as at 31 May 1972	U.S.\$ 43 060	Mailing Address:	c/o UNDP Representative P.O.Box 2338 Djakarta, Indonesia
Location	- North Sulawesi		
Duration	- 15 July 1967 to 30 September 1969		

(2) Deep Sea Fisheries Development (Skipjack Fishing) - (in coordination with INS 526 Project) - Status Report as at 30 June 1972

D.P. Allocation	U.S.\$ 65 625	Masterfisherman	- Kawakami, Z.
Expended as at 31 May 1972	U.S.\$ 60 565		
Location	- Ambon		
Duration	- 15 January 1971 to 30 March 1972		

These two projects are being considered together because of their related nature and the fact that one expert, a masterfisherman, served both. His terms of reference in respect of Project (1) were "to improve the tuna fishery, develop the live-bait methods suitable to local conditions and to conduct a feasibility study of the export of tuna", and in respect of Project (2) "to assist the Government of Indonesia in conducting a survey of bait supply around Ambon, with a view to determining a size of the skipjack fishing fleet which the bait supply can support."

situation, decided to commence the survey at Halmahera and adjacent areas where local fishermen had reported that substantial supplies of live-bait for a skipjack fishery were available. From August to September 1967 a survey of bait grounds east of Bitung was conducted using the Indonesian Navy, Department of Oceanography vessel M.V. GOMURU and other tuna vessels. Heavy catches of bait, exceeding 500 kgs per vessel per night were reported off the west coast of Morotai Island.

In February-March 1968, a 40 day survey with the M.V. JALANIDHY was done in the Molukka and Banda Seas, during which 12 potential bait fishing areas were identified, the most promising being Bangkalau Bay, Peleng Bay and Staring Bay. Bag nets with lights were used. Twenty-eight schools of skipjack tuna were also

Progress

Project (1)

The expert arrived in Aertembaga on 4 August 1967 and, after studying the local

observed south of the Banggai and in the vicinity of Kendari and Gunung Api Island.

It was decided to experiment with a Japanese stick-held dip-net (Bouke-Ami) for bait catching. Materials were ordered in mid-1968, but arrived only in 1969. By August 1969, the stick-held dip-nets were constructed under the expert's supervision and fishing operations commenced using tuna vessel TB-8 provided by the State Fisheries Enterprise, in the Bangka Strait, Lembah Strait, Ratah Tokok Bay and around Bulutin and Likupan. The results were very encouraging, the gear proving to be more effective than the bag-net. The main bait caught was Stolephorus spp.

Processing of dried skipjack for export was also started on a trial basis and 40 fish were exported to Japan as a sample order. Instructions in the more basic aspects of skipjack fishing were given to local fishermen.

#### Recommendations and Conclusions

- (1) Skipjack and yellow-fin tuna fishing in the eastern Indonesian waters holds great promise and Bitung would be a very suitable base for its development, provided that a vigorous training programme is also launched for existing and would-be fishermen.
- (2) An ice factory and cold storage facilities should be established at Bitung.
- (3) A pilot Arabushi plant should be set up.
- (4) The traditional smoking houses should be improved to ensure better quality processed fish.
- (5) The existing vessels should be improved by the provision of bait-holding tanks with a powered water circulation system, the insulation of the fish holds and the fitting of sea water spray pipes for chumming fish.
- (6) Bigger vessels 18 to 19 metres long, 30 to 35 tons, and fitted with 120 to 150 HP engines should be introduced. With more experience, larger vessels 50 to 70 tons could be introduced.
- (7) The present fibre nets should be replaced with synthetic nets and greater use should be made of Bouke-Ami nets.

- (8) A vessel for training and survey work should be obtained, as many areas still remain unexplored.

#### Project (2)

The expert was posted to Ambon in January 1971. The main purpose of his assignment to Ambon was to undertake a bait survey in order to determine the magnitude of the fishing fleet that could be operated economically.

A preliminary survey was conducted from 24 January 1971 to 13 February 1971 and on the basis of this survey and data obtained locally, the expert observed that catches of bait were decreasing in inner Ambon Bay. In addition, this bait-fish was being consumed by the local population, resulting in less bait-fish being available for the skipjack fishery. It was therefore decided to search for bait resources outside Ambon Bay, in the seas around Ceram, Buru and the Sulu Islands. The non-availability of a vessel till mid-June prevented any surveys being carried out during the dry period February to May 1971, which was the best season for the survey. Ultimately survey boat TB-23, a 39.93 ton, 22.40 metre boat powered by a 121 HP engine was provided on July 18, 1971.

The first survey commenced on 22 July in the Namlea area in Kajeli Bay. The conditions were favourable for bait-fishing operations. Thereafter, observations were made in the waters northwest of Buru, Bara Bay and Tomahu Strait. The vessel returned to Ambon Bay on 3 August. Small concentrations of bait-fish were located in Tomahu Strait, but because of the distance from Ambon and populated areas generally, this was not considered a suitable location for bait. Large schools of skipjack and yellow-fin were observed in Bara Bay. The second survey was conducted from 10 to 15 August 1971 in the Hitu and Piru areas where the most promising results were obtained.

The vessel was sent for docking thereafter and the next survey commenced in mid-September 1971. Surveys were conducted in outer Ambon Bay, in the Hitu area on the north coast of Ambon Island and in the vicinity of the south coast of Kaibobo. A good bait-fishing ground was discovered between Tawiri and Batu Kabur in the outer Bay, which had not been

previously fished by indigenous fishermen. Large quantities of Stolephorous zallingeri, Caesio sp. and Sardinella melanuva were observed. On the north coast of Ambon Island, big catches of Stolephorous devisi were obtained, with one catch of more than 200 buckets. On the south coast, where there are many sheltered bays and coves, Sardinella melanuva and Caesio sp. were caught, but fishing was often disturbed by bigger fish such as Caranx sp. and Sphyraena sp., which were attracted by the light.

The catches of bait and the size of individual fish increased progressively as the survey moved from the inner to the outer Bay of Ambon during this period. The catches in Taiwiri, which is very well located in relation to the skipjack fishing grounds, consisted of Stolephorous zallingeri, Stolephorous devisi, Sardinella melanuva and Decapterus sp., which were also the most suitable in order of priority. The expert noted that Sardinella melanuva and Caesio sp. were more suitable for distant water fishing because of their better holding qualities. The catches in the inner bay were smaller both in quantity and fish size. The south coast area appeared to be the most promising for Sardinella sp. As a result of the expert's operations, some local fishermen have decided to try the Bouke-Ami method themselves. The surveys continued until early November 1971 and big catches of Stolephorous devisi in the Hitu area were made into the latter half of October, even though traditionally this was considered to be the period of poor fishing.

During the period 12 December 1971 to 10 March 1972 the following areas were surveyed for bait: (a) inner Ambon Bay, (b) Ambon Bay, (c) Waai (northeast coast of Ambon Island), (d) Elpaputih Bay (Amahai and Meruru Bay), (e) Latira Bay (Kaibobo area), (f) Lufu (West Ceram), and the following areas were surveyed for skipjack; Ambon, south coast of Haruku, Saparna and Elpaputih Bay and West Ceram.

Despite the non-availability of the vessel TB-23 which had gone for docking, crew rest, etc., from 11 November 1971 to 10 February 1972 the expert investigated the conditions of bait-fishing by the use of beach seines which were being operated in inner Ambon Bay, Waai and Hitu. Owing to the unsatisfactory condition of the survey boat after its arrival and bad weather conditions, the survey was less long-ranging than the earlier ones.

Bait-fishing was started in inner Ambon Bay on 13 February 1972 and fairly good catches of small size Sardinella sp. were made. Operations in the outer Bay gave poor results, owing to the strong currents and swell during this time. In the Waai area, although big schools of Sardinella sp. were attracted to the light, catches were small because of the presence of big predatory fishes, notably barracuda. In Ruhu (West Ceram), although bait-fish in large numbers were attracted to the light, the catches of Stolephorous devisi, Sardinella melanuva and Rastrellinger kanagaruta were small, because of the presence of predatory fish. The operations in the Luhu area were in coral reef areas where beach seines cannot be used. This area is well situated for the skipjack fishery and has much potential for development.

FUNDWI/WIR/68/19

Marine Fisheries Development - Status Report as at 31 May 1972

Contribution - FUNDWI U.S.\$ 1 669 083

Government U.S.\$ 1 290 200  
 U.S.\$ 2 959 283

Expended as at 31 January 1972 U.S.\$ 819 497

Location - Sorong - West Irian

INDONESIA

Project Manager - Sperling, H.\*

Co-Manager - Pandelaki, R.A.

Mailing Address: P.O. Box 414  
 Sorong Irian Barat  
 Indonesia

Sub-Contractor - Nichiro Gyo-Gyo Ltd.  
 Tokyo (November 1969 to  
 March 1971)

Operational date - 30 December 1970

Termination date - 20 December 1974

\* From June 1972

Purpose

To assist the Government in developing marine fisheries in West Irian, in particular:

- (a) assist in development of a skipjack and tuna fishing industry, mainly with pole-and-line, with a view to earning foreign exchange;

- (b) modernize local fisheries by providing the local fishermen with better fishing gear and engines;
- (c) improve and expand the Sea Fisheries School Programme at Biak.

Type of Vessel

Combination Fishing/Training

Name

LOA

G.T.

H.P.

Delivery

9 m

31

April 1971

Five skipjack fishing vessels, one mother vessel and one carrier under NICHIRO sub-contract.

- (b) April 1970 - July 1970. Operation of pole-and-line fishing around Sorong and exploration of live-bait supply and fishing grounds in the northern coastline of West Irian.

Progress

According to the Plan of Operations the skipjack and tuna fishing programme was to be contracted to a competent fishing firm, with the Project Manager recruited by the Executing Agency supervising its work. It envisaged not merely fishing operations, but also the setting-up of necessary shore installations at Sorong and marketing the catch, if justified. The ultimate aim was the establishment of the commercial feasibility of a skipjack and tuna fishery leading to a joint venture.

- (c) August 1970 - December 1970. Based on the exploration specified above, operation on all fishing grounds to find suitable scale, type of operation and vessels and, if possible, the commercial feasibility of operation.

The live-bait in sufficient quantity was a problem at the early stages. The sub-contractor found abundant suitable live-bait on the eastern side of Halmahera and applied for a licence to fish in the area. In May and June the catches had not improved appreciably owing to scarcity of suitable bait, even though skipjack appeared to be available in large quantities in the area of Biak and Jajapura. The catches showed a marked improvement from August onward. In September the catch was around 165 tons and by December 1970, after one year of operation, 2 356 metric tons of fish had been caught, of which over 95 percent was skipjack and yellow-fin tuna.

Although the project was officially declared operational on 30 December 1970 actual operations commenced in November 1969, with the arrival of the first vessel of the sub-contractor. The Project Manager arrived on 24 September 1969. The sub-contractor's vessels came in quick succession and by early February 1970 the full complement was present. Concurrently, steps were taken to recruit local personnel for work on the vessels as and when required. By the beginning of February, 11 third-year students from the Biak School of Fishing arrived to work in batches on the boats. All the vessels were on the fishing grounds by February. Four pole-and-line boats caught 209 tons of skipjack and yellow-fin by 31 January, of which 73 tons were exported to Japan.

In December 1970 the question of extending the survey period, among others, was taken up with the Government. As the Government believed that the data collected during the year were sufficient and had clearly established that at least a pilot fishery venture was feasible, it agreed to extend the survey period up to 25 March 1971, on the understanding that no additional subsidy from the project funds would be provided for this period. That the sub-contractor accepted these terms and continued fishing operations, even on a reduced scale, is an indication of the potential that existed. It was also agreed

According to the work schedule of the sub-contractor, the operations of the fleet were phased as follows:

- (a) December 1969 - March 1970. Location of sources of live-bait and exploration of fishing grounds around Sorong.

that at the end of this period the Executing Agency would submit to the Government the complete and detailed feasibility study for a commercial pole-and-line fishery project and that the balance of the funds remaining in the allocations for the sub-contract would be utilized for capitalizing a commercial pole-and-line skipjack venture.

The sub-contractor terminated its operations in March 1971 and thereafter submitted two reports, one detailing the activities during the contract period and the other containing a proposal for commercial fishing.

The main conclusions of the survey were: (a) the existence of an abundance of skipjack and yellow-fin tuna in the sea around West Irian, the major fishing grounds being in the waters around Gag Islet, the north coast of Waigeo and Dampier Strait with the Gag fishing ground providing the best catches in March-April, North Waigeo in September-October, and Dampier Strait in December-January; (b) the existence of good bait-fishing grounds around the Islets of Batanta and Gag and the Bay of Fofak in Waigeo Islet and in reasonable quantity in Sorong Port, and off the coasts of Kofian, Dorehoem and Manokwari; and (c) that if the fish are handled well after capture, they could be marketed with profit in foreign countries.

Such factors as inexperienced local crews, delays in obtaining permits in the initial stages, delay in renewal of fishing

and radio permits, and the loss of several weeks when the Menadonese crew resigned also hampered operations. Despite these problems and although not operating on a fully commercial basis, the results were extremely satisfactory.

The IBRD showed interest in following up on the findings and a mission visited Indonesia in August-September 1972. In the meantime a draft proposal was prepared for the establishment of an interim commercial pole-and-line fishery by utilizing some of the remaining funds in the project. It envisages the purchase of the equipment required for locally built boats, an ice plant and other essential shore facilities. According to the proposal, the construction and delivery of the skipjack vessels and the management of the venture would be the responsibility of the Indonesian Government and the executing agency would provide the necessary equipment and ensure its proper use.

NICHIRO, in the course of its fishing survey, provided training for over 100 Indonesians. The number required for the commercial project is greater. Proposals to strengthen the Biak Fisheries School and establish a branch in Sorong are being implemented. The project has proposed changes in the curricula, with greater emphasis on training more deck-hands and fewer specialized and officer class personnel. The fibreglass multi-purpose boat for the training programme arrived in May 1971.

DP/INS/70/007

INDONESIA

Naval Architecture (Fishing Boats)

(in coordination with INS 526 Project) - Status Report as at 31 May 1972

D.P. Allocation U.S.\$ 24 000

Naval Architect - Friedrich, G.E.

Expended as at 31 May 1972 U.S.\$ 26 779

Mailing Address: c/o UNDP Representative  
P.O. Box 2338, Djakarta  
Indonesia

Location - Djakarta

Purpose

In coordination with the Fisheries Development and Training Project (INS 526), the incumbent will:

(a) Assist and advise the Director-General of Fisheries of Indonesia in the design and construction of fishing vessels and in the development of a boatbuilding industry.

(b) Advise operational Development Programme and other technical assistance projects in the field of fisheries with regard to fishing vessel requirements, specifications, construction and other technical aspects of fishing vessel development.

(c) Give in-service training to Government counterpart personnel.

Operational date - 1 September 1971  
Termination date - 31 August 1972

Progress

After his arrival in Indonesia on 16 September 1971 the expert assisted the Project Manager in resolving certain technical problems in regard to two fishing

DP/INS/71/526

Fisheries Development and Training - Status Report as at 31 May 1972

D.P. Contribution      U.S.\$ 1 246 210  
Government            U.S.\$ 1 165 000  
                             U.S.\$ 2 411 210

Expended as at 31 May 1972  
(D.P. Funds)      -      U.S.\$      450 939

Location - Djakarta and Tegal

Purpose

To assist the Government in strengthening training in modern fisheries techniques at the Academy of Fisheries in Djakarta and the

<u>Type of Fishing Vessel</u>	<u>Name</u>	<u>LOA</u>	<u>G.T.</u>	<u>H.P.</u>
Shrimp Trawler	TABULA RASA	23 m	100	200
2 Launches		12 m		
Fishing Vessel			40	
Shrimp Trawler	MUTIARA I	23 m		350
Trawler	MUTIARA II	20 m		165
Trawler	MUTIARA III	20 m		165
Purse-Seiner/Trawler	LEMURU	29.35 m	165	510

Progress

Although the project became operational on 6 July 1971, a fair amount of pre-project planning and activity preceded the operational date. The Project Manager (designate) arrived in Djakarta on 31 August 1970, the Fish Marketing Expert on 19 January 1971 and the Masterfisherman (duty station, Tegal) on 3 February 1971. Buildings and office equipment worth U.S.\$ 450 000 were given by the Government as part of its contribution. Inventories of boats and equipment used and varieties and quantities of fish caught per annum in the Java Sea were prepared by the Masterfisherman. A study of the marketing structure for fish and fishery products in Indonesia was commenced and plans and drawings for a main central fish market to replace the present one in Djakarta were prepared.

vessels under construction for the Department of Fisheries and assisted the Project Manager in Aertembaga in preparing definitive layouts, specifications and the general arrangements of the 30 fishing vessels to be built with IBRD financing. In January 1972 the project was absorbed by Project INS 526 and the progress of the work will be reported in the review of that project.

INDONESIA

Project Manager      - Kvaran, E.  
Project Co-Manager - Hadi, Atmowasono  
Mailing Address: Fisheries Development and Training Project  
P.O. Box 2338, Djakarta  
Indonesia

fisheries high school in Tegal, and to promote fisheries development through advisory services to the Directorate of fisheries.

Operational date - 6 July 1971  
Termination date - 5 July 1973

<u>LOA</u>	<u>G.T.</u>	<u>H.P.</u>	
23 m	100	200	} Owned by Government
12 m			
	40		
23 m		350	
20 m		165	
20 m		165	
29.35 m	165	510	

By 15 July 1971 a new Project Manager was appointed and agreement reached on the scope of the project. By 1 September the Institutions and Services Expert (stationed in Djakarta), the Fishermen's Training Officer and the Fishing Technologist Instructor (both stationed at Tegal) were also on duty. Recruitment of the Marine Engineer and the Naval Architect was in process, and the Co-Manager, the Director of the Fisheries Academy, had been appointed. Counterpart staff were assigned and office accommodation, lecture rooms and workshops, with the exception of the engine workshop and navigation bridge at Tegal, had been provided. The Project Manager reported that although the two small (45 HP) training vessels, the old TABULA RASA (a 100-ton shrimp trawler) and two 80 GT combination



trawler/purse-seiners which would be available in the near future were not the best suited for training and demonstration purposes, they would suffice for the minimum requirements for 1971/72. He was of the opinion that two 150 GT specially designed training vessels would be required for the future.

A one-month practical training course in net-making, seamanship and fish catching techniques commenced in Tegal on 1 September 1971. A survey of fish landing centres and distribution facilities in 21 towns and villages was completed. The general supervision of the Fish Preservation Project, Madura and the Fisheries Improvement Project at Lombok was entrusted to the Project Manager. By 31 December 1971 eight experts were in the field. Sea training, however, was badly affected as only the 100 GT TABULA RASA was available and that for too short a spell.

A paper entitled "On the Question of Fisheries Development in Indonesia" was prepared by the Institutions and Services Expert. The Marketing Expert continued his surveys relating to prices, processing and distribution of fish and fish products. The Naval Architect absorbed from the INS 007 project, advised on specifications and equipment for vessels required for the Aertembaga skipjack fishing project, the final aspects of the two 60-ton combination fishing vessels being built in Djakarta for the Department of Fisheries, and advised the ADB on the type of vessels proposed for the Riau Islands, which it is interested in financing.

Training in trawl net-making and related subjects was given to third-year students at the Academy of Fisheries in Djakarta. In Tegal, the second training course for 40 third-year students and the third course for 40 first-year students were run concurrently from 7 October to 7 December 1971. Simultaneously, training of instructors of the Academy and the High School continued. No sea training was possible because of the lack of vessels. Experimental fishing with two 18 metre vessels powered by 100 HP engines and using a net made by

the students was also carried out. Beam trawling for shrimp and scallop was tried out off the north central coast of Java.

The Project Manager was appointed Chairman of a Technical Advisory Group by the Director-General of Fisheries to review tender bids for vessels and equipment for the IBRD financed skipjack project at Aertembaga.

By 31 March 1972 ten experts were in the field, including the live-bait expert at Ambon. During the period 1 February 1972 to 30 April 1972, the major activity was concerned with providing data and advice for the draft requests that were being made by the Indonesian authorities to the IDA/IBRD for loans amounting to almost U.S.\$ 65 million for the following projects:

Sorong - Skipjack fishing project (see separate review). The project was mainly concerned with providing data regarding the size of vessels and preparation of a draft fishing venture.

Ambon - Skipjack fishing project. The live-bait expert's report was finalized.

Cold Chain for Java - Case studies with costs and earning estimates were prepared.

Rehabilitation of brackishwater swamp ponds (Tambak) - Assistance was given in the preparation of a request for an IDA/IBRD loan.

Fishermen's Credit - This is meant primarily for the small-scale fishermen. A total of U.S.\$ 50 to 60 million was considered necessary for the building of 2 000 small mechanized boats, 100 shrimp trawlers of 100-150 GT and 50 purse-seiners of 100-120 GT. The period of implementation has not been indicated. For the preparation of more accurate information necessary for the IBRD request, the Project Manager requested the recruitment of a Fisheries Credit Consultant.

Training Institutes - Specifications of equipment required for the Training Institutes were prepared.

Fish Terminals and Fish Harbours - In association with the IBRD Market Expert, a reorganization of markets was planned and a pre-investment study for five major fish terminals was prepared.

In April 1972 the first batch of 60 trainees was enrolled for a six-month training course comprising three months on shore and three months at sea. The shrimp trawler MUJIARA I under the command of the Fishing Technologist, went on exploratory training work with trainees from the Academy at Djakarta and the High School

at Tegal, off the south and east coasts of Kalimantan. The Naval Architect advised on modifications to the 40 GT skipjack vessel and also prepared design drawings for the FUNDWI 19/21 training vessels to be built at Badjo. As at January 1972, the project had absorbed the posts of Live-Bait Fishing Expert (Ambon), Fishery Statistician and Naval Architect, which had earlier been financed under the Technical Assistance Programme, and three extra posts of Coordinator, Masterfisherman (tuna fishing) and Ship's Engineer were created.

JORDAN

DP/JOR/68/511

Fishery Development - Status Report as at 31 January 1972

D.P. Contribution U.S.\$ 966 000

Government U.S.\$ 442 597

U.S.\$ 1 408 597

Expended as at 31 May 1972 U.S.\$ 848 537

Location - Aqaba

Project Manager - Roberts, D.A.

Project Co-Manager - Dr. Shahwan

Mailing Address: Fishery Development Project  
P.O. Box 45, Aqaba  
Jordan

Sub-contractor - Fisher Edge and Co. Ltd.,  
U.K.

Purpose

To assist in the development of Jordan's fishing industry by means of a demonstration distant-water fishing scheme. In particular, the project will:

- (a) Conduct fishing operations.
- (b) Train Jordanian fishermen in fishing operations.

- (c) Assist in the development of efficient fish marketing systems.
- (d) Provide advisory services on the administrative and institutional aspects of fishery development.

Operational date - 13 July 1970  
Termination date - 17 March 1973

<u>Type of Fishing Vessel</u>	<u>Name</u>	<u>LOA</u>	<u>G.T.</u>	<u>H.P.</u>	<u>Delivery</u>
Stern Trawler	TAREQ II	33 m	200	900	August 1970

The project became operational on 14 July 1970 when the TAREQ II left the United Kingdom for Aqaba after repairs and refitting. The Project Manager joined the ship at Aden on the last leg of its journey. The vessel, managed by the sub-contractor, commenced fishing operations on its voyage from Aden to Aqaba on 6 August. The freezing system failed to operate in sea water temperatures of 36°C, and the vessels had to be docked at Aqaba to await expert investigation of its defects. In September the security situation in Jordan

compelled the transfer of the vessel to Aden. The vessel remained in Aden till February 1971, when the security situation improved and the defects were remedied.

From August 1970 to May 1971 a total of 61 days was spent on fishing operations, and 27 tons of fish were caught during the period February to May 1971. The refrigeration system continued to give trouble, even after the repairs, and the only solution appeared to be to overhaul the entire

system which was estimated to cost U.S.\$ 100 000. This defect hampered operations and affected landings as not more than 20 tons of fish preserved in ice could be landed per month. Nine Government trainees joined the project in January 1971.

A preliminary cost analysis prepared by the Project Manager showed that as the known fishing grounds were almost 1 000 miles away in the southern part of the Red Sea, it would be more profitable to market the fish

at Aden than to take the catch all the way to Agaba, provided of course that fishing rights were obtained from the Yemen Arab Republic. During the period 1 August to 31 August 1971 fishing operations continued and 96 tons of fish were caught. Good fishing grounds were located off the Yemen Arab Republic coast. Fishing rights, however, had not been obtained by November 1971 and the Project Manager reported that there was little hope of establishing a commercially viable fishery in such a situation.

DP/MAG/68/515

MADAGASCAR

Fishery Development - Status Report as at 31 May 1972

D.P. Contribution	U.S.\$	966 500
Government	U.S.\$	422 000
Total	U.S.\$	<u>1 388 600</u>
D.P. Additional Allocation	U.S.\$	104 000*
Final Total	U.S.\$	<u>1 492 000</u>

Project Manager - Collart, A.

Project Co-Manager - Rakotovahiny, E.

Mailing Address: Fishery Development Project  
P.O. Box 1348  
Tananarive  
Madagascar

Expended as at  
31 May 1972 - U.S.\$ 711 995

Purpose

To assist the Government of Madagascar in training the administrative and technical personnel required to form the nucleus of a Government fisheries service; to carry out the studies necessary prior to the establishment of a modern marketing system and to undertake fishing trials to

determine how best to exploit the available stocks. In particular, the project will help to develop the basic economic infrastructure for a national fishing industry.

Operational date - 5 December 1968  
Termination date - 4 December 1972  
Revised Termination date - 4 December 1973

<u>Type of Vessel</u>	<u>Name</u>	<u>LOA</u>	<u>G.T.</u>	<u>H.P.</u>	<u>Delivery</u>
Combination Fishing Vessel: (Purse-Seiner/Trawler, Long-Liner/Live-Bait)	FAO 60	29 m	150	450	July 1971

The project has two chronological aspects:

1. 1969-1970 (a) counterpart staff training, assisting in organization of the fisheries service, and the drafting of fishery legislation, (b) fishery economics and fish marketing study.
2. 1970-1972 (a) evaluation of demersal and pelagic resources through exploratory fishing, (b) determination of

maximum sustainable yields, (c) assistance to improve existing facilities for the operation of a fishing industry.

Although definite periods have been assigned to the two aspects, certain items necessarily overlap. Fishery economics and fish marketing studies are intimately connected with item (a) of aspect 2 and a completely satisfactory fishery economics and marketing study cannot be done without

\* For extended period

the data from the evaluation of demersal and pelagic resources. Similarly, training of counterpart staff would necessarily involve practical work at sea, which is taken up in aspect (2) item (a).

### Progress

Counterpart staff training has proceeded satisfactorily. The counterpart biologist returned after training abroad and the other counterpart staff have been attached to the experts for practical training in the various fields. Fifteen trainees from the National Maritime School - Fisheries Section - have been given practical training on board FAO 60 in navigation techniques, the use of instruments and machines, and in fishing during routine exploratory trips in the Majunga area. Proposals have also been made to the Government for the setting-up of a Fisheries Administrative Service, but difficulties in funding and staffing have prevented their early implementation.

Draft fishery legislation, details of which are not available, has been proposed to the Government. All the proposals have not yet been adopted as law, but one result has been the promulgation of Decree No. 71238 of May 1971 regulating trawling in the territorial waters, and shrimp fishing off the northeast coast of Madagascar. The latter has been considered by the Project Manager as particularly important, as it will help to conserve stocks of juvenile shrimp.

Marketing and economic studies have been completed. Observations have been recorded of the volume, qualities and varieties of fish sold in the more important sectors of the capital. Because of insufficiency of fish production, it has not been possible to observe the proper operation of the fish distribution system. The Project Manager was of the opinion that the situation did not warrant a full-time marketing expert, and he was transferred in May 1972. Funds, however, were provided for a pilot marketing scheme, but no evaluation of the work is available at present.

Through the initiative of the project and the assistance of the experts, local interests were activated in the construction of a prototype ferro-cement boat. A local fishing company consequently placed orders for four trawlers (13.6 m) based on FAO plans, with an option for two more.

According to the Project Manager, this represented an investment of U.S.\$ 250 000. The first of these boats has already been put to use. The construction is being done in the shipyard at Diego-Suarez, the most important and best equipped in Madagascar.

Exploratory Fishing - FAO 60 arrived in Madagascar on 15 September 1971 but because of the long voyage from Spain could be taken out on trials only in mid-October. Defects in the machinery and equipment were observed in the first trials and these were attended to in addition to fitting up the ship for fishing during November, December 1971 and January 1972. The vessel, in effect, was available for regular operation only in February 1972. Operations commenced in February and have continued in terms of the programme, except in the month of May, which was interrupted by local disturbances. Numerous tuna (Euthynnus pelamys and Neothunnus albacores) were observed on the fringes of the northwest and northeast coasts from November to January. No fishing was done during this period except perhaps capturing a few fish for demonstration purposes. In February an abundance of tuna bait-fish, notably Sardinella sirm and Sardinella gibbosa was noticed on the northwest coast. These bait-fish were successfully caught with a lampara seine and kept live on board FAO 60. In March-April FAO 60 made two long trips, from Majunga to Tamatave and from Majunga to Tulear, exploring the entire area of the continental shelf.

With the cyclonic period coming to an end in May, the northeast, northwest and southwest coasts were explored and found to be relatively poor in pelagic resources (notably tuna). On the other hand, concentrations of fish were located in the depths and in several spots off the west coast, but always in rocky areas and coral reefs where fishing is dangerous. Investigation of these areas and the bays was not possible because of the difficulties of navigation and the Project Manager recommended that a small ferro-cement boat (10.6 m) be used for the purpose). The possibilities of expanding the yellow-fin and skipjack surface fishery presently undertaken by a Japanese firm with three tuna pole-and-line vessels and one carrier boat based at Nosy-Bé and Diego-Suarez, were examined and the biologist participated

intermittently in these commercial operations. The research observations of FAO 60 confirmed the experience of the commercial fishery, namely, the existence of bait on the northwest coast and the good prospects of commercial exploitation of small tuna in a fishery zone 150 to 300 miles off the northwest and northeast coasts.

During November-December 1971 the services of a naval architect were obtained for the construction of a prototype ferro-cement boat (10.6 m) for artisanal fishermen, with the idea of training local personnel in this technique. A request was also made for a consultant in mariculture for a period of three weeks in May 1972 to select suitable locations and prepare a development plan in this field.

The work done so far permits the following tentative conclusions in regard to resources:

- (a) Valuable bait-fish are available in abundance during the season November to February.
- (b) These bait-fish can be captured and kept alive.
- (c) Sizable quantities of small tuna occur during the season within a 150 to 300 mile perimeter off the northeast and northwest coasts.
- (d) Madagascar has the possibility of attracting large investments in this field, owing to the existence of the Port of Diego-Suarez which is well situated and fitted out with suitable facilities for a tuna fleet.

A prototype ferro-cement boat has been successfully introduced and fishing companies have already shown interest in purchasing these boats. The introduction and development of fish culture, particularly in the west coast, is a distinct possibility.

DP/MAL/68/520

MALAYSIA

Fishermen's Training Centre - Status Report as at March 1972

D.P. Contribution	U.S.\$ 1 339 100
Government	U.S.\$ 1 799 378
	<u>U.S.\$ 3 138 478</u>

Project Manager - Thomas, D.

Co-Manager - Selvarajah, V.

Mailing Address: Fishermen's Training  
Institute  
Glugot  
Penang  
Malaysia

Expended as at 31 May 1972 (D.P. Funds)	U.S.\$ 735 470
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Location - Penang

Purpose

To assist in the further development of industrial fisheries through the establishment and operation of a fishermen's training centre at Penang. In particular the project will provide qualified naviga-

tors, masterfishermen and marine engineers to meet the demands of the growing fishing industry.

Operational date - 5 November 1969  
Termination date - 4 November 1974

<u>Type of Vessel</u>	<u>Name</u>	<u>LOA</u>	<u>G.T.</u>	<u>H.P.</u>	<u>Delivery</u>
Trawler/Purse Seiner/ Training Ship	K.L. KURAU	29 m	150	450	October 1971
Training Ship <sup>1/</sup>	K.L. BAWAL	22 m		365	December 1971

<sup>1/</sup> Provided by the Government of Malaysia

Progress

The project became operational on 5 November 1969. A site for the campus was selected in Batu Maung in November 1969 and tenders were called in December 1969 for the development of the land. By June 1970 site preparations for the campus buildings were well under way with practically 75 per-cent of the work completed. The FAO training vessel was under construction in Spain and the contract for the second vessel to be constructed by the Government of Malaysia was signed on 29 May. The Co-Manager assumed his duties on 1 February 1970. The Marine Engineering Instructor arrived on 30 November 1970 and the full complement of Government administrative staff was assigned to the project by December 1970. Apart from the Co-Manager no other counterpart staff had been appointed. In the meantime, curricula were drawn up for the training courses by the experts.

Construction of the buildings commenced on 8 March 1971 and was scheduled for completion by August 1972. Three counterpart staff members in Marine Engineering, Fishing Gear and Methods, and Navigation and Seamanship were appointed on 19 February 1971, 3 May 1971 and 1 June 1971 respectively. The Fishing Gear and Methods Instructor and the Navigation Instructor joined the project in February 1971. During this period the three counterparts were given theoretical and practical training by the experts. The Marine Engineering Instructor advised on the construction of the Government vessel.

By November 1971 some of the essential buildings were completed. The UNDP/FAO Training Vessel arrived in October 1971 and after necessary trials was prepared for sea training. The Government vessel arrived in Penang in December. Fifty one trainees were recruited and the training course commenced on 4 December 1971. Simultaneously the two vessels named KURAU and BAWAL were commissioned. Three trips were undertaken in the two vessels around the harbour area in December for navigation orientation. There was difficulty in recruiting local skippers and engineers for the two vessels due to non-availability of qualified personnel and the comparatively unattractive rates of pay. A counterpart, a Net-Making Instructor, was appointed in August and the Ship's Engineer and the Masterfisherman I joined the project on 16 August 1971 and 10 September 1971 respectively. The second Masterfisherman joined the project on 18 March 1972. The Marine Engineering Instructor left the project at the end of October 1971.

The training programme consists of courses in navigation and seamanship, fishing gear and methods and marine engineering subjects related to fishing vessels. For practical work, a chart room for navigation work and an engineering workshop have been provided. A net loft for practical training of 30 trainees in fishing gear construction is also included. Initially, a general training in all the subjects will be given to all the trainees. Thereafter, they would be separated into two batches - Fishing and Engineering - and given more specialized training accordingly.

DP/MAR/68/505

MAURITIUS

Fishery Development - Status Report as at completion date 13 April 1972

D.P. Contribution                    U.S.\$ 389 090

Government                            U.S.\$ 560 947

U.S.\$ 950 037

Expended as at 31 May 1972  
(D.P. Funds)                        U.S.\$ 354 348

Location of Headquarters - Reduit

Sub-station                            - Point aux Sables

Project Manager                    - Cox, K.W.

Project Co-Manager - Ardill, D.

Mailing Address: Fishery Development  
Project  
c/o Ministry of Agriculture and Natural Resources  
Reduit  
Mauritius

Purpose

(a) To assist the Government in developing the fishing industry on the oceanic banks to the north of the island by means of trial fishing and training, and in carrying out a study of problems involved in marketing fish caught there.

(b) To attempt to open up new possibilities of fisheries on unexploited fish stocks.

Operational date - 14 April 1969  
Termination date - 13 April 1972

<u>Type of Vessel</u>	<u>Name</u>	<u>LOA</u>	<u>G.T.</u>	<u>H.P.</u>	<u>Delivery</u>
Trawler	INVESTIGATOR	26 m	130	450	November 1968

Progress

Exploratory Fishing - The major component of the Government's contribution to the project was the Research Vessel INVESTIGATOR, which was to be the chief means of achieving the objectives stated above. In April 1968 E.O. Oswald who examined the vessel reported that its limited freezer space made it unsuitable for long-range commercial type fishery operations, although it had the range and the safety to operate the entire Mauritius-Seychelles banks. Minor alterations were suggested in order to utilize the vessel: (1) to carry out experimental and exploratory fishing to improve the efficiency of present commercial vessels; (2) to explore possibilities of unexploited stocks, e.g. in the deep waters (50-150 fathoms) along the edges of Nazareth and Saya de Malha banks, and for lobster near St. Brandon; and (3) for bait studies. From October 1968 when the ship was delivered up to the end of March 1972 when the project was terminated, the vessel spent 148 days at sea, of which 100 days were spent on fishing.

themselves. (c) The waters in the oceanic banks are not abounding in fish as is commonly believed.

Subsidiary activities - Although the official operational date was 14 April 1969 field work commenced earlier in October 1968 with the arrival of the fish marketing expert. Pre-operational period arrangements were attended to by him and he also prepared a preliminary report entitled "Marketing of Fish in Mauritius", in which he suggested a Fish Promotion Campaign. During 1969 three papers entitled "Guide to Classify the Quality of Fish", "Basic Techniques to prepare Salted Fish" and "The Organization of the Fish Inspection Services" were submitted to the Government. A report on the Fish Salting Industry on the Island of Rodriguez was also jointly prepared by him and his counterpart. In 1970 an experimental fish salting and drying plant was built with Government assistance. The Marketing Expert completed his assignment in December 1970 and his counterpart, who had been trained adequately and was found to be quite competent, took over his work. The Expert's draft report "Fishery Development Project, Mauritius, the Marketing of Fishery Products in Mauritius" (Technical Report FI/MAR 5) has been prepared. The Project Co-Manager went on a three-month training fellowship in early 1970. The other fellowships were not availed of as there were no local counterparts available.

Nevertheless, even with its limited operations, the following conclusions can be drawn: (a) Present hand-line fishing techniques practised by the existing commercial fisheries are the most suitable and efficient in view of the relative scarcity of fish, the nature of the terrain, coral reefs, etc., and the often inclement weather in the oceanic banks of Nazareth, St. Brandon and Saya de Malha. (b) Other methods such as bottom long-line with various sizes of hooks, bottom gillnets, trolling, light fishing and traps are not suitable. This has been attributed to the low density of fish, lack of suitable inexpensive bait and ragged terrain resulting in heavy losses of fishing gear. Only traps appear to have some possibilities as they are inexpensive and are made by the fishermen

In 1971, after the visit of a UNDP/FAO review mission and a revision of Government objectives in the development of fisheries, it became obvious that emphasis would have to be placed on labour-intensive local fisheries such as oyster, freshwater shrimp and brackishwater fish culture. Accordingly, greater attention was paid to the promotion of aquaculture and oyster culture. A Japanese consultant was also engaged

(DP/MAR/71/007), for freshwater prawn development. Fifty thousand C. gigas cultch-free seedoyster were obtained from California and transplanted in Mauritian waters. As the results were promising further shipments of seed oyster were ordered by the private sector in March 1972 and are being raised on the lines of the pilot project. According to the Project Manager survival and growth

rate are high, but it was too early to draw definite conclusions at the time the project terminated in April 1972. A proposal for the development of aquaculture, oyster culture and two selected groups of brackish-water fish was prepared by Dr. T.V.R. Pillay (Chief, Fish Culture Section) in association with the Project Manager.

DP/PAK/68/028

PAKISTAN

Marine Fishery Biology - Status Report as at 30 June 1972

D.P. Contribution U.S.\$ 87 100  
Expended as at 31 May 1972 U.S.\$ 81 679  
Location - Karachi

Marine Fishery Biologist - Zupanovic, S.  
Counterpart - Mohiuddin, S.Q.  
Mailing Address: Marine Fishery Department  
Fish Harbour  
West Wharf 2  
Karachi, Pakistan

Purpose:

To advise and assist the Government of Pakistan: (a) Initiating a research programme in marine fishery biology aimed at the

estimation of the deepwater fishery resources of Pakistan, (b) Exploring the practical aspects of the prospective development of deepsea fisheries.

Operational date - 8 February 1968  
Termination date - 30 June 1972

<u>Vessels Used</u>	<u>Name</u>	<u>LOA</u>	<u>G.T.</u>	<u>H.P.</u>
Stern Trawler	MACHCHERA	20.42 m	52.41	120
Double rig Shrimp Trawler	MACHRANGA	67 ft		220

Progress

The expert arrived on 18 February 1968. The research vessel MACHCHERA, suitable for surveys only up to 70 fathoms, was undergoing repairs at the time of his arrival and the first cruises were made only in January 1969. Meanwhile, the expert commenced analysis of available data on shallow water fish stocks particularly the data of catches by the MACHCHERA for the period 1960-67. He also commenced training of the counterpart staff in sampling and statistical methods for fishery biology.

In January 1969, five trips were done on the MACHCHERA off the coasts of Karachi and Sind. The catch per trawl hour varied from 80 to 700 lb. Samples of catches were taken for analysis. The expert also supervised the scientific programme of the shrimp investigation scheme undertaken by the MEKARAN EXPLORER.

From February to April 1969, three trips on the MACHCHERA were undertaken and exploratory fishing was done in the 79 m to 124 m depth range. The MACHCHERA was under repairs from September to December 1969.

In January 1970, one trip was done on the MACHCHERA and another on the commercial vessel MACHRANGA. In February and March two more trips were done, but they were not interesting from the angle of catch.

The MACHCHERA was under repairs once again from October 1970 to April 1971. During this period the expert continued his analysis of field data, attended a symposium on Indian Ocean Fisheries at Cochin, prepared preliminary drafts of his reports and went on exploratory trips on the commercial vessel MACHRANGA. Field trips were not possible after September 1971, partly due to the unsatisfactory condition of the ship and partly due to the grave disturbances in the country in the latter part of 1971.

At the end of his assignment he had completed the following reports:

- (1) Demersal Fish Explorations off the Coast of West Pakistan
- (2) Shrimp Explorations off the Coast of West Pakistan
- (3) Shrimp, the Tide and the Moon (Preliminary Draft)
- (4) Economic Survey of Marine Fisheries of Pakistan.



The pages that follow examine in some detail Reports 1, 2 and 3.

1. Demersal Fish Explorations off the Coast of West Pakistan:

Material for the analysis was obtained from the data of trawling operations by the R/V MACHCHERA from September 1960 to May 1967 in the inshore waters and from January till March 1969 in the deeper waters of West Pakistan. Data were thereafter obtained from a commercial vessel MACHRANGA. The trawl net used was a semi-balloon type with otter doors, and the areas surveyed were:

- (a) Sind Coast - the Swatch-Khori Great Bank and the Indus Delta i.e. from the Indo-Pakistan border to the Paitiani Creek - an area of approximately 600 mi<sup>2</sup>
- (b) Karachi Coast - an area south of Karachi, extending from Paitiani Creek to Cape Monze.
- (c) Sonmiyani Bay - from Cape Monze to Ras Malan.
- (d) Mekran Coast - Ras Malan to Gwatar Bay, near the Iranian border.

Catch Rates - Period 1960-61 to 1966-67:

Area I (Karachi and Sind Coasts) - The average catch per trawling hour was 44.49 kg, and the maximum catch was 261.84 kg in March 1963, with a minimum of 3.20 kg in December 1960. The maximum catch was recorded in the shallower water in autumn (September to November) and in spring (March to May), with the minimum catch being registered in winter (December to February). The data indicated the possibility of a migration toward deeper waters in winter. The average catch per trawling hour which reached a peak of 68.56 kg in 1962-63 declined to 22.85 kg in 1966-67.

Area II (Sonmiyani Bay and Mekran Coast) - The average total catch per trawling hour was 59.41 kg with a high of 284.43 kg in November 1964 and a low of 8.70 kg in February 1965. In this area the highest catches were obtained in autumn (November) and the lowest in winter (December to February).

Areas III and IV (The Swatch-Khori Great Bank) - The Fishing grounds lie about 100 mi south-east of Karachi. Figures are not available for the entire period 1960-67, but the average catch per trawl hour on the Swatch in January-February 1964 was 285.11 kg and in December 1966 to February 1967 25.29 kg. In Khori Great Bank,

the average catch per trawling hour was very poor during the winter with 12.94 kg and 8.51 kg in January and February 1967 respectively.

In Area I, the highest catch rate was obtained in waters of 28-37 m depth range followed by 66-73 m. In Area II, the highest catch was obtained in the 18-27 m depth range and there was a relative abundance of demersal fish in the shallow waters. In Areas III and IV, the highest catch was in the 46-55 m range and in the Khori Great Bank in the 27-37 m range.

All the conclusions above were drawn from data obtained during the trawling operations of the MACHCHERA in 1960 to 1967, which were therefore not supervised by the expert.

Data were collected by the expert during exploratory fishing surveys by C/V MACHRANGA in April 1969, January, February and October 1970 and March/April 1971. The average catch per trawling hour was 186 kg. The figures indicated that catch per unit effort in Sonmiyani Bay and off the delta of the River Indus were better than those off Karachi.

The operations of the C/V MACHRANGA for the period 1966-69 showed that the relative abundance of fish was highest during March-April and lowest during June in the coastal waters (i.e. up to 12 mi). The second highest catch recorded was in October which coincided with the spawning period of many commercially important species.

Trawling surveys were done by R/V MACHCHERA from January to early March 1969 in the area extending from Cape Monze to the Indian border where the shelf extends from 15 to 60 miles. The areas surveyed ranged in depth from 46 to 125 m. Of the total catch of 2817.1 kg, 28.36% was Nemipteridae, 28.26% Nemipterus japonicus, 17.47% sharks, rays and skates, 12.27% Himantura bleekeri, 6.40% Pomadasys maculatus and 5.58% Neturma (Avis) thalassinus.

The relative abundance of fish increased with depth, the average catch per trawl hour ranging from 22.6 kg in the 0-17 m zone, 51.1 kg in 18-35 m zone and 76.9 kg in the 36-55 m zone. Old adults were heavily represented in the catches indicating that the grounds were underexploited. Commercially important species were found in the shallower

zone of 45 to 80 m. Between 80 and 100 m the fish caught were of little commercial value, with Nemipterus japonicus forming the bulk of the catch.

These surveys used a semi-balloon type trawl net, commonly used for shrimp fishing. The expert has given no indication of the allowances he made for this gear when calculating catches.

Potential Annual Yield - The U.S.S.R. Azcher NIRO expedition in 1969, estimated that in the shelf zone off the coast of Pakistan i.e. outside the 12 mi territorial limit, in an area of approximately 31 000 km<sup>2</sup> the quantity of fish available was 66 500 tons in winter, 117 400 tons in spring, 96 000 tons in summer and 40 000 tons in autumn.

The expert estimates that (1) the catch of demersal fish in deeper waters (up to 150 m) could be increased approximately 3 to 4 times the 1970 catch, which is estimated at 170 000 tons inclusive of low value fish presently discarded at sea, and (2) recommends that large commercial trawlers be built for offshore and deepsea trawling to reach a target of 500 000 tons in the year 2000.

Shrimp exploration off the Coast of West Pakistan - Surveys were conducted off Karachi with the MEKCRAN EXPLORER from October 1968 to January 1969 in the 5 to 15 fathom zone and in the coastal and offshore waters (3 to 70 fathoms) from December 1968 to April 1971 with the MACHCHERA and the MACHRANGA. The following species of shrimp have been identified from the catch: Penaeus merguensis, P. penicillatus, P. semisulcatus, P. indicus,

P. monodon, P. japonicus, Metapenaeus monoceros, M. affinis, M. stebbingri, M. brevicornis, Parapenaeopsis stylifera, P. sculptilis and P. hardwickii. Commercially the most important are Penaeus merguensis, P. penicillatus, P. indicus, locally known as "Jaira", Metapenaeus monoceros, M. affinis, M. stebbingri and M. brevicornis, locally known as "Kalri" and Parapenaeopsis stylifera, P. sculptilis, P. hardwickii, together with juveniles of "Jaira" and "Kalri", locally known as "Kiddi".

The area exploited by commercial vessels was divided as follows:

- (1) The Swatch (Khorl Great Bank), which is beyond the reach of small trawlers and exploited by bigger trawlers from October to December.
- (2) Indus Delta - about 100 mi north-west of Karachi where there is moderate fishing.
- (3) Offshore Karachi-Indus Delta to Sonmiyani Bay and up to 50 fathoms which is easily accessible by small trawlers, and where fishing is heavy.
- (4) Sonmiyani Bay where fishing is heavy.
- (5) Off the coast of Mekran up to the Iranian border which is underexploited because of its distance.

According to the surveys carried out by the commercial vessel MACHRANGA, the maximum stock intensity occurs in the Swatch-Khorl Great Bank and off the mouth of the river Indus, while the lowest occurs off Karachi and in Sonmiyani Bay, the area of most intensive fishing. The standing stocks of the most abundant commercial shrimp are estimated as follows ( in '000 tons).

Species	Swatch	Indus Delta	Offshore Karachi	Sonmiyani Bay	Mekran Coast
"Jaira" and "Kalri"	1.8	2.1	1.8	1.2	1.9
Level of Fishing	Slight	Moderate	Heavy	Heavy	Slight

The shrimp potential is therefore in the areas which are lightly or moderately fished.

The total production of shrimp and prawns in 1970 has been estimated at 16 046 tons, having reached a peak of 18 196 tons in 1966. The catch per boat has declined from 71.06 tons in 1964 when 226 boats were operating to 35.66 tons in 1970 with 450 mechanized boats

operating. The decline is attributed to over-fishing.

The following recommendations have been made:

- (1) The number of boats in the inshore waters should be reduced to about 300 of the present size and efficiency.

- (2) The fishery should be extended to under-exploited grounds such as the Swatch, Indus Delta and Mekran Coast and to deeper waters such as the Khorl Great Bank.
- (3) A further programme of research in regard to the stocks in the areas mentioned in (2) above should be undertaken.
- (4) A closed season from July to August should be introduced to conserve and develop the stocks.

Shrimp, the Tide and the Moon - The catches in terms of day and night and also in relation to the tides and the phases of the moon have been analysed and the conclusions are as

follows:

- (1) Higher catches of shrimp have occurred in the daytime.
- (2) Catches of Penaeid shrimp have been larger at night during the spawning season.
- (3) Females preponderate in the daytime catches.
- (4) Catches have been larger during the brighter phases of the moon.
- (5) Catches have been larger during the neap tides or within a few days of such tides, than during the spring tides.

DP/SIN/68/506

SINGAPORE

Fishery Training Centre - Status Report as at end 1971

D.P. Contribution	U.S.\$ 1 287 400	Project Manager	- Ochi, T.
Government	U.S.\$ 1 552 800	Project Co-Manager	- Ng Chee Kien
	<u>U.S.\$ 2 840 200</u>	Mailing Address:	Fishery Training Centre
Expended as at 31 May 1972			Changi Point
(D.P. Funds)	U.S.\$ 953 952		P.O. Box 8
			Singapore 17, Singapore

Location - Changi

Purpose

To assist in the development of industrial fisheries through the establishment and operation of a training centre at Changi. In par-

ticular the project will train and produce qualified local technicians to operate modern fishing vessels and gear to meet the immediate needs of the industry.

Operational date - 7 October 1969  
Termination date - 6 October 1974

<u>Type of Vessels</u>	<u>Name</u>	<u>LOA</u>	<u>G.T.</u>	<u>H.P.</u>	<u>Delivery</u>
Combination training vessel	JURONG	35 m	212	650	February 1971
Trawler	KANGKAR	20 m		365	July 1970

Progress

The Project Manager arrived on 20 April 1968 and the Plan of Operations was signed on 14 July 1969. Bids for the construction of the training vessel were opened on 30 September 1968 and the contract was signed in August 1969. Despite the project not being operational, authorization for spending U.S.\$ 400 000 for the vessel was obtained in March 1969 from UNDP. During this period the Project Manager made preparations for the training of counterpart staff on board the Vietnamese project boat and at the Regional Research Centre and with the Gear Technologist organized a short training course (mostly on-shore) for local fishermen commencing August 1969. Twenty-nine trainees out of the intake of 35 completed their training and by the end of December 1969, 12 of the trainees had received employment in local fishing companies. The second batch of 25 trainees commenced their course in November 1969, and 13 completed the course. A one-week training course for Masters and Assistant Masters of Trawlers was also conducted in January 1970. The Master-fisherman and the Marine Engineer arrived in January 1970. At the request of the Government an examination standard for certificates

of competency for Fishing Vessel Engineers was also prepared. By the end of June 1970, with the completion of the main building at Changi, the project office was moved to its permanent site. Three short-term training courses for fishermen, and a one-week course for Masters and Assistant Masters were conducted. Seventy-nine trainees were admitted and 53 graduated. Most of those who completed training obtained employment.

The main one-year training programme commenced in August 1970 with 24 trainees. The KANGKAR was delivered on 3 July 1970 and commenced operations in October. The JURONG arrived in February 1971 and by June 1971 had made three fishing trips. Eight trips were made by the KANGKAR between January and June 1971. Some of the trainees were sent on a fishing trip in a Japanese vessel. The international staff was at full strength and all except two of the counterpart staff had also been assigned by June 1971.

The one-year training course was

completed in September 1971 and all the 21 trainees who completed the course passed the examination. Of the 8 graduates in the Deck Department, 4 were employed by local fishing companies, 3 in merchant navy vessels, and of the 13 graduates of the Engine Department, 7 were working in either fishing or merchant navy vessels, 4 in local shipyards and 2 in engineering firms. Six cruises were done by the JURONG between July and December 1971 in areas ranging from the mouth of the Irrawaddy in the north-west to 70 miles north of Tioman Island to the east of Malaysia. Promising results were obtained off the Burma coast, where 27 819 kg of fish (excluding trash fish) were caught in 20 trawling operations lasting 29.6 hours. The KANGKAR did two cruises and was thereafter docked for repairs. A new Co-Manager was appointed in September 1971, on the transfer of the previous Co-Manager as Officer-in-Charge Jurong Fishing Port. The content of the engineering course was modified to enable graduates from the Centre to find alternative employment in the shipyards or the Merchant Navy.

The JURONG went on a second cruise without trainees in January 1972 to Martavan Bay, off the Burma coast. An average of 600-700 kg per haul of trawling was recorded consisting mainly of Pomfret, Spanish mackerel, snapper and particularly jewfish (Johnius aneus). The fish was caught in waters of a depth of 30 to 33 metres. The Project Manager concludes that, (a) if commercial fishing operations are carried out (8 to 9 trawling operations a day) 5 to 10 tons of marketable fish could be caught per day, (b) since the area outside Burmese territorial waters with these depths is rather narrow only three 300-ton commercial trawlers can operate, (c) the water depth and the seabed are suitable for trawling, (d) the sea in this area is rich in plankton, (e) there is an abundance of kingfish, mainly Scomberomorus niphonius and Scomberomorus commersoni, and (f) chub mackerel and Indian mackerel (Rastrelliger kanagurta) are also abundant.

At the end of January 1972, the second one-year course commenced with 57 trainees.

DP/SOM/67/513

SOMALIA

Fishery Survey - Status Report as at 31 March 1972

D.P. Contribution	U.S.\$ 614 050
Government	U.S.\$ 113 200
Total	U.S.\$ 727 250
D.P. Additional Funds	U.S.\$ 163 300*
Government	U.S.\$ 10 000
Final Total	U.S.\$ 900 500
Expended as at 31 May 1972 (D.P. Funds)	U.S.\$ 511 718

Project Manager - Kawaguchi, K.

Acting Project  
Co-Manager - Ahmad Sherif Akeel

Mailing Address: Fishery Survey Project  
P.O. Box 24  
Mogadiscio  
Somalia

Sub-Contractor - PROMMASEXPORT, Moscow

Location - Mogadiscio

Purpose

To assist the Government in carrying out a fisheries resources survey, based on existing data and supplemented by exploratory fishing in the waters off the Somali coast.

Operational date - 5 May 1969  
Termination date - 4 May 1971

Revised Termination date - 4 May 1973  
(Project extended for two years from 4 May 1971).

\* For extended period

<u>Type of Fishing Vessel</u>	<u>Name</u>	<u>LOA</u>	<u>G.T.</u>	<u>H.P.</u>	
Multi-purpose exploratory fishing vessel	ZHELENZNYAKOV	55 m	1100	1000	Chartered August 1970 to December 1971
Fishing boat *		10 m		60	Delivery - September 1972
Fishing boat *		8 m		20	Delivery - September 1972

### Progress

The Project Manager arrived in May 1969. The vessel did not arrive as expected owing to delays in choosing the sub-contractor. By August 1970, negotiations between FAO and PROMMASEXPORT for the charter of the Survey vessel ZHELENZNYAKOV were finally concluded and arrangements were made for the ship to reach Mogadiscio on 18 August 1970. During the first half of 1970, the Fishing Gear Technologist fabricated an experimental beach seine and operations commenced. An alternative design for boats to be made of fibre-glass was also proposed. Between May and August 1970, no activities except desk duties were possible because of the monsoon. Counterpart staff consisting of the Project Co-Manager, Marine Biologist/Oceanographer, Masterfisherman and Rigger/Fishing Master were appointed.

The survey ship arrived on 18 August and commenced fish-scouting operations in the Gulf of Aden which lasted until 24 September. The first cruise was mainly a general oceanographic survey of the Gulf of Aden to collect data on water temperatures, oxygen content and nutrient salts and plankton in order to determine environmental factors affecting behaviour and distribution of fish. Some exploratory and experimental fishing was also done with purse-seiners, longlines and traps. In 13 purse-seining operations of 7 hours each, a catch of 2123 kg was recorded and 5 longlining operations and 3 light attraction operations, recorded catches of 375 kg and 250 kg, respectively. During this period Technical Report No. I "The Tuna Fishery in the Gulf of Aden" based on the work of G.F. Losse, Fishery Biologist, was completed and submitted to the Government.

From 1 November to 22 January 1971, the vessel continued operations until it ran aground. Purse seine operations were not possible because with increasing water temperatures, the thermocline descended to deeper levels. The conditions were therefore considered more suitable for a modified form of longlining in certain limited areas where the topography was steep and uneven, and where fairly good concentrations of yellow-fin tuna had been observed. Accordingly, the longline was modified with shortened lines and more hooks and a shuttle method of operation adopted. There was an improvement in the total catch, catch per 100 hooks and hook rate, but they were not significant.

The vessel recommenced operations after repairs on 8 February 1971 and by the end of April 1971, the first stage of the survey encompassing the whole fishing season in the Gulf, September to early April, had been completed. The tentative conclusions of the survey were as follows:

- (a) A shortened longline and shuttle method of longlining has proved to be more efficient than purse-seining in the in-shore area, due to the rugged terrain of the ocean floor.
- (b) During the season the best fishing grounds are within a narrow coastal belt 7 miles from the shore.
- (c) Yellow-fin, shark, small tuna and tuna-like fishes and small pelagic fishes such as sardine, maasbanker and scomber occur but the most significant is the yellow-fin.

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\* Being built in local boatyards

(d) There is a clear change in oceanographic conditions beginning mid-March, with water temperatures increasing and the thermocline descending to deeper levels. Simultaneously, tuna shoals thin out, till by the end of April, the catches are insignificant.

Preliminary recommendations (the nature of which are not known) regarding existing fish processing enterprises and marketing potential were submitted to the Government. The training of counterpart staff on board the vessel was completed by the end of February.

On 24 June 1971, the second stage of the survey commenced and fish-scouting and exploratory fishing were done in Zeila, Ras Djilas, Berbera and Cape Guardafui. The conditions were found to be unfavourable for any aggregation of fish and although experimental fishing was tried with purse-seines, gillnets, driftnets and light attraction with side traps, it was hardly successful. From August to mid-October, the northern coastal waters were covered six times using purse-seines and drift-nets and a total catch of 11 700 kg of fish was recorded. Ninety per cent of this catch was through purse-seines, with tuna and tuna-like fishes accounting for almost 83%. The catch was not much more than that presently caught by indigenous craft. The surveys were completed on 18 October 1971.

With the new Project Manager's arrival in September 1971, plans for the second stage were prepared in consultation with the Governmental authorities and it was decided to standardize fishing gear and boats on the north coast to supply requirements of fish processing factories (estimated at 7 000 tons), to conduct exploratory and experimental fishing off the east coast for exportable species, for which two boats 8.5 m and 10 m would be built in the Mogadiscio boatyard, and to improve fish processing and fish marketing methods. The project would also assist in the setting-up of a pilot fishermen's cooperative in Mogadiscio

and Adale and would plan for the mechanization of the craft, the establishment of a pilot marketing facility and the training of the members in modern fishing techniques and processing.

In November, a Naval Architect from FAO headquarters visited Mogadiscio to examine the boat proposal. A counterpart assistant and a part-time administrative assistant were appointed in January 1972. The project is also providing technical guidance to the Maritime Fisheries School in Mogadiscio.

#### Conclusions of Survey:

- (1) The oceanographic survey revealed that the most favourable areas for pelagic fish in September/October, are located between Guardafui Point, Osrolay Point, to the west of Ras Sura Point and the approaches to Tadjura Bay.
- (2) Longline operations have definitely proved to be unsuccessful. During the first cruise (26 August 1970 to 24 September 1970) the average catch was 30 kg per 100 hooks; during the second cruise (24 September to 23 November) the average was 19.3 kg per 100 hooks and during the fifth cruise the average was 18.6 kg per 100 hooks. Indices of the third and fourth cruise are not available. Even though the December indices are not available, the progress reports covering that period do not indicate any spectacular increase in tuna catches by longline and the general conclusion is that longlining is not a successful operation, despite the use of a modified line.
- (3) Potential for a trawl fishery exists off the north-east coast.
- (4) Most fish inhabit a narrow coastal belt within seven miles of the northern coast.

DP/CEY/68/009

SRI LANKA

Fishing Technology (Skipjack Pole-and-Line Fishing) - Status Report as at 15 June 1972

D.P. Contribution U.S.\$ 67 200 Fishing Gear Technologist - Pagot, G.A.

Expended as at 31 May 1972 U.S.\$ 26 912 Mailing Address: c/o UNDP Resident

Location - Colombo Representative  
P.O. Box 1505  
Colombo, Sri Lanka

Purpose

To experiment with improved methods of catching live-bait for skipjack pole-and-line fishing by means of light attraction and purse-seines, lampara nets, or other suitable means; to carry out bait experiments, to determine the ability of various species to survive in bait tanks and traps; and to conduct fishing trials for skipjack tuna.

Operational date - 13 January 1972  
Termination date - 28 March 1973

Progress

The Technologist arrived in Sri Lanka in March 1972. Certain changes in the equipment to be used were suggested. The equipment such as the seine is scheduled to be delivered in early July.

DP/CEY/71/004

SRI LANKA

Fishery Statistics - Status Report as at 31 May 1972

D.P. Contribution U.S.\$ 51 200 Fishery Statistician - Inoue, K.

Expended as at 31 May 1972 U.S.\$ 12 417 Mailing Address: c/o UNDP Resident

Location - Colombo Representative  
P.O. Box 1505  
Colombo, Sri Lanka

Purpose

The Fishery Statistician will carry out the following tasks:

(a) Assist the Government of Sri Lanka with the design and implementation of the Fishery Census presently being undertaken.

(b) Review and evaluate the presently existing system concerned with the measurement of all current statistics (landings, fishing efforts, utilization and production, prices, etc.) necessary for the administration and development of the fisheries of Sri Lanka.

(c) Propose and implement improvements to the current system, giving special emphasis to the use of sampling techniques and ensuring

continuity over time in the statistics provided by the current system and the revised system respectively.

(d) Deal with any other fishery statistical matters as they arise.

Operational date - 2 January 1972  
Termination date - 30 June 1973

Progress

The Fishery Statistician arrived in Sri Lanka on 12 February 1972. He has not submitted any report so far on the activities he has undertaken. Equipment for his work has been ordered. The project provides for two fellowships of three months each. Nominations have not been received from the host Government.





DP/THA/69/016

THAILAND

Fresh Fish Handling and Processing Technology - Status Report as at 30 May 1972

D.P. Allocation U.S.\$ 27 700

Expended as at 31 May 1972 U.S.\$ 41 394

Location - Bangkok

Technologists - Howgate, P.F. - 15 May 1970  
to 15 January 1971  
- Cann, D.C. - 15 January 1971  
to 15 August 1971  
- Graham, J. - 30 November 1971  
to 29 May 1972

Mailing Address: c/o FAO Regional Office for  
Asia and the Far East  
Maliwan Mansion  
Phra Atit Road  
Bangkok, Thailand

Purpose

- (a) To study further the current practices of handling, icing and storage of fish, and in particular shrimp, at sea and on land during transportation and distribution. To effect a research programme to improve existing practices.
- (b) To study fishmeal production and advise on improvements, in particular, the control of odour from fishmeal plants.
- (c) To advise the technological laboratory on the design and quality of a cold store, chill room and freezer for pilot-scale product development work.
- (d) To train local technological staff.

Progress

The first expert, a biochemist, arrived in Bangkok on 15 July 1970. During the first month he familiarized himself with the situation of the fisheries processing industry in Thailand and also observed fish handling at sea. Members of the staff of the Fisheries Technological Laboratory were trained in improved methods of determining Total Volatile Nitrogen and Trimethylamine, to be used to study changes during icing of shrimp. A start was also made on analytical methods to measure the quality of fermented fish. Experiments were continued in September and problems associated with the quality control of shrimp were also taken up. During this period he commenced the first of a series of lectures on the principles and practices of fish technology. At the request of a processor, experiments in drying shrimp meat were carried out using the Torrey kiln of the

Technological Laboratory. In November, experiments in the mechanical drying of fish and the preparation of fermented fish from marine fish were conducted. The kiln was also used to make smoked products and the best products were found to be kippered chub mackerel. The expert completed his assignment in early January.

The second expert, a bacteriologist, assumed duties on 17 January 1971. After the usual familiarization tours, he commenced checking and servicing equipment and facilities for his work. He also commenced a series of lectures in addition to practical instructions. Visits were made to fish markets and processing centres and arrangements were made with the Bangkok authorities to inspect the wholesale fish market at regular intervals and to effect improvements. From February to April the expert continued his work in regard to fish spoilage, fish poisoning and fish handling in vessels. Advice was given to the fish market authorities to ensure better hygienic conditions and as a result of his recommendations, subsistence processing was removed from the floor of the fish market. By May, comparative studies on the storage life of whole and beheaded shrimp were completed. It was observed that whole shrimp kept better. A study of the bacterial flora of fresh and spoiled shrimp was completed. Efforts to obtain chlorinated water for the Bangkok fish market were also successful. The expert completed his assignment on 30 June 1971.

The third expert, an engineer, assumed duties on 5 December 1971. His assignment was to follow up on the work done by the two previous experts and advise on improve-

ment and better operation of freezing and storage plant and equipment. By the end of January 1972, the expert had completed his survey of the fish processing industry. He observed that none of the air blast freezers were able to quick freeze fish. The type of freezer designed to freeze by air convection and contact with the cooler coils was found to be unsatisfactory. The operation of plate freezers was found to be faulty. Packing methods and water spillage necessitating de-frosting after each freeze resulted in only a 50% utilization of the equipment. Poor storage conditions and bad operating methods, irregular de-frosting, overloading etc. were observed in the cold stores. Much of these practices were due to lack of professional advice.

During February, the expert concentrated mainly on fishmeal manufacture. Four factories were visited and samples taken at various stages of processing to determine losses caused by rejection of the press

liquor. Preliminary observations indicated a considerable wastage. It was observed in the case of one factory that fishmeal output could be increased by 20% with press liquor recovery, and, if the oil was utilized, the extra saleable commodity could be increased by 30%, without taking into account the improvement in quality. During March the expert completed his report on "Fishmeal Manufacture in Thailand" and was in the process of finalizing his report on "Odour Suppression of Fish Plants". Horizontal plate freezer tests were conducted with his counterpart and advice on freezer design and layout was given to a commercial firm. By mid-May 1972, the expert had completed further supplementary reports on fishmeal and on specifications for freezer, cold storage and chill facilities for the Fishery Technology Laboratory. He completed his assignment in May 1972. One fellowship for six months in Fresh Fish Handling and Processing was awarded to a local counterpart.

DP/THA/70/008

THAILAND

Shrimp and Prawn Farming Development - Status Report as at 31 May 1972

D.P. Allocation U.S.\$ 56 700

Expended as at 31 May 1972 U.S.\$ 33 676

Location - Bangkok

Shrimp and Prawn Farming

Expert - Cook, H.L.  
Counterpart - Thien Banasopit

Mailing Address: FAO Regional Office for Asia and the Far East  
Maliwan Mansion  
Phra Atit Road  
Bangkok, Thailand

Purpose

In cooperation with the FAO Regional Fish Culturist, the Shrimp and Prawn Farming Expert provides assistance to the Government of Thailand: (a) to initiate shrimp and prawn farming development activities aimed to increase production by improving existing operations, (b) to formulate a research programme in shrimp culture, (c) to initiate studies in the various factors concerning shrimp and prawn farming operations as a basis for the effective implementation in the near future of a large-scale nationwide development project.

Operational date - 8 August 1971

Termination date - 7 August 1972

Progress

The expert arrived in Bangkok on 19 August 1971. In September he visited shrimp farms and research facilities at Samut Sakohn, Rayong and Surat Thani. In a preliminary report he noted that, (1) the presence of numerous predators and competitors in the ponds, (2) the unavailability or inadequacy of desirable seed stock, (3) the effect of salinity changes on mortality, and (4) insufficiency of natural foods and unavailability of supplemental foods, limited shrimp production.

By the end of November 1971, the expert had visited all the Government installations

where research on shrimp culture was being conducted. At Samut Sakohn, screens were introduced to prevent predators from entering the pond. An experiment was also conducted in the use of "tea-seed" cake at a concentration of 25 ppm to control predatory fish. Analysis of seasonal abundance of post-larval shrimp was started. Experiments with tea-seed cake continued in January and February 1972 and showed that small fish, less than two centimetres in length were affected within 30 minutes and fish up to six centimetres, within two hours. The number and total weight of shrimp were greater in the treated than in the untreated ponds.

In the fertilization experiments, two ponds of 1.4 hectares each were filled with water from 18 December till 5 January, and superphosphate at the rate of 12.5 kg per hectare was introduced to one pond, and ammonium sulphate and superphosphate at the rate of 62.7 kg and 3.8 kg per hectare to the other pond. Three applications were made to the first pond and two to the second. At harvest on 15 February, 100.3 kg of shrimp and 4.4 kg of fish were collected from the first pond and 176.2 kg of shrimp and 4.7 kg of fish from the second. The low yield of

fish was due to the use of screens. The expert reported that despite the increased costs incurred on the second pond, the added benefit from this fertilization was U.S.\$ 53.55. Experiments in larval culture continued though the results were not satisfactory. In late January the expert presented a paper entitled "Recommendations for improving the traditional method of shrimp farming in Thailand", at a symposium held in the Marine Fisheries Laboratory, Bangkok.

The fertilization experiments at Samut Sakohn continued in May 1972 and the growth rate of the shrimp was checked and the water analysed for dissolved oxygen, temperature, salinity, pH phosphate, nitrate and turbidity. A second set of ponds was completed and experiments with tea-seed cake for predatory control, and with superphosphate and ammonium sulphate for fertilization were conducted. One experiment was conducted to determine the salinity tolerance of *Penaeus semisulcatus*, but it was not successful due to the water being polluted by a chicken mash feed. He also assisted in the planning and construction of ponds for the Thai army at Bang Poo and advised a commercial *Macrobrachium* farmer on larval culture.

DP/PDY/64/501

PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN

Fishery Development in the Gulf of Aden - Status Report as at 30 June 1972

D.P. Contribution	U.S.\$ 1 206 400
Government	U.S.\$ 538 459
	<u>U.S.\$ 1 744 859</u>
Expended as at 31 May 1972 (D.P. Funds)	U.S.\$ 1 019 835

Project Manager - Paiyulaid, M.M.  
Project Co-Manager - Hariri, K.I.

Mailing Address: Fishery Development in  
the Gulf of Aden Project  
P.O.Box 1188  
Aden, People's Democratic  
Republic of Yemen

Location - Aden

Purpose

To assist the Government in the development of their marine fisheries through demonstration fishing in the Gulf of Aden and its adjacent waters, advisory services and

training of fishermen. In particular the Project will demonstrate the commercial feasibility of demersal and pelagic fisheries.

Operational date - 1 July 1966  
Termination date - 31 December 1972

<u>Type of Fishing Vessel</u>	<u>Name</u>	<u>LOA</u>	<u>G.T.</u>	<u>H.P.</u>
Combination fishing vessel (purse-seiner)	RIZQ-AL-BAHR	20 m	75	Owned by Government
Stern Trawler	NISSHIN MARU NO.52	43.35 m	263	550 Chartered - October 69 to November 71
Research Vessel	MANIHINE			Chartered - October 66 to November 66 and February 67 to April 67
	NOQUM			Delivered - September 70

### Progress

The Plan of Operations was signed by the Government on 25 May 1966 and the project was declared operational on 1 July 1966. The Project Manager (designate) arrived earlier in January 1966 and assisted in finalizing matters pertaining to the Plan of Operations. Field work commenced in July 1966 but had to be suspended from April 1967 to April 1969, due to internal security problems. Work was resumed in April 1969 and was scheduled to be completed by December 1972.

By September 1966, a fisheries biologist and an administrator had been recruited and the contract for the charter of the R/V MANIHINE belonging to the East African Marine Fisheries Research Organization was concluded. Basic studies on the biology of the oil sardine (Sardinella longiceps) commenced. No exploratory fishing was possible as the Government vessel RIZQ-AL-BAHR was being modified for the exploratory surveys. Analysis of existing oceanographic data sub-contracted to the Institute of Marine Resources, University of California, San Diego in March 1966, was in progress. The Project Co-Manager was appointed during this period along with other administrative staff.

The R/V MANIHINE arrived in Aden on 4 October 1966 and till the end of November four scientific and exploratory cruises in the Gulf were undertaken. The RIZQ-AL-BAHR was commissioned in November and four short cruises were made in the Gulf between 2 November and 21 December. The biologist joined a Greek factory ship on a cruise in the Gulf and off the north-east coast of Somalia between 15 and 24 December. The limited exploratory fishing revealed that the standard oceanic type longline gear was unsuitable for the Gulf. In

stick-held dip-net operations, although fairly large concentrations of fish were attracted, catches were small because of strong currents. The Project Co-Manager was replaced with effect from 1 November 1970. On 25 December the Project Manager died in a car accident and the Fishery Biologist was appointed acting Project Manager.

In February 1967, the R/V MANIHINE arrived in Aden for the second phase of its charter. Two biological and fishing cruises were made in the Gulf of Aden and the adjacent seas and the vessel completed its work by 6 April. The RIZQ-AL-BAHR was unserviceable till 27 March when she joined the MANIHINE on the last part of her cruise. Studies on the oil sardine were continued and demersal fishes caught off the Somali coast were identified. The exploratory fishing once again proved the ineffectiveness of longline fishing. The potential for lamp fishing techniques appeared promising - the main fish groups being sardines, small horse mackerel, mackerel and squid. Echo surveys revealed the highest concentrations of fish in depths of 10 to 20 fathoms close to the shore. The final report on Fishery Oceanography in the region was received from the Institute of Marine Resources, University of California, San Diego. A deteriorating security situation caused many problems and when it worsened project activities were suspended in April 1967.

Operations were resumed in April 1969 when a new Project Manager was appointed. A revised Plan of Operations was signed on 29 May 1969. The RIZQ-AL-BAHR was taken up for conversion for demonstration purse-seining, and a contract with the Nichiro

Fishing Company for the charter of the Stern Trawler NISSHIN MARU NO.52 for demonstration trawling was signed on 1 November 1969.

The NISSHIN MARU NO.52 commenced exploratory and demonstration trawling on 10 November 1969 and by 10 April 1970 had completed five cruises. The following fishing grounds were investigated; Aden, Socotra, Kuria-Muria, Ras Madraka and Ras Fartak and 120 tons of fish were caught. Five fishermen, one deck officer and one assistant engineer were trained on board. The RIZQ-AL-BAHR was docked for an overhaul on 7 February 1970. The operations of the NISSHIN MARU NO.52 revealed commercial quantities of Antakh (Nemipterus japonicus) and cuttlefish (Sepia officinalis) in Ras Fartak area, but the data were insufficient to assess stocks and productivity. During the period 1 May 1970 to 31 October 1970, the NISSHIN MARU NO.52 completed 5 cruises, comprising echo-sounding surveys and trawlings and caught 110 tons of fish. The RIZQ-AL-BAHR came out of dock on 24 September 1970 and purse-seining and sonar-surveys under the supervision of the Masterfisherman commenced on 3 October 1970. Sardine schools, some of which were estimated at 100 tons, were located in the Aden area. The Government vessel NOQUM started fishing on 8 October 1970.

Advice was given on the selection of a site for a fishmeal factory at Mukalla and the construction of improved curing sheds. Proposals for a modern fish retail market were also made. In view of the lack of proper supervision and expert guidance for vessel-repair work, as experience with the RIZQ-AL-BAHR had shown, the Project Manager recommended the recruitment of a Marine Engineer.

During the period 1 November 1970 to 30 April 1971, NISSHIN MARU NO.52 completed six cruises of echo-sounding surveys and trawling and caught 99 tons of fish. Up to 31 March 1971, the RIZQ-AL-BAHR completed 8 cruises comprising 890 hours of echo-sounding and 6 254 miles of sonar-survey. In 56 hauls with the purse seine 86 tons of fish were caught. An oceanographic survey of 28 stations was also carried out in the Mukalla area. In the same period the NOQUM completed 12 cruises and carried out experiments with longlines, drift-nets, trolls and handlines. 5 900 hooks and 355 driftnets were shot and 10 tons of fish caught.

A marketing survey in the Khormaksar area in Aden revealed an annual average per caput

consumption of 36 kg of fish. Instructions for processing, freezing and packing for export of the small spiny lobster were given and sample exports resulted in an Italian firm entering into an agreement with the National Cold Storage Corporation for the purchase of the entire quantity of lobster produced within the ensuing 3-6 months. Demonstrations in processing other products such as squid, shark and ray wings and snapper fillets were also carried out. Quality control was introduced and recommendations made for the improvement of freezing and cold storage facilities. The fishery biologist arrived on 10 January 1971. The fellowship in fishing gear and methods commenced in April 1971.

During the period April to October 1971, the NISSHIN MARU NO.52 completed 6 cruises, comprising 28 hours of echo-sounding, and 359 trawlings of 430 hours duration. 115 tons of fish were caught. The RIZQ-AL-BAHR completed 7 cruises comprising 421 hours of echo-sounding, and 3029 miles of sonar-survey. Twentyfive driftnets were shot 12 times and 15 tons of fish were caught. Owing to a faulty clutch, purse seining commenced only toward the end of October 1971. The NOQUM completed 3 cruises spending 36 days at sea using driftnets, longlines and lampara seines. In view of its unsuitable condition, the NOQUM was returned to the Government in August and the reconditioned SOUTHERN HOPE was received. Sixteen driftnet surveys were completed from 5 to 29 October by this vessel.

The exploratory surveys revealed commercial quantities of cuttlefish (Sepia pharaonis) in Ras Fartak area during September and October, catches of 800 to 1300 kg per trawling hour being recorded. Sardine concentrations were observed in Ras Shihir area in April and around Aden in May. Yellow-fin, skipjack and bonito schools were observed in areas east of Shuqra, in Shuqra, Mukalla and around Aden. Driftnetting with the SOUTHERN HOPE averaged 30 to 40 kg per 40 fathom net per day in the Shuqra area.

The Fish Marketing and Processing Expert completed his assignment in July 1971, and his draft final report was submitted to FAO headquarters. His replacement arrived on 7 September 1971. The Marine Engineer arrived on 2 May 1971 and, apart from training of counterparts, supervised the repair and reconditioning of the RIZQ-AL-BAHR and the SOUTHERN HOPE.

A feasibility report on the fishmeal industry was submitted to the Government in July and an FAO/UNDP Fishery Industry Adviser arrived on 14 September 1971, on a three-month assignment to prepare a programme for assembly and erection of the fishmeal plant stored at Mukalla. Two fellowships in fishing gear and methods and fish processing technology were availed of and completed by October 1971. By the end of this period 18 fishermen and two assistant engineers had been trained on board the trawler. As a result of the efforts of the Marketing and Processing Expert, a total of 220 tons of frozen fish and fish products was exported by the National Cold Storage Corporation during this period, as compared to a total export of 150 tons during the whole of 1970.

A UNDP/FAO review mission visited the project in the second half of 1971 and recommended its extension till the end of December 1972. It also suggested that greater emphasis be placed on the pelagic fisheries and the artisanal fishery sector.

During the period October 1971 to April 1972, the RIZQ-AL-BAHR completed 9 cruises comprising 727 hours of echo-sounding and 5176 miles of sonar-surveys. In 32 hauls with the purse seine, 477 tons of fish were caught consisting of 447 tons sardine, 10 tons small horse mackerel and 20 tons catfish. The NISSHIN MARU NO.52 completed its surveys by 9 November. The fishing surveys and operations revealed commercial concentrations of sardine in Mukalla area and around Irqa. Using a new purse seine the RIZQ-AL-BAHR brought in catches of 50 to 60 tons per set of purse seines in Mukalla area, during September to December. The Masterfisherman estimated that 15000 tons of fish could be landed by a 200 ton capacity boat during the sardine season. On the basis of these experiments and findings, the Yemeni Fishmeal Company was founded in January 1972 and the Government entered into an agreement with the Kuwait Fund for Arab Economic Development for necessary financing of this industry.

Mechanized gillnetting and longlining demonstrations by the Masterfisherman were completed in December 1971, and his draft report was submitted to the Project Manager. The Marketing and Processing Adviser completed his six-month assignment in March 1972. The construction of a demonstration fish curing yard was completed under his supervision. The Fishery Biologist completed his assignment in December 1971 and the Marine Engineer in April

1972. Under the supervision of the Industry Adviser, the basic preparation of the fishmeal plant site was completed and heavy equipment moved to their approximate positions. A Naval Architect worked with the project as Consultant from 8 November 1971 to 31 December 1971 to advise and assist the Government on the improvement of the fishing fleet. The Refrigeration Consultant's report on cold storage requirements was submitted to the Government in January 1972. An FAO/IBRD Cooperative Programme Mission visited the project from 3 to 27 February 1972 to examine more closely the investment opportunities identified by the FAO/IBRD Mission of June 1971.

The draft terminal report of the Project Manager has been submitted. His conclusions and recommendations are as follows:

(1) Trawl Fishing: The trawlable fishing grounds are approximately 7750 square miles and the maximum sustainable annual yield of demersal fishes is estimated at 80 000 tons comprising 30 000 tons breams, 10 000 tons antakh, 10 000 tons small horse mackerel, 5 000 tons lizard fishes, 5 000 tons mormora, 2 000 tons rock cods, and about 11 000 tons of cuttlefish, squid, shrimp and lobster. The present annual production is estimated at 20 000 tons, which includes 5 500 tons of cuttlefish and lobster. The development of trawl fishing in two phases is suggested. Phase I would include the introduction by stages of ten 1 000 to 1 500 GT freezer trawlers manned by expatriate officers and part local crew, to operate from Aden. This will enable training in big trawler management and trawl fishing and also help to obtain foreign markets. Simultaneously, a fishing harbour should be constructed at Nishtun and skippers and engineers for small trawlers should be trained at the Training and Research Centre, Aden and through scholarships abroad where necessary. Small 200 GT trawlers manned by local crew based at Nishtun and to operate exclusively in the Ras Fartak area should be introduced. The number of trawlers has not been indicated.

(2) Purse seining, longlining and gillnetting: (a) Sardine purse seining is commercially feasible from September to December and the season can be prolonged up to February if a special purse seine suitable for shallow waters is used. The sardine and anchovy yield has been estimated at 240 000

tons. A 200 ton hold-capacity purse seiner equipped with two purse seines of 280 x 42 fathoms and 190 x 26 fathoms (for shallow waters) is recommended. Mechanized beach seines for shallow waters from January to May are also recommended. (b) Surface long-lines and driftnets and bottom lines for rocky bottoms for use by mechanized local fishing craft should also be introduced. Yields are estimated at 20 000 tons of mackerel, 15 000 tons of yellow-fin, skipjack and bonito, and 5 000 tons of kingfish.

(3) Marketing, Distribution and Processing:

(i) Freezing plants and storages should be set up at the following places:

- (a) Aden - Freezer 20 tons/day; cold storage 800 tons frozen fish; 20 tons/day ice-making plant and 50 tons flake-ice store.
- (b) Shuqra - 20 tons iced fish storage plus insulated trucks for transport to Aden.
- (c) Mukalla - Freezer 15 ton/day; Cold storage - 800 tons frozen fish; 10 ton/day ice-making plant and 45 tons flake-ice store.
- (d) Shihr - 15 tons iced fish storage plus insulated trucks for transport to Mukalla.
- (e) Nishtun - Freezer 40 tons/day; Cold storage - 1 500 tons frozen fish; 40 ton/day ice-making plant and 80 ton store flake-ice.

(ii) Fish-meal industry - The existing fish-meal plant should be assembled at Mukalla and its capacity doubled. Future expansion can be considered when the condition of the sardine stocks is better known.

(iii) Modern fish curing stations should be erected near the main fishing villages to improve the quality of salted and dried fish.

(4) Fishing Fleet and harbours:

(a) The traditional fishing boat, the ebri sambuk should be modified for mechanized fishing in accordance with the drawings and specifications prepared by the Naval Architect.

(b) A new flat-bottomed boat - 8 metres-powered by a 6 HP engine should be introduced to replace the small craft such as the canoe, huri and kanbari sambuk.

(c) A repair and construction yard with a slip, woodworking shop and engine repair shop should be established at Khalaf in Mukalla for vessels up to 20 metres in length.

(d) A modern fishing port complex should be established at Nishtun, after the necessary investigations have been made.

(e) Plans should be made for the improvement and extension of the existing jetty at Khalaf in Mukalla to provide berthing for vessels up to 100 gross tons.

(f) Improvement and development of the harbours at Bir-Ali, Ras-Sharma and Quishin, at a later stage are also suggested.

(5) A programme of biological studies of the condition of fish resources, particularly sardine, should be undertaken in order to avoid over-fishing. Work in this field has already been started by the Project Biologist.



