

Report on Fisheries Training Institute  
in Ceylon

August 1972

Government of Japan  
Overseas Technical Cooperation Agency

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## Preface

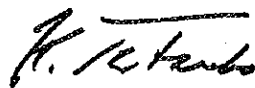
I am much pleased to present the preliminary survey report on Fisheries Training Institute in Ceylon, which was prepared by the survey team headed by Dr. C. Hamuro, Fishing Boat Laboratory, Fisheries Agency.

In accord with the request of the Government of Ceylon, the team was organized by our Agency on behalf of the Government of Japan and carried out preliminary survey on the subject for the period between Feb. 24 and Mar. 15, 1972.

I sincerely hope that the report will prove to be useful for the establishment of Fisheries Training Institute and will contribute to the promotion of the fisheries in Ceylon.

I would like to express my deepest appreciation for the valuable assistance and cooperation extended by the competent Ceylonese authorities.

July 1972



Keiichi Tatsuke  
Director General  
Overseas Technical Cooperation Agency

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## Introduction

Ceylon is an oceanic country with favorable geographic conditions, having a coastal line of 1,100 miles and being blessed with continental shelves rich in marine resources especially at her north-western and northern parts.

Fish is a source of precious animal protein indispensable to the food life of the Ceylonese. At present, however, the total domestic demand for protein-containing marine products is about 190,000 tons, while the quantity of fish catch which Ceylon can supply to her people is about 115,000 tons. Consequently, Ceylon is short of about 75,000 tons of protein-containing marine products, and the unfilled demand is all met with imports bought with her foreign currency reserves. In 1958, the Ceylonese Government mapped out the Ten Years Plan Draft 10-years plan for the development of the fishing industry (Ceylon Fisheries Corporation Colombo 3 1965) for the purpose of gradual achievement of self-sufficiency in marine products, but the plan was modified to make it more practicable after some efforts were made to carry it through. The present situation of Ceylonese fisheries is far different from what was conceived by the plan for such reasons as insufficient foreign currency reserves and technical problems: since the plan was put into effect, only five stern trawlers of 230 tons for trawling and two boats of 200 tons for long line fishing of tuna were put in operation in the deep sea fishing conceived by the plan. During this period the fishing production was increased by only about 4,000 tons a year in trawling in the fishing ground around the Wadge Bank and long line fishing of tuna in the fishing ground in the Indian Ocean.

As a consequence, the Ceylonese Government Worked out the National Programme for the Development of Ceylon's Fisheries in 1971 as a more practical general plan of fisheries supported by an intermediate plan of five years (1972 -- 1976) which aims to attain a total increase of marine production of about 60,000 tons.

To be concrete,

Present Total Marine Production

(1) Coastal Fisheries	100,000 tons
(2) Trawlers & Tuna Boats and 11-ton Boats (Belonging to the Ceylon Fisheries Corporation)	4,000 tons
(3) Inland Fisheries	11,000 tons
Total	115,000 tons

Target Increase in Five Years to Come

(1) Coastal Fisheries	25,000 tons
(2) Inland Fisheries	10,000 tons
(3) Deep Sea Fisheries	25,600 tons
Total	60,600 tons

The concrete plan of the deep sea fisheries, in particular, conceived by the Ceylonese Government is as follows:

(1) 10 Trawlers	6,000 tons
(2) 20 60-ft Fishing Craft	5,000 tons
(3) 175 45-ft Fishing Craft	14,000 tons
(4) 2 Pole & Line Vessels	600 tons
Total	25,600 tons

However, the plan does not furnish information on the types of 60-ft and 45-ft vessels in items (2) and (3).

In an attempt to develop deep sea fisheries as part of the Programme, the Ceylonese Government approached the Japanese Government for cooperation and support in the selection of proper types of fishing operation and planning and establishment of institutions for necessary fisheries training.



The Ceylonese Government has already taken some concrete measures to implement this plan: the existing Negombo Training Center is to be enlarged and a new training center is to be set up in three districts, that is, Jaffna, Batticaloa and Tangalle; an educational institution of deep sea fisheries of a higher level than the existing Coastal Training Center is to be built in Negombo; the land and buildings for the training centers to be established in the three districts have already been secured and the working budget has been appropriated so that those institutions may be opened around May 1972, and the construction of the building and installation of its facilities for the educational institution to be set up in Negombo are to be completed by the end of 1973 so that the training there may be started in 1974.

The Ceylonese Government approached the Japanese Government with this basic plan for its concrete suggestions including financial and technical support.

Against this background, the survey team conducted a survey of all the basic environmental conditions necessary to determine the proper types of deep sea fisheries and the level and scale of required educational institutions and training boats.

The Ceylonese Government has shown the following concrete plan for attaining the target increase in marine production.

- (1) To build fishing boats and equipment for a period of five years, as mentioned below.

	Quantity
3.5-ton power boat	2,200
Outboard motor boat	5,000
45-ft fishing boat	175
60-ft fishing boat	20
Trawler	10

- (2) To promote the growth of fishermen's cooperatives, finance them for acquisition of fishing boats and gear, and improve the accident compensation system and distribution systems.

- (3) To improve Galle and Trincomalee Ports.
- (4) To promote the development of domestic fisheries with support from Japan, Canada, Norway, U.S.S.R., China, F.A.O., etc.

#### Purpose of Survey

##### Request of Cooperation to the Japanese Government

(1) The Negombo Training Center which was built in 1961 with cooperation of the Japanese Government is to be raised in status from an inshore fisheries training center to an offshore fisheries training center for the purpose of training fishermen who are to be on board 45 - 60 ft fishing boats, and a new training center of the same scale of the Negombo Training Center is to be set up at Jaffna (northern part), Batticaloa (estern part), and Tangalla (southern part). The new Negombo Training Center is to lead the three training centers which are to be newly set up, planning the training programmes and carrying them through and guiding and supervising those three training centers at the same time.

(2) The Ceylonese Government wishes to have renewed cooperation from the Japanese Government. To be concrete, it wishes to receive Japanese experts in fisheries, send Ceylonese trainees to Japan, and receive grants-in-aid in the form of training boats and equipment and materials for intensified training. If the Japanese Government is willing to extend cooperation as requested, the Ceylonese Government, is ready to enter into a second training center agreement with the Japanese Government.

(3) The Ceylonese Government requests that the Japanese Government study the details of the plan formulated by the Ceylonese Government, make recommendations concerning the methods of training and training facilities, and despatch a survey team to Ceylon for the purpose of determining the possibility of new cooperation.

2) Background to the Despatch of a Survey Team Study of the Request of the Ceylonese Government for Cooperation

In the past three survey teams of experts in fisheries were despatched to Ceylon, that is, a survey team of about ten experts to provide guidance to the Negombo Training Center, a survey team of tens of experts to guide the operation of tuna fishing boats by the Japan-Ceylon Joint Fishing Company, and a survey team to provide guidance concerning fisheries and fishing ports. Moreover, from 1950 to 1960, a number of Japanese tuna fishing boats conducted fishing operations in Ceylonese waters, since those waters were good fishing grounds of tuna, and besides, many Japanese survey boats of marine research institutes entered Colombo Port, conducting test operations in the adjacent waters. As a consequence, those fishing boats and survey boats furnished a great deal of information on inshore and offshore fishing.

Prior to the despatch of the survey team, a series of discussion meeting were held to review the request of the Ceylonese Government from a technical point of view and study if effective cooperation could be extended. As a result, the following conclusion was reached.

In order to promote the fisheries of Ceylon, fishery training should be carried out for the purpose of developing offshore and inshore fishing grounds of skipjack, which is the sole undeveloped aquatic resource of Ceylon, and it is imperative to cultivate fishery experts to furnish a solution to their insufficiency which is a common problem to Ceylon and other developing countries.

### Basic Concept of Survey

The necessity of institutions for fisheries education naturally ties in development of fisheries. The study of possibilities of deep sea fisheries the development of which Ceylon considers most desirable leads to the determination of the type, level and scale of institutions for fishery education. To this end, it is of prime importance to determine the types of deep sea fisheries which suit best the requirements of Ceylon, and considerations should not be limited to such factors as the presence and quantity of fish to be caught and distance from the fishing grounds when surveys are conducted to determine the desired types of deep sea fishing operations. The survey team conducted surveys with this basic concept in mind.

In other words, fulfilment of various environmental conditions which must be met to help develop deep sea fishery on a continuous basis is prerequisite to the promotion of deep sea fishing operations which have to be run as a sort of a business enterprise. Needless to mention, however, those environmental requirements vary with the type and scale of fishing operation. Although those environmental requirements do not necessarily have to be exhaustive and be completely met for a certain type of deep sea fishery which is and has to be developed from scratch, it is a precondition to be met that some room should be left for improvement of various environmental conditions and expansion of the scale of deep sea fishery in accordance with or in anticipation of the future development of fishing operations.

From this point of view, the team decided to determine the types of fishing operation on the basis of the results of a survey of the following environmental conditions in deep sea fishery the development of which was considered imperative.

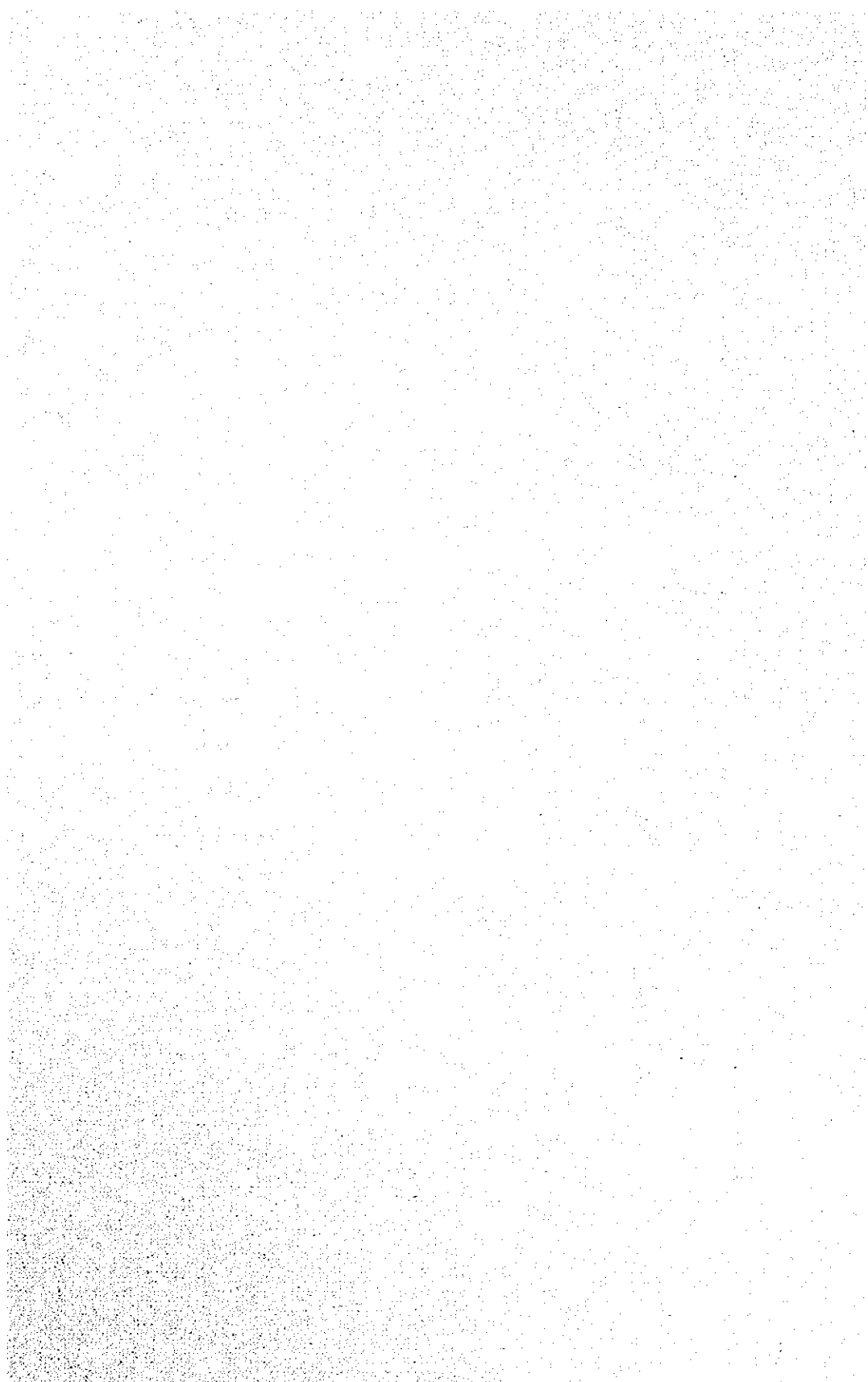
- (1) Social environmental conditions
- (2) Economic environmental conditions
- (3) Educational environmental conditions
- (4) Industrial environmental conditions
- (5) Ecological conditions of fish to be caught

The team decided to select the type of deep sea fishery which would be developed under the present environmental conditions and determine the types of fishing operation in such a manner that environmental conditions might be improved in accordance with or in anticipation of the development of the selected deep sea fishery.

The team conducted surveys with such a basic concept that the social environmental conditions of Ceylon should be taken into due consideration in the determination of the type, level and scale of institutions for fishery education which would meet the requirements brought about by the development of fisheries.

[NOTE]    Definition of Deep Sea Fishery;  
Deep sea fishery is defined here as a type of fishing operation conducted for a certain period of consecutive days on the high sea waters.





### Summarized Conclusion

The conclusion reached by the team is summarized item by item as follows for ease of understanding:

(1) The following three methods of (deep sea) fishery have been selected as suitable means of fishing to be adopted in Ceylon for the time being, provided trawling and medium-scale seining are to be started after pole and line fishing of skipjack has proved a success.

First stage: Deep sea pole and line fishery of skipjack

Second stage: Trawl fishery

Third stage: Medium-scale purse sein fishery

(2) Effective cooperation including technical guidance and assistance is to be extended for about five years, since provision of fishing gear and materials alone may not produce any favorable effect at all.

(3) This project should not be interpreted as simple assistance in fisheries but should be studied and carried through as a plan which will produce general effects on the Ceylonese economy, since the project is expected to play a decisive role in the rehabilitation of the Ceylonese economy, if it proves to be a success.

(4) G.C.E.A.L.'s are to be admitted to the training centers for the purpose of development of deep sea fishery, and training centers of such a level as a fisheries senior college are to be established.

(5) Those training centers are to have two courses, that is, fishing course and engine course which are to be finished in two years.

(6) Ten trainees are to be accepted for each course, and the number of trainees is to be increased by two in the third year. The total number of the first-year trainees is 24 in the third year and is to be increased to 30 in the fifth year. The number of trainees is to be increased as required as fishing operations develop, but the maximum number of trainees should be limited to about 50.



(7) A postgraduate course is to be set up to allow a maximum of two to three graduates of the two-year course rigidly selected to continue education and research for about one year. The postgraduate course should be left unfilled, if eligible trainees are not available.

(8) The postgraduate course is to be established for the purpose of cultivating educators of the training centers and research workers of fishing techniques, and should be of such a nature as a technical research institute.

(9) In addition to Japanese experts who are to be assigned to teach trainees in the two-year courses and one-year postgraduate course, Ceylonese professors at relative universities and other experts are to take a part-time position for fundamental education and training at those training centers.

(10) The training boat is to be a steel or F.R.P. of 65 tons of pole and line fishing boat for deep sea skipjack fishing. The boat should enable trainees to conduct drift-net, trawl-line and sticknet operations.

(11) The training boat is to be operated and controlled in close and organic relations with the Fisheries Department (Biological and Oceanic Research Institutes in particular) and educational institutions, and such operations and control should be carried out in reality so that the boat may engage in full activities in surveys and researches of fishing grounds, oceanic condition and fishing methods, as well as in actual fish-catching operations besides training.

(12) As an auxiliary training boat, an 11-ton boat is to be attached.

(13) The training and education should be conjointly carried out by the Fisheries Department, Research Institutes, the new Negombo Senior Fisheries College, and training boat.

(14) In order to maintain smooth and effective control of operations as mentioned in Paragraph (11) above, a chief of Japanese experts is to be assigned to a post of management adviser directly connected to the Director of Fisheries to furnish him with advice and suggestions at all times.

(15) The graduates of the senior fisheries college and postgraduate course should be given an appropriate authoritative qualification.

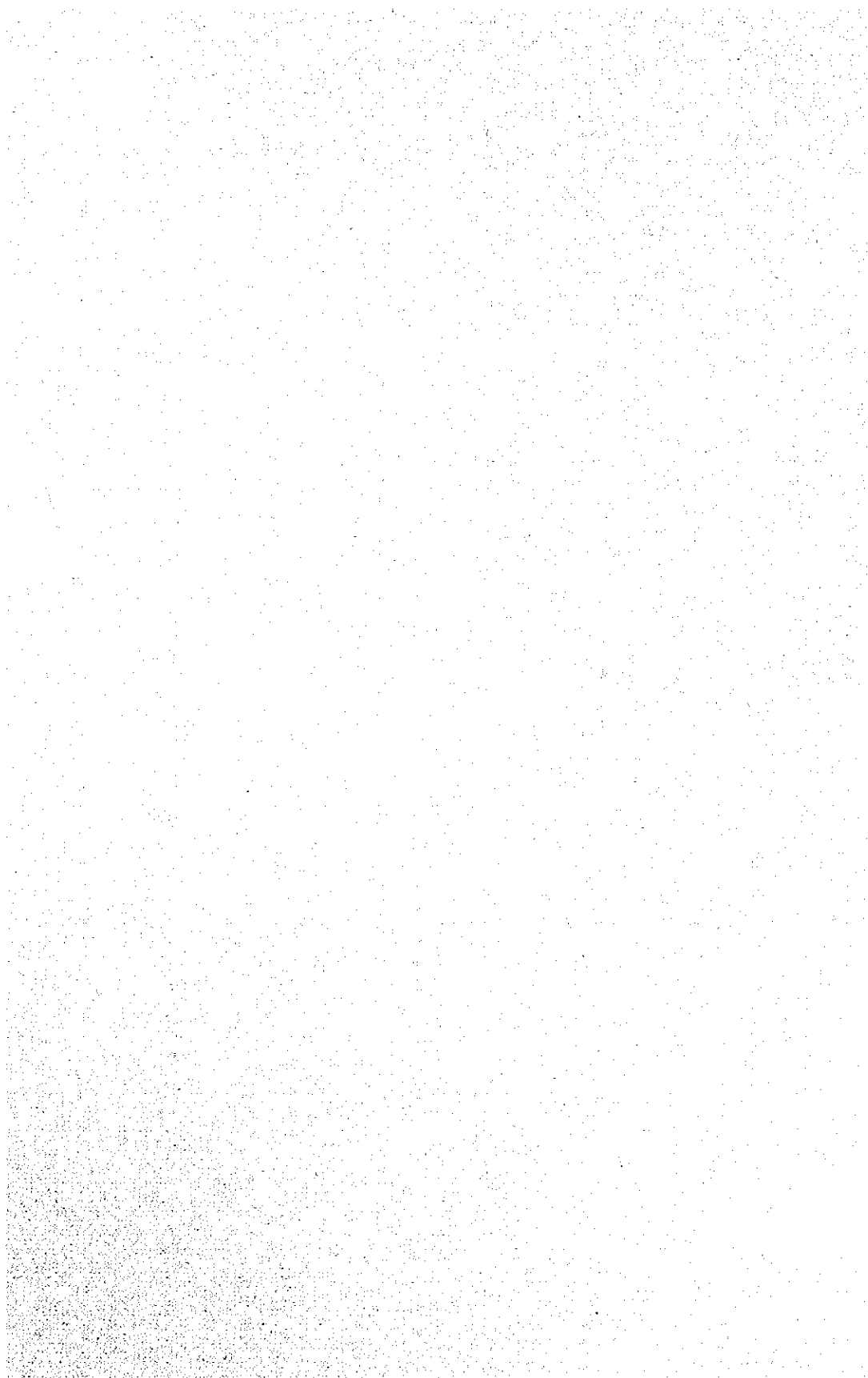
(16) It is desired that about three Japanese experts (including one field worker) will be despatched to Ceylon as soon as possible so that they may conduct further field tests concerning live baits for use in pole and line fishing of skipjack.

(17) It is strongly desired that the Ceylonese authorities concerned will make efforts to conduct tests for accustoming terapias to salt water for use as live baits.

(18) The trainees are to be trained at those local training centers for one year, and the purpose of training there consists in cultivation of competent personnel who are able to play a leading role in the improvement of fishing gear and methods in inshore fishing and repairs of engines and machines. The present report includes the curriculum of education and training and concrete plans for achieving effective results during the period of six months contemplated by the Ceylonese Government.

(19) It is hoped that the Asian Development Bank or other international financial organizations will extend cooperation to Ceylon when fishing boats for commercial operation are to be built in the future.





## Consideration of Survey Results

### 1. General Selection of Fishing Operation

It is not reasonable at all to regard solely the quantity of an aquatic resource and distance from the fishing grounds as the criteria for determining certain types of deep sea fishery which are to be developed in the future in one country. Needless to mention, the environmental conditions of fish species are important factors for the development of fishery. However, it is of great necessity to study to the fullest extent whether the country has various foundations for the catch and consumption of those species of fish which may permit the country to maintain and promote the deep sea fishery. It is equally important to consider the possibilities of improvement of the environmental conditions which form the basis of those foundations.

Accordingly, the team conducted a survey of the social, economic, industrial and educational conditions of the country and investigated into the stock of the species considered and distance from the fishing grounds for the purpose of determining the types of deep sea fishing operations.

The examination of the results of survey of the social and environmental conditions has made clear that it is of vital importance to select such types of deep sea fishing operation which may produce as large a catch as possible in view of the future population growth and increasing demand for aquatic animal protein. The examination of the results of survey of the economic and environmental conditions has made clear that it is desirable to select such types of deep sea fishing operations which may enable fish to be supplied to the nation at as low a cost as possible and such species of fish as currently bought from abroad to be caught. The survey of the industrial and environmental conditions has also made clear that the type of deep sea fishery to be adopted must not require extremely sophisticated and expensive fishing gear and that such a type of deep sea fishery must permit a sufficiently great number of fishing boats to make port at Galle and Trincomalee for supplies and fuel.

As a result of a survey of the environmental conditions of the fish species to be caught, pole and line fishing of skipjack has been selected as appropriate deep sea fishery, as shown in Table 1. The results of survey of the educational environmental conditions have also led the survey team to conclude that pole and line fishing of skipjack is an appropriate type of deep sea fishery for Ceylon.

Table 1 Determination of the Type of Deep Sea Fishery

Environmental Condition	Species of Fish	Appropriate Type of Deep Sea Fishery and Order of Importance
Environmental Condition of Species of Fish to be Caught	1. Skipjack	1. Pole and line fishing 2. Troll line fishing 3. Medium-scale seine fishing (Surface fish other than skipjack should be the main catch.)
	2. Tuna	1. Long line fishing 2. Drift- and gill-net fishing 3. Pole and line fishing
	3. Demersal fish	1. Other trawl fishing 2. Pair trawl fishing 3. Single-boat trawling
Social Environmental Condition	1. Skipjack	1. Pole and line fishing 2. Medium-scale purse seine fishing
	2. Demersal fish	1. Other trawl fishing 2. Pair trawl fishing 3. Single-boat trawling
Economic Environmental Condition	1. Skipjack 2. Demersal fish	1. Pole and line fishing 2. Otter trawl fishing
Industrial Condition		1. Pole and line fishing 2. Other types of fishing
Educational Condition		No specifically negative factor
Final Selection		1. Pole and line fishing skipjack 2. Otter trawl fishing 3. Medium-scale purse seine fishing

As shown in Table 1, line fishing of skipjack can be said to be the most appropriate type of deep sea fishery in view of all environmental conditions of Ceylon. On the other hand, fish cannot be caught by otter trawl fishing in such large quantities as required by Ceylon, unless fish are sought far off the coast, and medium-scale purse seine fishing cannot be considered an appropriate type of deep sea fishery for Ceylon, because it requires highly advanced techniques from the viewpoint of the oceanic condition and fish may be tired to death while hauling and closing a net or the freshness of fish may be reduced to a considerable extent because of the water temperature.

As a conclusion, pole and line fishing of skipjack can be said to be the most appropriate type of deep sea fishery for Ceylon, if the problem of live baits can be solved.

## **2. Educational Institutions Necessary to Develop the Selected Type of Deep Sea Fishery**

### **2-1 Level and Scale of Appropriate Institutions for Fishery Education**

#### **2-1-1 Level of Educational Institutions**

The level of the new educational institutions to be set up for the development of deep sea fishery depends on the position which their graduates occupy in fishing operations and type of activities they perform in practice. The level of those institutions may also depend on the method of fishing. The determination of the level of education may be influenced by the purpose of education, that is, whether the trainees should learn only how to operate a deep sea fishing boat or they should also acquire technical and economical knowledge required for the development of deep sea fisheries to play a leading role in the future. Be that as it may, unlike inshore fishing which is a general practice in Ceylon except for a limited number of fishermen engaged in deep sea fisheries, deep sea fisheries require a certain level of technical knowledge with which to determine the position of a fishing boat in the ocean and understand and analyze the oceanic environmental conditions with accuracy to seek a school of fish, since a deep sea fishing boat must go out far into

high seas unlike an inshore fishing boat which may always determine its position with reference to the land in sight.

Furthermore, since Ceylonese deep sea fishery must start from scratch, surveys and researches must be conducted in parallel with an effort to develop deep sea fishery so as to improve the fishing methods which best suit the environmental conditions of the fish species to be caught before attaining the stage of simply repeating an established method of fishing. In addition to these surveys and researches, technical and managerial researches are also necessary to run deep sea fishery as a business on a profitable basis. Accordingly, fishery education in Ceylon should be different in nature from that of those countries where deep sea fisheries are an established practice.

In Japan, for instance, the majority of officers of fishing boats of tens or hundreds of tons are not graduates of a special institution of fishery education. They obtain the seaman's competency certificate after they acquire experience and knowledge in a fishing boat and engage in deep sea fishing operations as officers, captains or chiefs. In those countries where deep sea fisheries are far advanced, however, fishing operations themselves are conducted according to a highly systematic programme with logical and scientific techniques, and those techniques include a great deal of results of studies and researches conducted in various fields such as biology, oceanography, fishing gear and methods, mechanical engineering, etc. Accordingly, fishermen can learn fishing techniques for themselves to become officers while being engaged in fishing operations without receiving education at a special institution of fishery education, since those leading fishing countries have an established system in which fishermen can cultivate their knowledge and techniques in a fishing boat and obtain a competency certificate or other licences.

In Ceylon, however, such an educational foundation is not established since deep sea fishery is going to be inaugurated for the first time in the history of Ceylon. As mentioned before, it is not sufficient to cultivate officers of fishing boats in Ceylon. The purpose of cultivation of experts in deep sea fishery must include the training of high class technicians and experts who are able to conduct biological and



oceanographic researches for finding schools and improve the fishing gear and methods which may be used in catching the detected schools. Moreover, it is only natural that fishery education in Ceylon should also include the cultivation of educators of those technicians and experts.

As a result of surveys conducted in Ceylon, the team has concluded that Ceylon should start deep sea fishery first with shipjack pole and line fishing, and then otter trawl fishing and medium-scale purse seine fishing in order of mention. Judging from the techniques required in these fishing operations and reasons mentioned above, the new educational system of fishery should be of such a level as the fisheries senior college. Accordingly, the fisheries senior college should receive those selected out of the graduates (G.C.E.A.L.) of the advanced course who have completed the science course of senior secondary education of the old educational system. The senior fisheries college of the new educational system should also receive those selected out of the graduates who have finished the science course of the upper school of the two-year educational system. (See Fig. 1)

#### 2-1-2 Number of Applicants for Fishery Education and Other Related Problems

The present educational system of Ceylon is as shown in Fig. 1. The difference between the old and new educational systems lies in the fact that importance was attached to the art course and commerce source in the old system, while priority is given to the science course in the new system. However, five years are required before the graduates of the senior secondary education of the new system become available for further fishery education, since the first graduates of the senior secondary education are expected to come out in 1977. For the coming five years, therefore, there is no alternative but to give fishery education to the graduates of the old educational system which attaches importance to the art course and commerce course.

The unemployment rate of the graduates of the science course is as low as 2%, whereas that of the graduates of the art and commerce courses is as high as 50%. It is undesirable that the new fishery educational institutions which are planned to be (and

must be) established should receive graduates of the art and commerce courses, because graduates of courses other than the science course will find it difficult to understand the lessons in view of the educational curriculum of those fishery educational institutions.

As shown in Table 2, there have been a great number of candidates for entrance to the senior fishery college in every term, but it is an undeniable fact that those candidates are weak in scientific subjects. Accordingly, the problem of fishery education lies in the fact that it must be given to the graduates of the science course.

The problem will be far easier to solve by the time when deep sea fishery is developed as a business, since the importance of this industry will have been widely recognized and fishery education can be given to the graduates of the schools of the new educational system and a greater number of graduates of the science course by this time. In the meantime, however, some special measures must be taken.

If things are left to take their own course without taking such special measures for this problem, the fishery education may prove fruitless and the deep sea fisheries will not show any satisfactory development. The sole and most important measure to be taken in this connection may be to show practically remarkable results of deep sea fisheries. In other words, what matters most is to show an actual catch of shipjack to make people understand that deep sea fisheries have possibilities of developing as a business and contributing a great deal to the rehabilitation of the Ceylonese economy in the future. To this end, the training boat should not be regarded as a means of training only, but the mission of the training boat as a pioneer of shipjack fishing must be fully recognized. In other words, the training boat should be utilized to the fullest extent in actual fishing operations as well as in surveys of the fishing grounds in close cooperation with the existing Research Stations belonging to the Fisheries Department for the first year of navigation training, not speak of the period during which training is not scheduled. (See Fig. 1). It is ardently desired that a pioneer boat intended for use in actual fishing operation will be provided, if possible, for cooperative activities with the training boat.

It is also pointed out that the Ceylonese people's subconscious distinction of trades may baffle the qualified G.C.E.A.L's in their aspiration for education at the new fishery educational institutions. However, the problem of trade distinction will be gradually solved, if it can be demonstrated that skipjack pole and line fishing can develop as a business in the future.

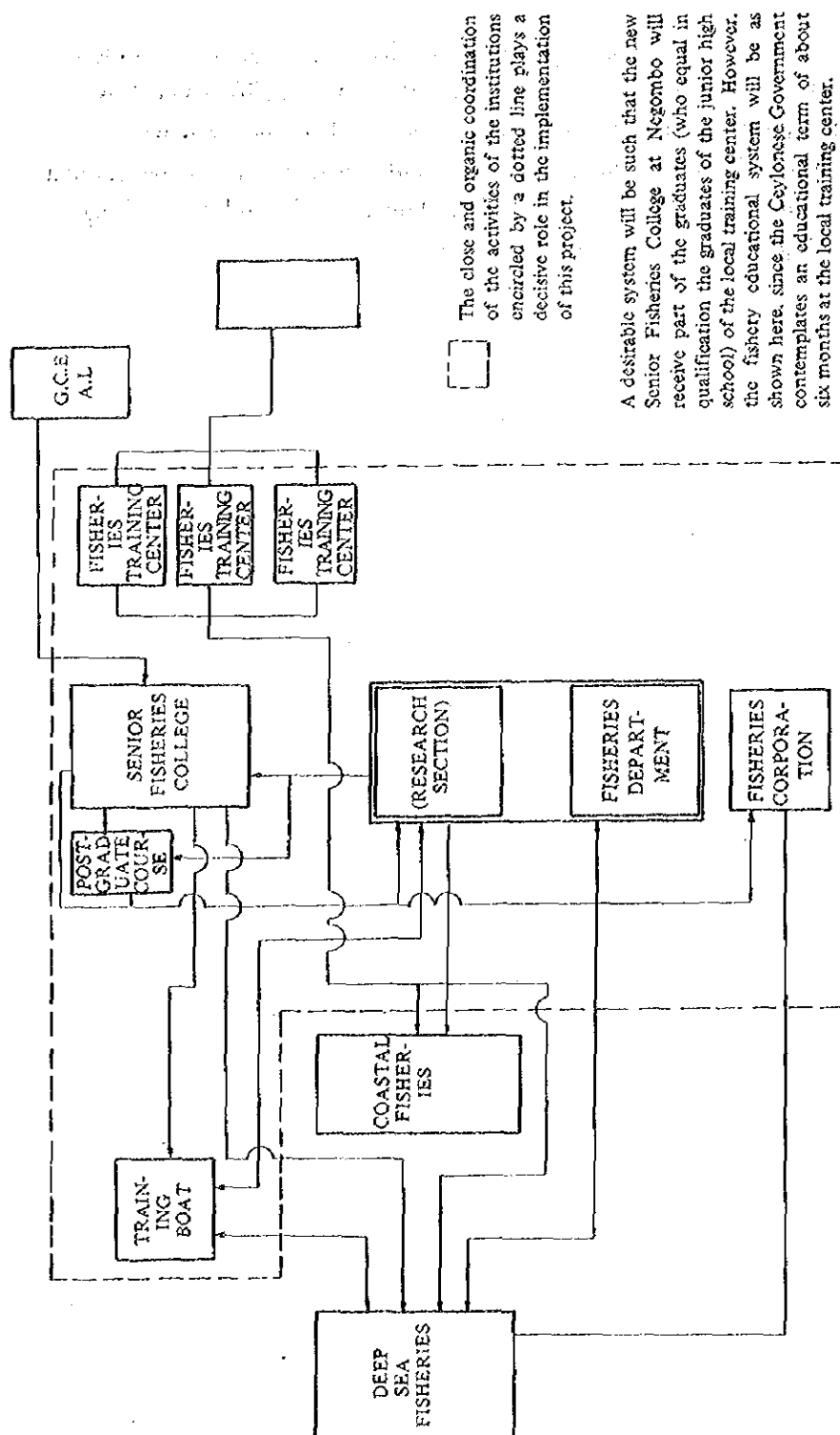


Figure 1 Functional Flow Chart of Proposed Fishery Educational Institutions

### 2-1-3 Number of Students of the New Fishery Educational Institutions and Kinds of Courses

Great care should be employed in the determination of the number of students of the new fishery educational institutions which make it a principal aim to cultivate leaders of fishery to be assigned to promote underdeveloped deep sea fishery and make it a secondary aim to cultivate the educators of those institutions and staff members of technical research institutes of fisheries.

The reason is that it is evidently not permitted to allow the graduates and students of those fishery educational institutions to conceive a fear of unemployment or fail to be employed, until the Ceylonese people recognize the fact that deep sea fishery is an attractive industry for Ceylon. Accordingly, the number of students of those institutions should be such that all of them may be employed upon graduation, even if no commercial fishing boat for skipjack pole and line fishing does not exist at all at that time. In such a case, it is desired that they will be employed as candidates for the officers of the five trawlers and two long tuna liners already engaged in deep sea fishery and lecturers of the senior fishery college.

From this viewpoint, an appropriate number of students may be as follows:

Table 2 Planned Number of Students

Year	1974 1st year	1975 2nd year	1976 3rd year	1977 4th year	1978 5th year	1979 6th year	1980 7th year	1981 8th year	1982 9th year	1983 10th year
Fishing Course (2 yrs)	10	"	12	"	15	"	"	"	"	"
Engine Course (2 yrs)	10	"	12	"	15	"	"	"	"	"
Total Number	20	"	24	"	30	"	"	"	"	"
Number of graduates										
F.C.	—	—	10	"	12	12	15	"	"	"
E.C.	—	—	10	"	12	12	15	"	"	"
Advanced Course (1 yr)										
F.C.	—	—	2	2	2	2	3	3	3	3
E.C.	—	—	2	2	2	2	3	3	3	3
Number of Graduates										
F.C.	—	—	—	2	2	2	2	3	3	3
E.C.	—	—	—	2	2	2	2	3	3	3

The new fishery educational institutions are to have a regular course of two years and a special course of one year, and both courses are to be divided into a fishing course and an engine course. The applicants for entrance to these institutions must be qualified G.C.E.A.L.'s, and only those who have finished the science course are to be admitted upon examination. The number of students of the advanced course or postgraduate course is to be limited to two and is to be increased to three in the seventh year. The number of students of the regular course is to be increased to fifteen in the fifth year and a further increase is to be determined depending on the development of skipjack pole and line

fishing. However, the education should not be limited to skipjack pole and line fishing but cover a wide range of deep sea fisheries at large.

## 2-2 Outlook for the Employment of Graduates

As discussed in Paragraph 2-1, the number of students to be admitted to the fishery educational institutions should be determined depending on the development of skipjack pole and line fishing. If the number of students is limited at the early stage of deep sea fishing, complete employment may be possible. The graduates of those fishery educational institutions may be employed, first, as candidates for officers of the skipjack pole and line fishing boats, and the trawlers and tuna long liners already engaged in deep sea fisheries, secondary as technicians of the Fisheries Department, Fisheries Corporation and fishing companies, and thirdly as lecturers of the local training centers of fisheries. Lastly, those graduates may take the advanced course of the new fishery educational institutions and may be employed as lecturers of the new Senior fishery college or research workers of the research institutes which are expected to be established to promote technical researches of fisheries.

## 2-3 Location of the New Fishery Educational Institutions and Facilities

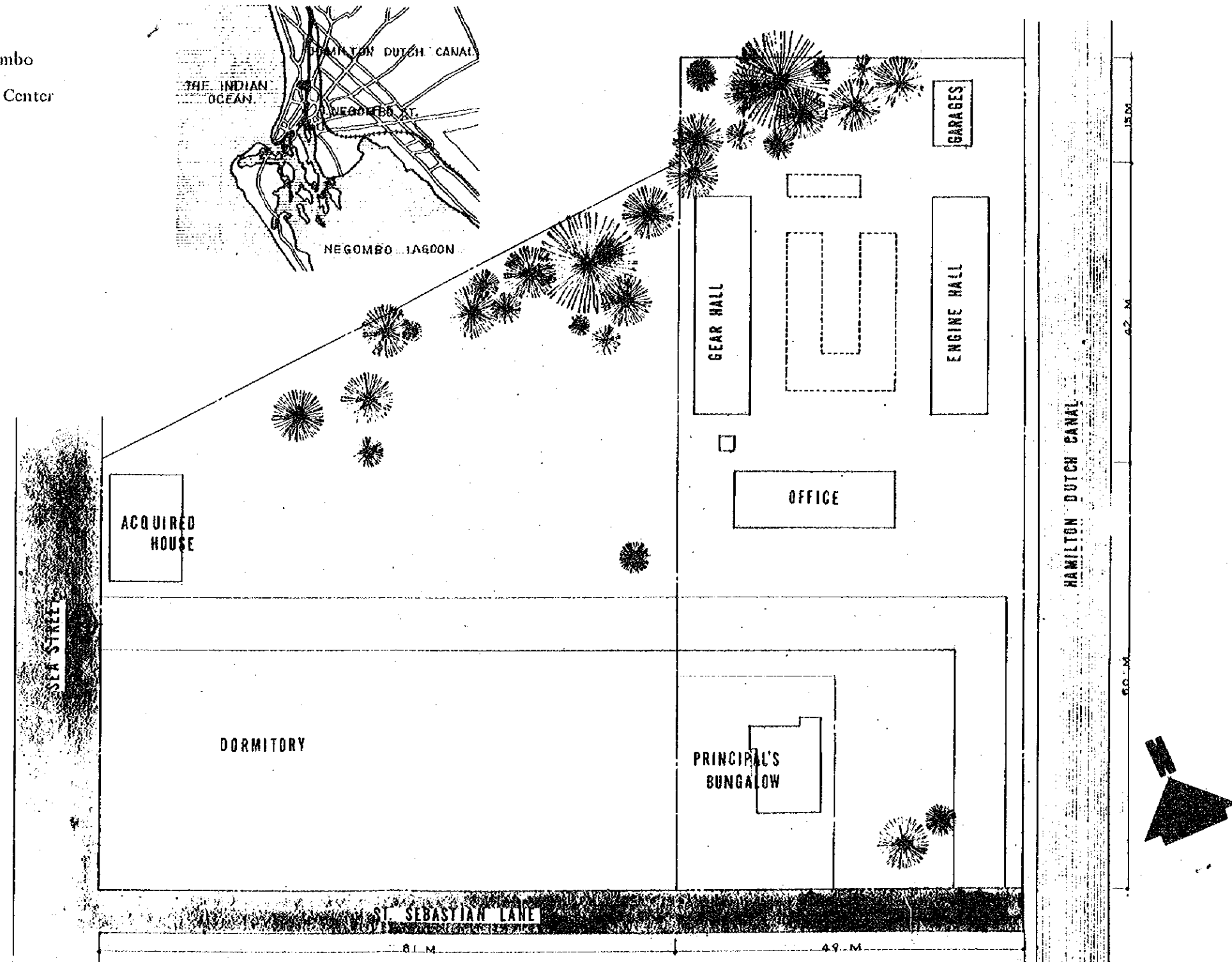
It can be said that Negombo where the Ceylonese Government plans to set up the new fishery educational institution has been rightly selected as a site for construction of such an institution. However, the plan of construction the new educational institution in the proximity of the old training center is not considered reasonable, since the available area is not large enough. It is therefore necessary to move the old training center to some other location.

However, the site of only three hectares available at Negombo is not large enough to train more than a total of 60 students of the regular courses in the first and second years, that is, 15 students of the fishing course and engine course each, and four to six students of the advanced course. It is more desirable to move the training center to some other location rather than expand the site to admit a larger





Figure 2-1 Present Negombo  
Fisheries Training Center



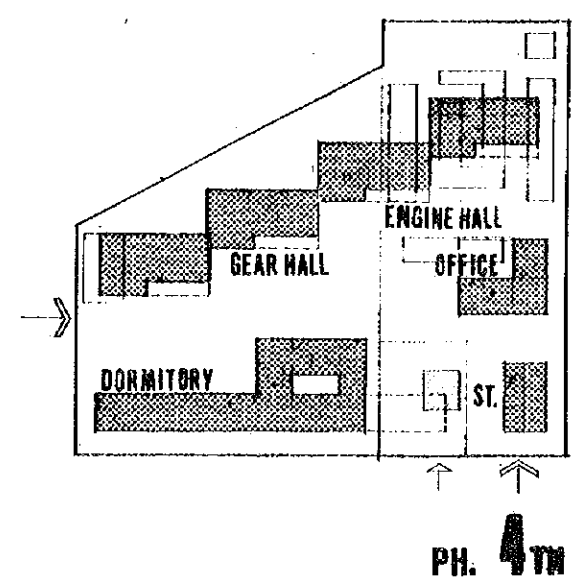
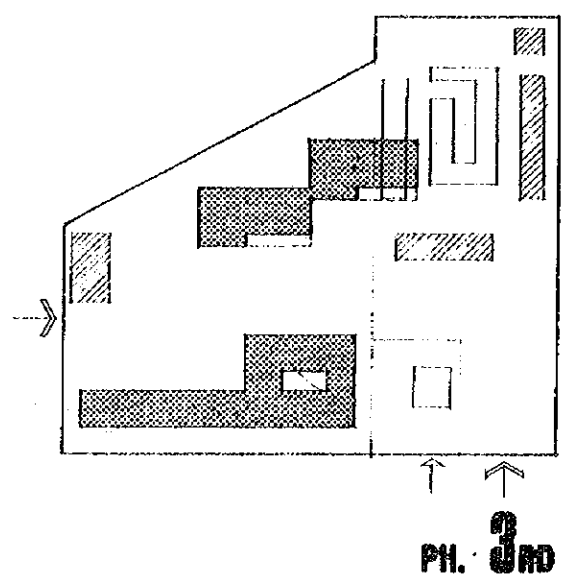
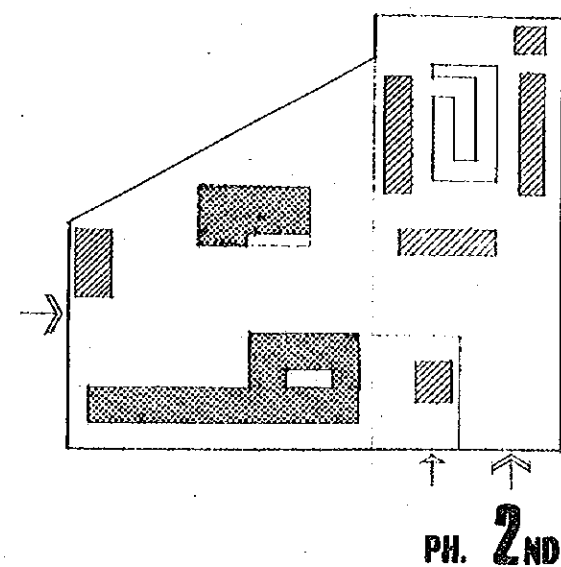
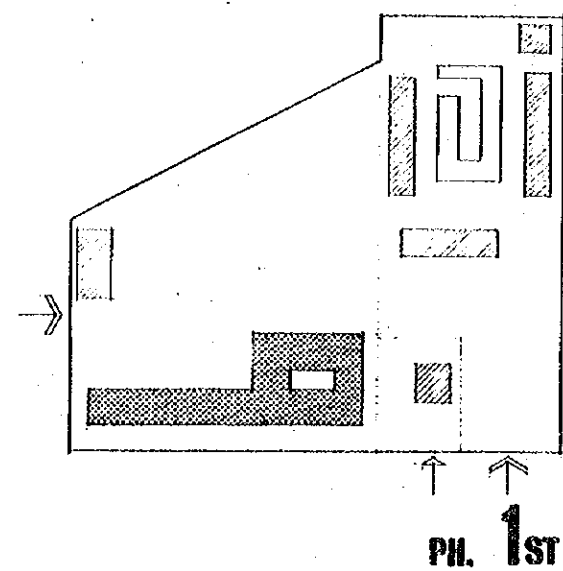
**A FISHERIES TRAINING CENTER**

**SITE PLAN**

**SCALE 1:500**

**NO. 3**

Figure 2-2 Layout of New Negombo Training Center



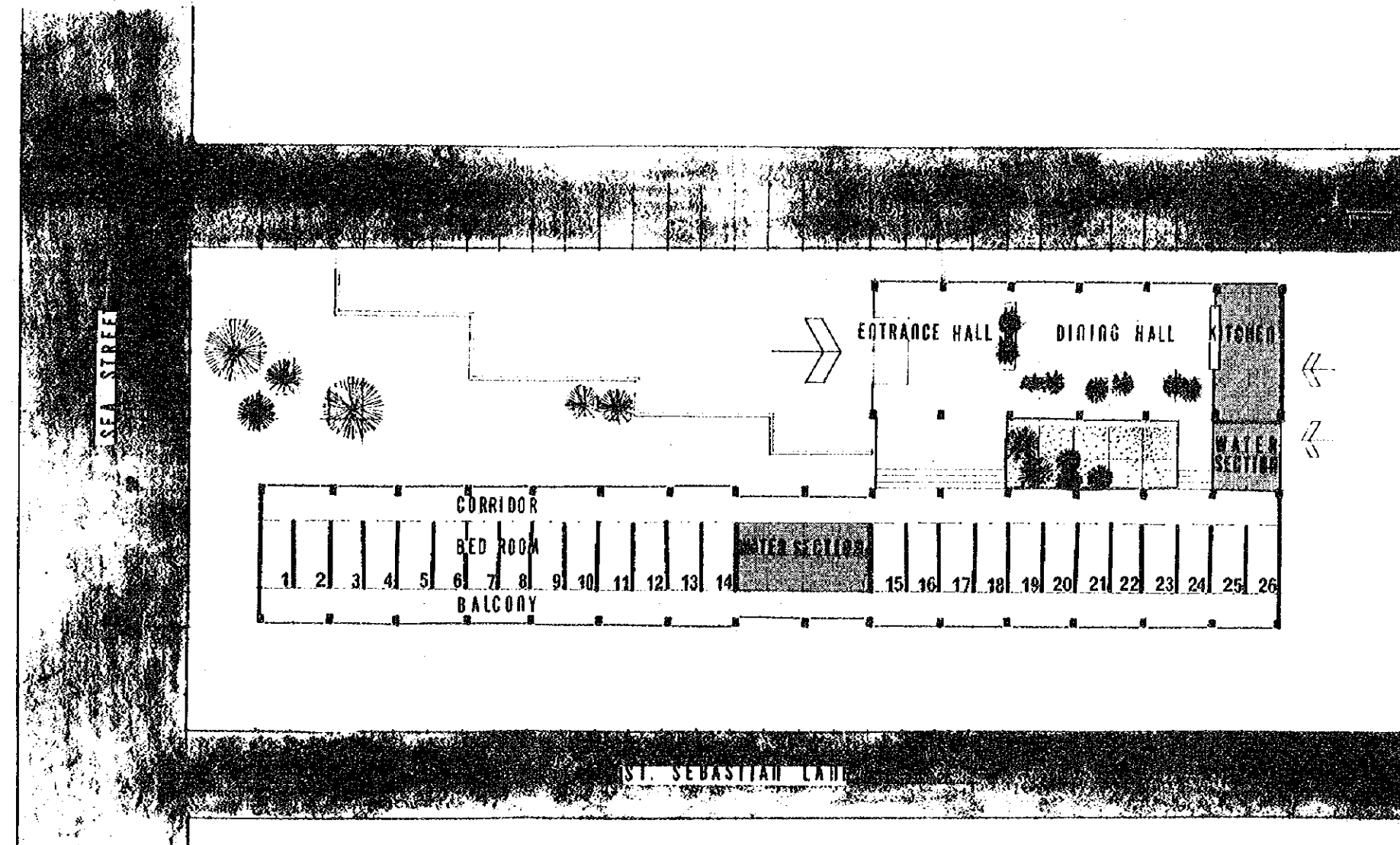
A FISHERIES TRAINING CENTER

PHASE OF CONSTRUCTION

SCALE 1:1500

NO.2

Figure 2-3 Layout of New Negombo Training Center



A FISHERIES TRAINING CENTER

PLAN OF DORMITORY SCALE 1:300 NO. 4

number of students in order to cope with the development of deep sea fishery.

Negombo is generally an appropriate site for construction of the new fishery educational institution, because, as to be mentioned in Paragraph 2-5, the site is located at a reasonable distance from Colombo University, Fisheries Department and Fisheries Corporation so that professors of Colombo University and staff members of those governmental organizations may be able to teach at the new fishery educational institution as lecturers. From only a geographical point of view, however, the new fishery educational institution may be set up in Colombo to advantage. The facilities which are to be installed in the proposed site at Negombo are shown in Fig. 2.

#### 2-4 Curriculum of the New Fishery Educational Institution

The principal subjects to be studied at the new fishery educational institution are as shown in Table 3 and 4.

Table 3 Subjects by School-year (Fishing Course)

School-year Subject	1st year	2nd year	Advanced Course	Contents
Introduction to fishery	○			General fishing and manufacture of aquatic products
Fishing grounds (including oceanography)	○	○		Characteristics of the deep sea fishing ground, plankton and fishing, and introduction to oceanography
Econology of fish	○			Ecology of aquatic animals
Introduction to physics of fishing gear	○	○	○	Physical explanation of fishing
Materials of fishing gear	○	○	○	Properties of the materials of fishing gear
Construction of fishing gear	○	○	○	Construction of fishing and netting gear
Fishing methods	○	○	○	Sounding of fish schools, ecological characteristics of fish, and application of fishing methods

School-year Subject	1st year	2nd year	Advanced Course	Contents
Cos-navigation	○		○	Coastal navigation, navigation aids, bearings and magnetic compass
Celestial navigation		○	○	Introduction to astronomy, calculation of the longitude, and determination of the ship's position
Steerage	○	○		Fundamentals of steerage, general steerage and steerage in stormy weather
Preservation of fish catches		○		Preservation of fresh fish and primary processing of fish
Fishing boats		○	○	Introduction to fishing ships (Classification, construction and equipment of fishing ships)
Engines		○	○	Outline and terms of the engines, internal combustion engines, shafts and propellers
Introduction to the fishing equipment		○	○	Types, functions and operation of the fishing equipment and equipment of fish processing
Hygienics	○			Hygiene in fishing ships
Introduction to the international laws	○			Outline of the international laws
Introduction to radio communication		○		Types and outline of methods of electrical communication
Fishermen's cooperatives	○			Characteristics and management of fishermen's cooperatives and businesses run by fishermen's cooperatives
Oceanic meteorology				Weather report, weather chart, and marine accidents
(Field Training)				
Fishing gear training	○	○		
Steerage training	○			
Engine training		○		
Navigation training	○	○		
Fishing training	○	○		
Radio communication training		○		
(Training on board a training boat)		○		

Table 4 Subjects by School-year (Engine Course)

School-year Subject	1st year	2nd year	Advanced Course	Contents
Introduction to fishery	○			Fisheries in general, and manufacture of aquatic products
Mechanical mathematics	○	○		
Mechanical materials	○	○		
Mechanical technology	○	○		Casting, welding, machining and heat treatment
Internal combustion engines	○	○	○	Outline of the internal combustion and diesel engines
Mechanics	○	○	○	Materials and construction of machines
Mechanical drafting	○	○	○	Fundamentals of drafting and mechanical drafting
Electricity	○	○		Introduction to electricity, AC motors and reception and distribution of electric power
Fishing machines	○	○		Types, functions and operation of fishing machines
Fishing boats	○	○	○	Outline of the fishing ships (Classification, construction and equipment of fishing ships)
Meterage	○	○	○	
Introduction to refrigerating equipment	○	○		Principle of refrigeration, coolants, and refrigerating equipment
Propellers	○	○	○	
(Field Training) Cartography and drafting	○			Fundamentals of cartography and drafting
Designing and drafting		○		Applied drafting
Material experiment	○			Measurement of the strength of materials, etc.
Machining	○			Machining
Engine training		○		Operation, disassembly, construction and function of the engine
Welding training		○		

## 2-5 Number and Composition of Instructors

As already described, success of deep sea fishery development in Ceylon depends primarily on whether good catches are actually attained or not.

For this reason, the chief Japanese expert should be appointed the management advisor serving directly under the Director of Fisheries Department.

Instructors should be composed of Japanese experts and part-time Ceylonese instructors. It is hoped that their composition will be as shown below.

Fishing Course:	3 Japanese experts (1 serving concurrently as management advisor) 4 part-time Ceylonese instructors
Engine Course:	2 Japanese experts 3 part-time Ceylonese instructors
Training Boat:	2 Japanese experts

Training is to be given by Japanese experts or part-time Ceylonese instructors aided by Ceylonese assistants.

## 2-6 Training Equipment

Training equipment and instrument required for the fishing course are shown in Table 5, and those for the engine course in Table 6.

Table 5 Training Equipment and Instrument for Fishing Course

Item	Quantity	Cost (Thousand yen)
(Total of fishing gear)		2,170
Fish Finder	1	390
Automatic Skipjack Angler	1	500
Others	17	1,280
(Total of nautical training instrument)		2,482
Equipment for Deviation Adjustment Training	1	350
Log	1	182
Loran	1	550
Radar	1	1,200
Others	8	200
(Total of equipment for seamanship training)		1,148
Equipment for Collision Prevention Training	1	150
Structural Model of Stem and Stern	1	190
Model Hydraulic Pump (motor driven)	1	380
Others	9	428
(Total of training equipment for Oceanographic and meteorological observation)		2,564
Electric Water Temperature-Indicator	1	175
Automatic Set-current Recorder	1	272
Aqualung	1	300
	1	770
Anemometer-wind Direction Recorder	1	145
Others	18	902
Total		9,000



Table 6 Training Equipment and Instrument for Engine Course

Item	Quantity	Remarks
Marine Diesel Engine	1	9 PS, 4 c/s
Hydraulic Dynamometer	1 set	
Air Compressor	1	3 PS
Oil Cleaner	1	For LO
Propeller, Propeller Shaft, and Stern Tube	1	
Thermoelectric Thermometer for Exhaust Pipe	1	14 point contact type
CO <sub>2</sub> Meter		
Others	18	
(Total of Engine and Related Equipment)		
Universal Testing Machine	1	Relaying type
Shore Brinell ) Hardness Meter	1 each	
Metaloscope	1	
(Total of Material Testing and Experimenting Equipment)		
Gas Electric ) Welding Machine	1 each	
Lathe	1 -- 5	
Four-in-one Machine	1	
Horizontal Milling Machine	1	
Vertical Milling Machine	1	
Hack-sawing Machine	1	
Tool Grinder	1	
Milling Cutter	1	
Others	14	
(Total of Welding Apparatus)		
Diesel Engine Generator	1	3 kW, 3P, AC
Switchboard	1	
DC ) Motor	1 each	
AC )		
Rectifier	1	
Others	20	
(Total of Electrical Equipment)		
(Total of Model Equipment)	5	
Total		

### 3. Tonnage and Functions of Training Boat

#### 3-1 Tonnage of Training Boat

A fishing boat operating on a commercial basis is required, of necessity, to have an optimum tonnage satisfying various conditions such as safety, payability, fishing method, catchability coefficient, crew accommodation and working condition. The tonnage of a training boat, too, must be determined with due account taken of the safety of operation and number of trainees. In the case of the training boat which will be furnished by the Japanese Government, it is advisable that a careful study be made to decide on the minimum required tonnage and cut down the cost. From this viewpoint, the team assumed that the training boat will be employed chiefly for the purpose of giving training in deep sea skipjack pole and line fishing, and prepared a diagram of correlation between the tonnage and such factors as the construction cost, number of crew, capacity of the hold, number of days and distance of voyage in order that an optimum tonnage may be obtained from the number of trainees.

If the fishing course and engine course are to be offered for 12 trainees each as shown in Table 2 for simultaneous training aboard the training boat, the number of trainees will total 24. With one each of Japanese and Ceylonese instructors added to this number, the total of crews from the College will be 26. Since the boat will be manned by 11 of its own crew comprising captain (1), skipper (1), chief engineer (1), deck-hand (4), engineer (3), and cook (1), it will carry a total crew of 37. Hence, the tonnage of the boat turns out to be 90 tons and the construction cost approximately 84 million yen.

However, since the training in the two courses need not be simultaneously conducted on the boat and no inconvenience is expected to arise from conducting the two courses separately, the tonnage can be determined with 24 taken as the total number of crew to be carried at the same time. (12 trainees, 1 instructor and 11 of boat's own crew). Accordingly, the tonnage and cost will be 56 tons and about 48 million ton respectively as can be obtained from Fig. 4.

When the training boat is not employed for the purpose of training, it should be used for actual skipjack pole and line fishing operation. In such a case, the boat should carry, in place of the 13-member training crew (12 trainees and 1 instructor), fishermen and research staffs who will engage in the study of aquatic animals and other subjects.

To meet any substantial increase in the number of trainees, training on the boat is to be given over a number of times by dividing trainees in each course into groups, or the boat is to be designed to have a tonnage large enough to accommodate the estimated increment of trainees. It can be reasonably anticipated, however, that a new training boat will be constructed to meet such increase because the development of skipjack line fishing will have made a substantial progress by the time when the increase is actually required.

However, it is both practical and advisable that the tonnage be determined on the assumption that the number of trainees in each course will be increased to 15. In other words, the boat should preferably have a tonnage that enables it to carry a total crew of 27.

Boat's own crew	11
Trainees	15
Instructor	1
Total	27

Hence, the tonnage is set at 65 tons and the cost 62 million yen. The cost, however, would have been estimated to reach 70 million in consideration of the future rise in construction cost.

### 3.2 Functions of Training Boat

Apart from its training function, the training boat is required to fully display the role of a forerunner in skipjack pole and line fishing operation which offers a promising prospect and a high development potential for Ceylonese deep sea fishery. Development of deep sea fishery into the country's basic industry will not only check the outflow of foreign currency reserves for import of fishes but also provide the

basis for developing related industries. This will open the way for rehabilitating and stabilizing Ceylonese national economy.

Accordingly, the training boat should be capable of actually catching skipjacks by line fishing method and perform, at the same time, the function of giving supplementary training in drift and gill net fishing and long line fishing. Further, a bait fish carrier should be provided since live bait is indispensable for skipjack fishing, and freezer with a sufficient capacity should be installed so as to produce cold sea water in which fishes are to be kept.

Living quarters of trainees should be separated from those of the boat's crew since the boat's prime objective is training. The captain and the instructor should be given a private cabin.

The training boat should preferably be a steel boat or a F.R.P. boat. Priority should be given to F.R.P. boat since it can avoid the corrosion and teredo damage of wooden boats and save the corrosion preventive maintenance work required for steel boats. It may be added that the technical level in Ceylon is high enough for any repair work that may be required for F.R.P. boats.

### 3-3 Equipment of Training Boat

#### (i) Equipment for skipjack line fishing

- (a) The boat would have a fishing platform extending on all its sides with sprinkler tubes arranged on its lower outside part and a suitable seawater pump installed in the engine room.
- (b) The boat should also have a fish hold in which sea water can be circulated through holes with remote controlled valves on the boat's bottom.
- (c) To cool down sea water in the fish hold, a cold sea water tank with cooling pipes arranged on its outside should be installed in the fish hold, and cold sea water should be pumped into the fish

hold through a suitably arranged conveyance pipe by a power pump.

- (d) To prevent the skipjack blood to flow from the deck into the sea, the holes in the bulwark (scuppers) should be so designed as will be closed during fishing operation.
  - (e) Winches and other equipment should be installed for landing the catch when the boat is berthed.
  - (f) Fishing rods, line and hooks.
- (ii) Equipment and arrangements for drift and gill net fishing
- (a) An open space of suitable size should be provided on the stern for smooth netting work.
  - (b) A detachable payout roller should be installed at the stern.
  - (c) A roller should be installed on the edge of the fishing platform on the front port side of the front deck and a detachable line hauler on the deck for smooth hauling work.

- (iii) Equipment and arrangements for long-line fishing.  
Same as for Item (ii) above.

- (iv) Equipment for navigation training

Sextant (trainees should carry their own sextants)	1 unit
Chronometer	1 unit
Magnetic Compass (1 each to be installed on and inside the bridge)	2 units
Wind Direction-Velocity Meter (vane type)	1 set
Towing Speedmeter	1 unit

Depth and Temperature Indicator-Recorder (or a set of telemetering depth and temperature meter and electric water temperature meter)	1 unit
Secchi Disk	1 unit
Colour Indicator	1 set
PH Meter	1 unit
Salinometer	1 unit

(v) Other equipment

Lifeboat Raft	For 30 persons
Life Buoy	For 30 persons

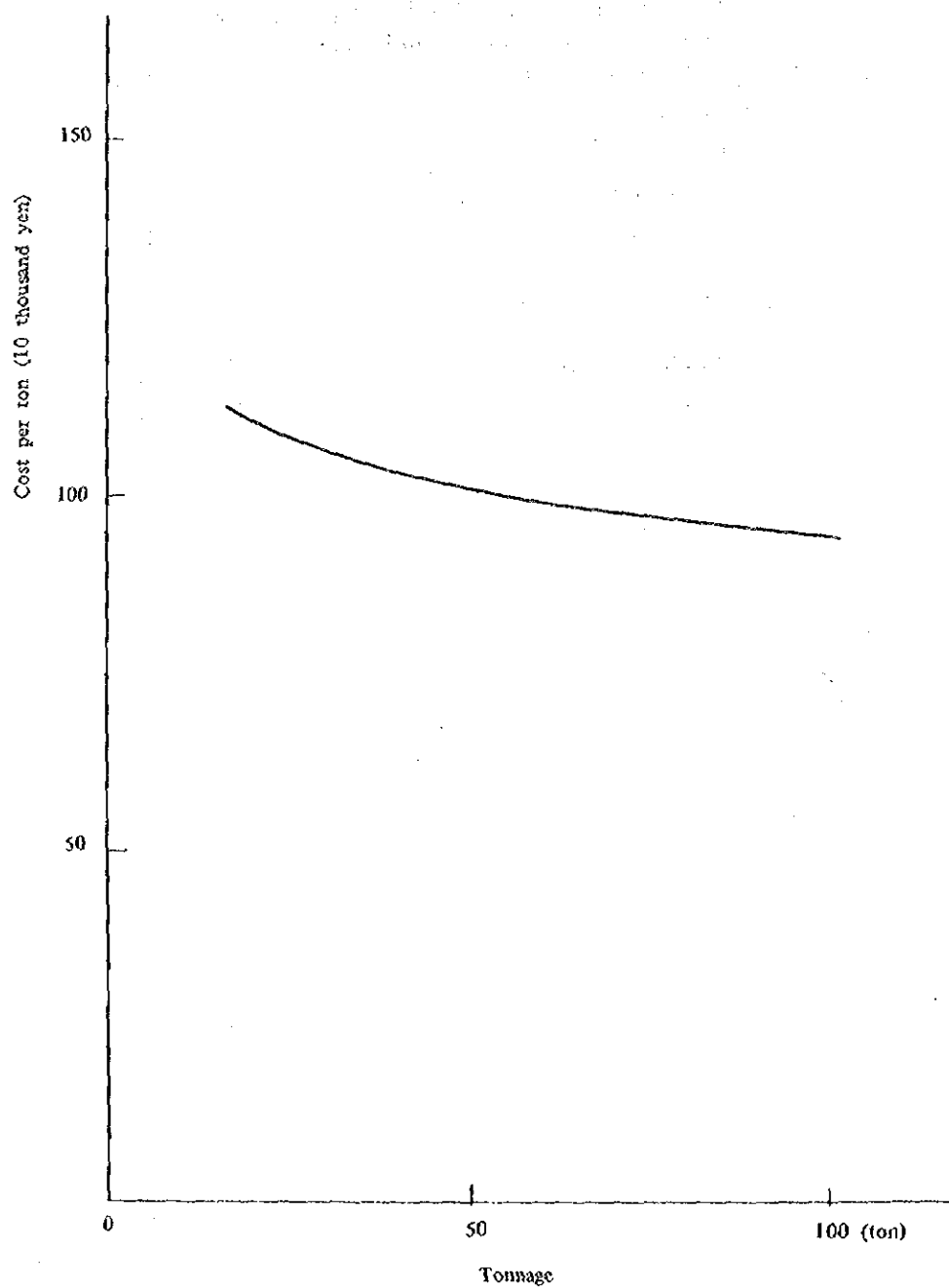


Fig. 3 Estimation of Per Ton Cost of F.R.P. Boat for Skipjack pole and Line Fishing (Inclusive of Hull, Engine, Machines and Equipment, and Fittings)

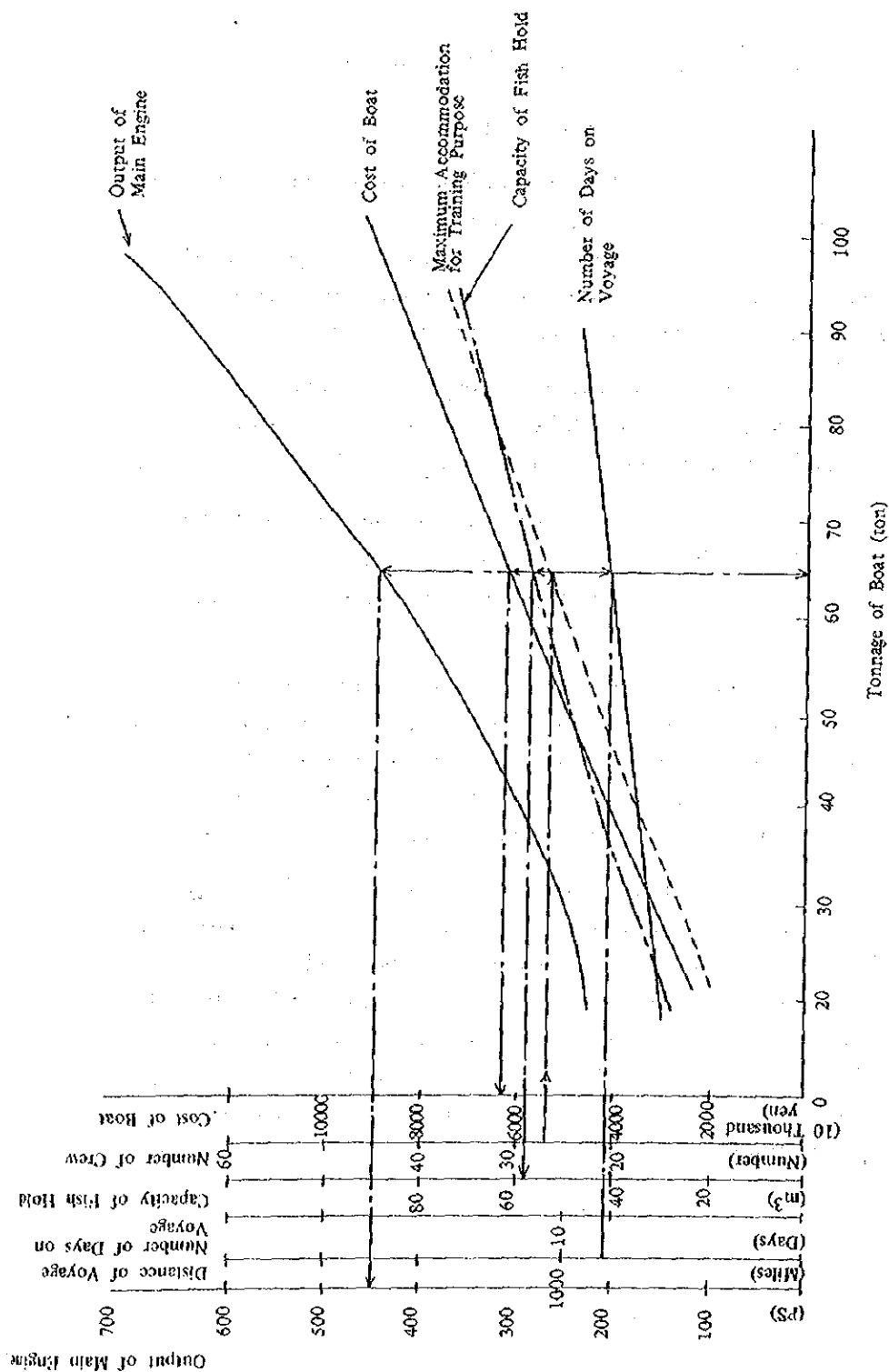


Fig. 4 Correlation Diagram for Obtaining Optimum Tonnage of F.R.P. Skipjack Line Fishing Boat



### 3.4 Operation and Payability of Training Boat

#### 3.4.1 Operation of Training Boat

The Senior Fisheries College is essentially intended for the development of deep sea fishery. Deep sea fishery bears closely upon the rehabilitation of Ceylonese economy in that it promises the improvement of the country's economic infrastructure through self-supply of animal protein and saving of precious foreign currency reserve.

What must be done through the training programme for smooth development of deep sea fishery is to demonstrate actual and convincing catches to the trainees and Ceylonese people.

It is therefore urged that the training boat will be engaged not only in the training but also in the actual fishing operation and biological and oceanographic researches in the fishing ground.

For this purpose, smooth and satisfactory operation of the training boat should be ensured by the close coordination between the Fisheries Department, its research institute, the Senior Fisheries College at Negombo as well as by their full understanding of the significance and target of the training programme.

If the training boat is completed and the college opened in 1974, no training will be conducted in that year. The boat should therefore be used for actual fishing operation and biological and oceanographic survey in the fishing ground throughout 1974. In 1975, three months should be allotted to intermittent or continuous training in the fishing course, one month to the training in the engine course, and seven months to actual fishing operation and surveys, and the remaining one month to the maintenance service and recreation of the boat's crew.

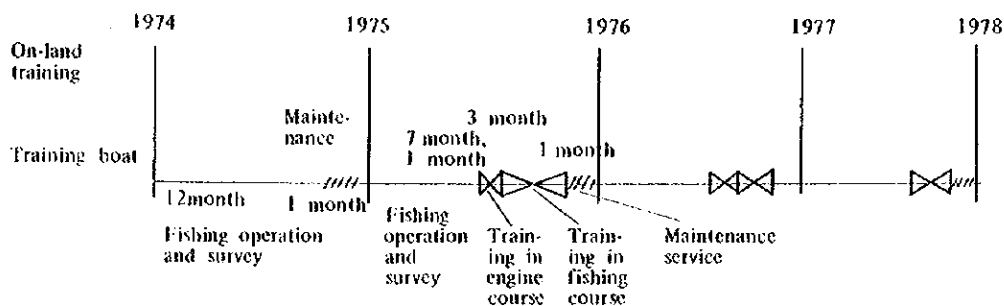


Fig. 5 Operation Schedule of Training Boat

### 3.4.2 Payability of Training Boat Operation

Since the training boat is to be used not only for the training purposes but also for actual fishing operation, its crew should be given wages and treatment proportionate to their services.

The payability of the boat's operation is studied below on the basis of the estimated catch.

The estimated quantity and value of the catch of the training boat can be obtained from the following equation.

$$C = \rho \times N \times q \times t \times m \times D \times Y \times X \dots \dots \dots (1)$$

where,

- C: Annual catch (kg)
- $\rho$ : Number of fishes caught per fisherman per minute (number)
- q: Average weight per skipjack (kg)
- t: Duration of fishing operation for one school (min)
- m: Daily frequency of meeting object fish schools

D: Number of actual operating days per voyage (days)

N: Number of fishermen (persons)

X: Monthly number of voyages (voyages)

Y: Number of operating months (months)

With these factors taken at the following values, the catch turns out to be

$$C = 1.5 \times 15 \times 10 \times 2 \times 5 \times 3 \times 10 \times 25 = 168,750 \text{ kg}$$

$$\rho = 1.5 \text{ fishes/min.}$$

N = 15 persons (number of fishermen actually engaged in fishing operation)

$$t = 10 \text{ min.}$$

$$m = 2 \text{ times}$$

$$D = 5 \text{ days}$$

$$X = 3 \text{ voyages}$$

$$Y = 10 \text{ months}$$

$$q = 2.5 \text{ kg}$$

The above estimated value shows a close approximation to 160,000 kg which is the catch of a 65-ton boat obtainable from Fig. 6.

The value of catch (S) can be calculated as follows from the producer's price (Rs 1.25 per lb; Rs 2.7 per kg).

$$S = \text{Rs } 2.7 \times 168,750 \text{ (kg)} = \text{Rs } 455,625$$

The payability calculation based on Hamuro's formula is shown below.

$$S = Pk_1k_2 + Pk_3 + M + Sk_4 + Sk_5$$

$$S = \frac{P(k_1k_2 + k_3) + M}{1 - k_4 - k_5} \quad \dots\dots\dots (2)$$

where,

S: Total annual value of production (Rs)

P: Cost of boat (Rs)

M: Fishing cost = sum of  $m_1$ ,  $m_2$ ,  $m_3$  and  $m_4$

$m_1$ : Labour cost (incl. wages and cost of meals)

$m_2$ : Fuel cost

$m_3$ : Cost of live bait

$m_4$ : Repairing and other expenses

$k_1$ : Rate of loan in total capital input

$k_2$ : Rate of interest (fixed sum)

$k_3$ : Rate of depreciation (fixed sum)

$k_4$ : Rate of shares

$k_5$ : Rate of profit

For the above factors, the following values are assumed.

S = Rs 455,625 obtained from equation (1)

P = Rs 126,000 (= 63,000,000 yen)

$M = m_1 + m_2 + m_3 + m_4 = \text{Rs } 304,987$

$$\begin{aligned} m_1 &= [\text{Rs } 300 \text{ (wages)} \times 12 \text{ months} + \text{Rs } 5 \\ &\quad \text{(meals)} \times 365 \text{ days}] \times 27 \text{ persons (same} \\ &\quad \text{values assumed for trainees and boat's crew)} \\ &= (3,600 \times 1,825) \times 27 \\ &= \text{Rs } 146,475 \end{aligned}$$

$$\begin{aligned} m_2 &= \text{Output of main engine (PS)} \times \text{Coefficient of constant operation} \times \text{Fuel consumption (kg/ps/hr)} \\ &\quad \times 1/0.85 \times \text{Fuel cost (Rs/l)} \times \text{Operating hours} \\ &\quad \text{per-day} \times \text{Annual number of operating days} \\ &= 600 \text{ (PS)} \times 0.8 \times 0.18 \times 1/0.85 \times \text{Rs } 0.33/\text{l} \\ &\quad \times 20 \text{ (hours)} \times 200 \text{ (days)} \\ &= \text{Rs } 134,112 (= \$22,352 - \alpha) \\ &\quad (\alpha = \text{customs duty and commission in Ceylon}) \end{aligned}$$

$$\begin{aligned} m_3 &= \text{Cost of one voyage} \times \text{Number of voyages} \\ &= \text{Rs } 400 \times 36 \text{ voyages} \\ &= \text{Rs } 14,400 \text{ (An assumptive value was taken} \\ &\quad \text{for the cost of live bait since it is unknown)} \end{aligned}$$

$$m_4 = \text{Rs } 20,000 (= 1 \text{ million yen})$$

$k_1 = 0$  (since the boat is to be donated by Japan)

$k_2 = \text{Ditto}$

$k_3 = \text{Ditto}$

$k_4 = 0.05$

By the application of equation (2), the profit rate ( $k_5$ ) can be obtained as follows.

$$455,625 = \frac{126,000 \times 0 + 304,987}{1 - 0.05 - k_5} = \frac{304,987}{0.95 - k_5}$$

Therefore,

$$\begin{aligned} k_5 &= 62,143.25/455.625 \\ &= 0.136 \end{aligned}$$

Accordingly, the net annual profit of the training boat will be

$$\begin{aligned} S \times k_5 &= \text{Rs } 455,625 \times 0.136 \\ &= \text{Rs } 62,101.69 \end{aligned}$$

Further, if the annual catch is processed into maldivian fish, its weight will be 67.2 tons because the weight of dried fish is about 1/2.5 of that of fresh fish. Export value of 67.2 tons of maldivian fish is as calculated below.

$$\begin{aligned} 14,000,000 \text{ (kg)} : 2,260,000 \text{ (dollars)} &= 67,200 \text{ (kg)} : x \\ x &= 15,187.2 \text{ dollars} \end{aligned}$$

The calculation worked out above indicates that 15,188 dollars of foreign currency can be saved by the training boat alone. Foreign currency expenditure for fuel import must be subtracted from the said saving, but this calculation is omitted.

The average income per boat's crew member will be as calculated below.

$$\begin{aligned} &300 \text{ (Rs)} \times 12 \text{ (months)} + 455,625 \text{ (dollars)} \times 0.05 \times \frac{1}{27} \\ &= 3600 \text{ (Rs)} + 843.8 \text{ (Rs)} \\ &= \text{Rs } 4,443.8 \end{aligned}$$

Hence, the monthly average income of the boat's crew will amount to about Rs 370 per person.

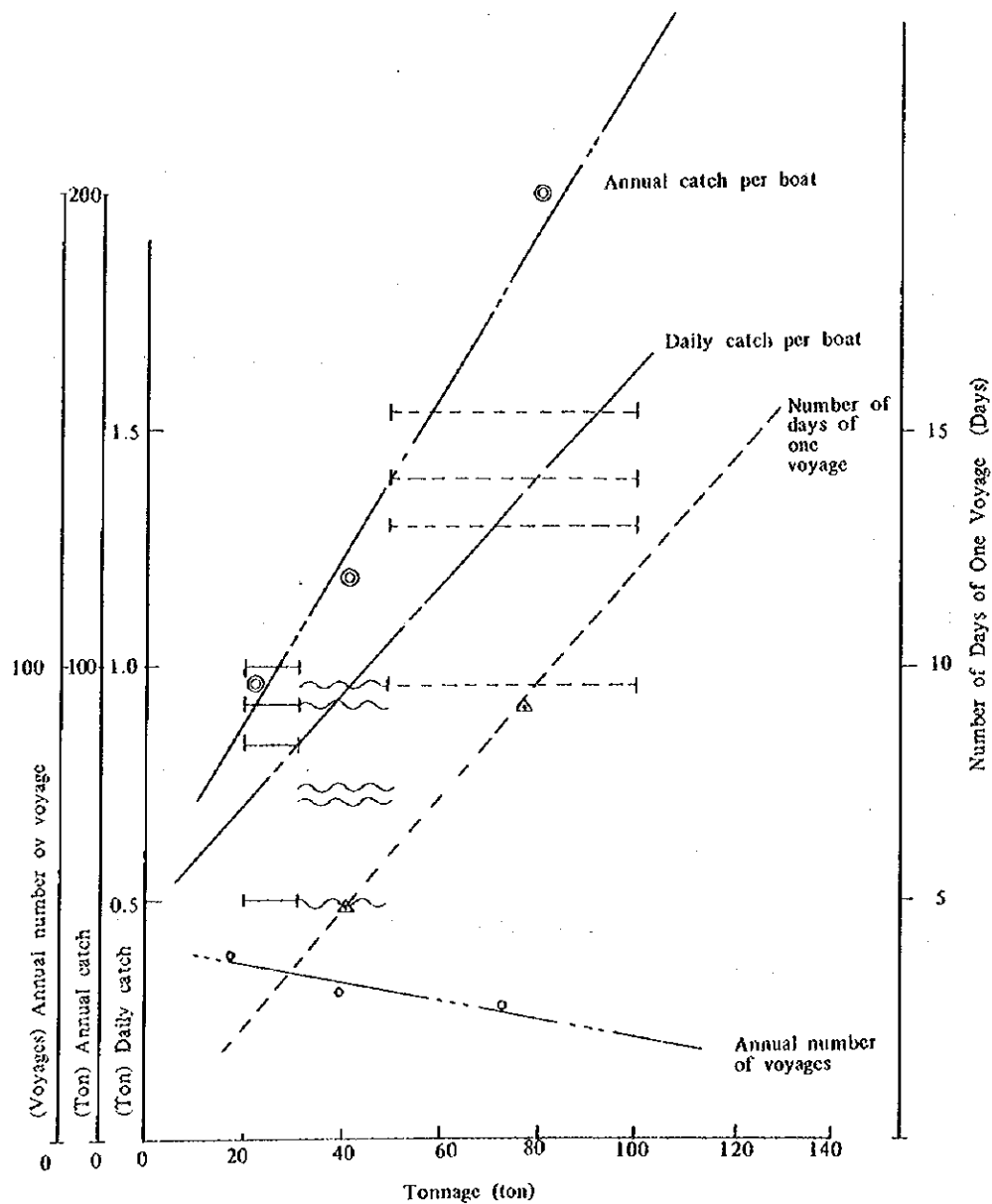


Fig. 6 Catches of Japanese Skipjack Fishing Boats (1956 - 1960)

### 3.5 Views on Auxiliary Boats

#### 3.5-1 Small Auxiliary Training Boat

Among the training subjects at the Senior Fisheries College, practical training on a small boat is particularly necessary for first-year students, and consideration must be given so as to make an 11-ton boat available as occasion demands. On this 11-ton boat, trainees should be given training in coastal navigation, practical training in sea manship, and practical training in coastal fishing including driftnet fishing, long-line fishing, trawl fishing etc. For this purpose, the Ceylonese Government should provide one of the existing 11-ton fishing boats.

#### 3.5-2 Provision of an Additional Fishing Boat for Increasing Fishing Efficiency

Neither rapid development of deep sea fisheries nor efficient school finding can be expected from the operation of the training boat alone and therefore, an additional boat intended exclusively for deep sea skipjack pole and line fishing should be provided. This boat is to be used for improving the catch and training the fishermen.

It is considered reasonable to provide a second-hand skipjack pole and line fishing boat for this purpose, and cooperation by the Asian Development Bank or other financial organizations is desired.

It is suitable to provide a boat of about 100 tons or less.

### 4. Relation between Shore Training and Education and Training on Boat

#### 4-1 Horary Relation (Refer 3-4-1)

#### 4-2 Relationship among Details of Educational Curriculum

Shore education and training subjects are detailed in the curriculums explained in the Paragraph 2-4. On the training in navigation, operation, fishing methods, preservation of catch and operation of boat;

and the students of the Engine Course are given education and training in engine operation, handling of ice engines, control of fish hold temperature and are also provided with general knowledge of fishing boat and fishing methods.

Duration of practices on boat is three months for the Fishing Course trainees and one month for the Engine Course trainees. Practice on board should be conducted continuously or intermittently according to the purpose of training.

Furthermore, training on the small boat should be conducted with an eleven-ton boat for a short period.

#### Details of Training:

##### Fishing Course:

Sighting practice (by sun, moon and stars)

Practice on-coastal navigation (bearing etc.)

Practice on correction of deviation

Practice on steering and operation of boat

Practice on skipjack line fishing method, operation of fishing rod, handling of catch, preservation, school finding, positioning of the boat to the location of a school, angling practice, maintenance of fish hold for live baits

Oceanographic observation and meteorological practices

Practices on various operations and handling (maintenance of hull, countermeasure to storm, stability characteristics, wireless telephone)

##### Engine Course:

Practice on operation and handling of engines

Practice on operation and handling of deck machines

Practice on operation and fishing machines

Practice on transfer of fuel oil from oil tank and fresh water from water tank and trimming regulation



Practice of operation of refrigerator and control of temperature in the fish hold

Other practices on fishing vessel and fishing methods

#### 4-3 Relation with Skill Certificate

Ship certificates are issued by the Port Commission in Ceylon, and following is stipulated for ships which are required to obtain certificates and for horsepower of engine:

Navigation certificate is required for every ship of more than 50 tons, and engine certificate for every main engine of 300 p.s. Four-year career on board and one-year experience as an officer is required for anyone who sits for the examination for captain. This examination is conducted at Bombay.

Special consideration should be given to the graduates of the Fisheries Senior College so that they may be qualified for the examination.

#### 5. Mutual Relationship among Training Boats, Educational Institutions, Fisheries Department and Research Institute

Deep sea fisheries of Ceylon is currently conducted only by 5 stern trawlers belonging to Ceylon Fisheries Corporation and operating at Wadge Bank and 2 long-line vessels engaged in tuna long-line fishing in the Indian Ocean.

Therefore, in order to smoothly improve the Senior Fisheries College for development of deep sea fisheries, it is important to produce a climate which incites capable students to enter the College and also offer the posts they will occupy upon graduation. As such requirements will not be filled before the opening of the College, measures must be taken to arouse public interest in deep sea fishery and make it attractive to prospective applicants. For this purpose, and this in turn calls for actual fish catch must be increased as soon as possible and this in turn calls for strenuous fishing efforts of the training boat. Also, as fishing ground condition and ecology of skipjack are not well studied in Ceylon, fisheries surveys must be conducted with specific

stress placed on these two factors which directly affect the catch. It is no use to continue random navigation; studies must be made about change of locations of fishing grounds, meteorological conditions etc., and fishing voyage, training voyage, survey navigation and also combined voyage which are suited for such studies must be planned and conducted. It is no exaggeration to say that the success of the deep sea fishery development project hinges on these studies.

In the concrete, it is indispensable to operate the fisheries authorities, research institutes concerned with biology, the College and training boats in close cooperation. In order to promote this in a more concrete form, it is earnestly recommended that a Japanese expert be appointed an adviser for comprehensive planning and operation under immediate control of the Director of the Fisheries Department who is the highest responsible executive of the project.

For the above reasons, it is strongly advised that not only equipment and boats be provided, but a agreement including despatch of Japanese experts be concluded for the Japanese Government's cooperation to Ceylon.

Fig. 1 illustrates the relationship among the factors.

#### 6. Relationship among Existing or Local Training Center and Senior Fisheries College

According to the training level of the planned Senior Fisheries College at Negombo, it is very difficult or almost impossible from the viewpoints of scholastic ability and institutional relation for the graduates of the existing fisheries training centers or the planned centers for three districts to enter the College because of institutional reasons and the educational level planned by the Government of Ceylon for the centers (25 middle school graduates are trained for 6 months). Therefore, only the graduates (A.L) of ordinary high schools can be expected to enter the Fisheries Senior College. Most of the students will be scarcely or not connected with fisheries and a few of them will be from fishing villages. However, it is considered rather difficult to expect high school graduates (A.L) from ordinary families to enter the College especially in the early

stage when deep sea fishery may not be graded as a promising fishing industry. Accordingly, it is recommendable that the institutional status of the three planned training centers be so determined that their graduates will be qualified to enter the College at Negombo.

However, as the 6-month training plan formulated by the Government of Ceylon is to be started around May 1972, the ideal plan drawn by the team will not be realised. Therefore, until the time when deep sea fishery is developed and graded as a fishing industry, applicants will be actually limited to the graduates (A.L) from fishing village and those who are comparatively excellent among them will be accepted.

## 7. Outlook and Measures for Gradual Improvement of Fishery

### Educational Institutions

As the newly planned fisheries educational institutions are expected to promote the development of deep sea fishery of Ceylon, their gradual improvement should be based on a forecast or plan of development of deep sea fishery.

For this purpose, it is necessary to make up a plan for increase in the tonnage of fishing boats according to the annual target of fish catch.

#### 7-1 Efficiency and Payability of Commercial Fishing Boats

Calculation of catchability and payability is worked out on the assumption that a number of used fishing vessels of 100 tons will be employed.

Catchability of a skipjack line fishing boats (100 tons) is obtained from Fig. 6 as follows.  $C = 220$  tons. According to the statistics in Japan, however, a line fishing vessel of 50 or 100 tons attains a catch of about 2 tons a day (430 tons a year) with 30 to 35 voyages. As fishing grounds are not far and catchable stock is large, the annual catch is estimated to be 400 tons in this study. Therefore, the value of catches (S) is obtained as follows:  $S = 2.7 \text{ R.S} \times 400,000 \text{ (kg)}$   
 $= 1,080,000 \text{ R.S.}$

The payability of a fishing boat of 100 tons can be calculated as follows, from equation (2) shown in Paragraph 3-4-2 — (2)

$$S = \frac{P(k_1 k_2 + k_3) + M}{1 - k_4 - k_5}$$

Value P (cost of boat) can be calculated to be ¥93 million (465,000 R.S.) from Fig. 9, however, as vessels are to be used ones, the cost is assumed to be 40% of that of new vessel, i.e., 186,000 R.S. (¥37.2 million).

- $k_1$ : 1.0 (in case total investment amount is covered by loan)  
 $k_2$ : 0.15  
 $k_3$ : 0.2 (to be a fixed amount in consideration of possible increase in expenses to be disbursed repairing in addition to depreciation)  
 $k_4$ : 0.1

Therefore, from the above equation,

$$1,080,000 = \frac{186,000 (1 \times 0.15 + 0.2) + M}{1 - 0.1 - k_5}$$

$$k_5 = \frac{469,500 - M}{1,080,000} \dots \dots \dots (3)$$

value M (expenses) is calculated by  $M = m_1 + m_2 + m_3 + m_4$

$$m_1 = [300 \text{ (R.S.)} \times 12 \text{ (month)} + 5 \text{ (R.S.)} \times 365 \text{ (day)}] \times 32 \text{ (man)} \\ = 173,600 \text{ (R.S.)}$$

$$m_2 = 800 \text{ R.S.} \times 0.8 \times \frac{1}{0.85} \times 0.33 \text{ R.S./1} \times 20 \times 20 \\ = 179,520 \text{ (R.S.)}$$

$$m_3 = 500 \text{ (R.S.)} \times 36 = 18,000 \text{ (R.S.)}$$

$$m_4 = 25,000 \text{ (R.S.)}$$

Accordingly,  $M = 396,120 \text{ (R.S.)}$

Therefore,  $k_s$  can be calculated by equation (3) as follows:

$$k_s = \frac{469,500 - 396,120}{594,000} = 0.123$$

And, the annual profit will be as follows:

$$1,080,000 \times k_s = 1,080,000 \times 0.123 = 132,840 \text{ (R.S.)}$$

The average annual income per crew member will be 8,800 R.S. i.e. 733.3 R.S per month.

## 7-2 Plan for Increasing Commercial Boat

Plan is drawn up as follows.

Import from Maldives: 10,000 tons in volume of fresh fish  
Value — \$2.26 million

Total import: 90,000 tons in volume of fresh fish  
Value — \$14.3 million

Therefore, if the production target is set up to save the foreign currency expenditure required in the coming five years for import from Maldives, the number of 100-ton line fishing boats must be increased to 25 in five years. In this case, however, if used boats are purchased with the profits earned by commercial fishing boats, 132,840 R.S. out of 186,000 R.S. (price of a used vessel) can be covered with own fund.

It can therefore be concluded that if the number of fishing boats is increased to 75 (25 vessels  $\times$  3 = 75 vessels) within 10 years 30,000 tons out of the fish import of 90,000 tons by means of skipjack fishing after 10 years.

A plan drawn up with some wishful expectation for step-by-step development of deep sea skipjack line fishing among deep sea fisheries is as shown in Table 7.

Table 7 Estimation on Increase in the Number  
of Line Fishing Vessels (Plan)

Year	No. of Increase	Total No.	Kind	Tonnage	Remarks	Estimated Catch /year(ton)
1974	1	1	Training ship	65		168
1974	1	2	Fishing ship	100	Used one	$168+400 \times 1=568$
1975	3	5	"	100	"	$568+400 \times 3=1768$
1976	6	11	"	100	"	$1768+400 \times 6=4168$
1977	7	18	"	100	"	$4168+400 \times 7=6968$
1978	7	25	"	100	"	$6968+400 \times 7=9768$
1979	7	32	"	100	"	$9768+400 \times 7=12568$
1980	8	40	"	100	"	$12568+400 \times 8=15768$
1981	10	50	"	100	"	$15768+400 \times 10=19768$
1982	10	60	"	100	"	$19768+400 \times 10=23768$
1983	16	76	"	100	"	$23768+400 \times 16=30168$

If the number of fishing boats (skipjack pole and line fishing boats) is increased as indicated in the above Table, officers to work on board are required to be technicians shown in Table 8; however, among the officers for one boat, the captain, master fisherman, chief engineer and reserve officers are to be provided by the new educational institute, and other officers by the three local fisheries training centers.

Table 8 Distribution of Graduates. (Plan)

Year	No. of Graduates			Posts for Graduates									
	Regular Course			AC		Officers of Fishing Vessels		Instructors of the College		The 3 training centers		Research Institute	
	Fishing Course	Engine Course	Fishing Course	Fishing Course	Engine Course	Deck Section	Engine Section	Fishing Course	Engine Course	Fishing	Engine	Fishing gears, Fishing method	Engine, Machine
Early 1975	10	10				8	8						
Early 1976	10	10	2	2		8	8	1	1	1	1		
1977	12	12	2	2		10	10	1	1	1	1		
1978	12	12	2	2		10	10	1	1	1	1		
1979	15	15	2	2		13	13					2	2
1980	15	15	3	3		12	12	1	1	1	1	1	1
1981	15	15	3	3		12	12	1	1	1	1	1	1
1982	15	15	3	3		12	12	1	1	1	1	1	1
1983	15	15	3	3		12	12	1	1	1	1	1	1

The plan for increase of the number of fishing boats up to 1975 is made rather conservative, because the period up to 1975 is a transitional period to observe the actual records of training boats, and after 1975 is advisable to increase the number of boats as shown in Table 7. For this purpose, it is necessary to strongly ask the Asian Development Bank and the World Bank etc. for loans.

Fig. 7 illustrates the planned increase in the number of fishing boats, estimated catches and required number of officers by year, which relate to Table 8.

The planned increase of fishing boats should naturally be supported by the availability of necessary fait. In this regard, favorable results are hoped to be produced the Survey team on Bait to be despatched in the near future. Skipjack fishing boats must be employed as shown in Table 7 and Fig.7.

The number of students and trainees of new Senior fisheries College must be increased as shown in with Table 2 to cope with the planned increase in the number of fishing boats.

The growth of skipjack pole and line fishing in the coming 10 years is estimated to produce catches not larger than three times the present fish import from Maldives (in terms of fresh fish). This is because unless supported by the improvement of fundamental environmental conditions, fishing boats cannot be expected to successfully continue fishing operation on their own, and also because nothing definite is known as to the availability of live fait.



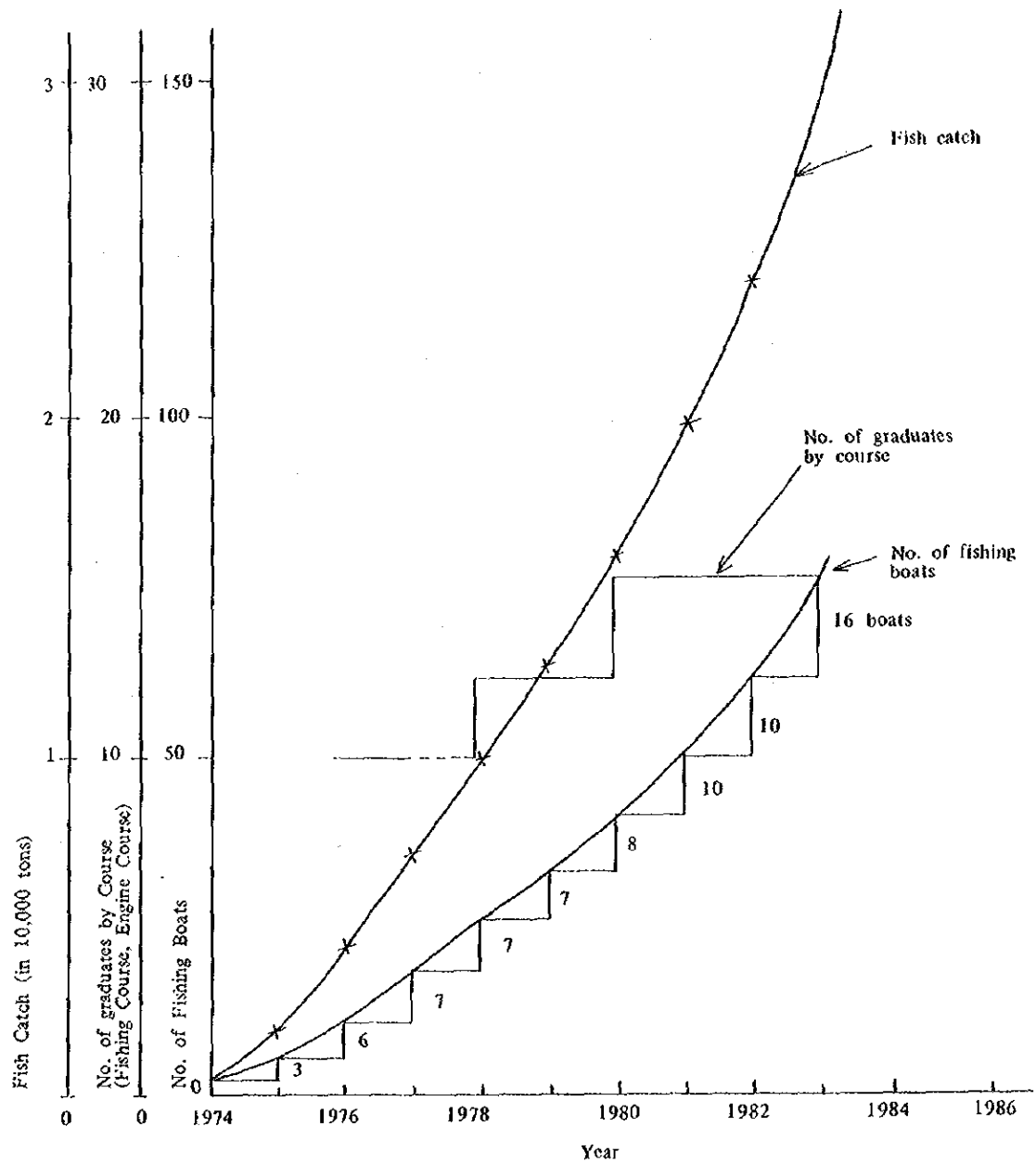


Fig. 7 Plan for Increasing of Fishing Boats and Number of Graduates from New Senior Fisheries College

## 8. Comprehensive Effects

Fishing industry as the mainstay for rebuilding the economy of Ceylon has great importance, and development of fishing industry accelerates expansion of related industries and brings solution for employment problems as well. In Ceylon, economic and labor problems are closely correlated with each other and seem to be mutually restricted. In order to improve this phenomenon, it is urgently required to find out what point should be taken up first for solution so as to bring remedy to the whole situation. To this end, there are different ideas based upon different basis: improvement and expansion of agriculture, development of land resources, development of land industries, or development of fishing industry etc.

The drawback common to all these ideas lies in the fact that all the related environmental conditions must be improved to equal or surpass the level contemplated for any specific development plan.

As for fishing industry, it is considered from the viewpoint of the fish resources that the selection of fishing methods suited to the existing environmental conditions will be the most effective measure to find a clue to rebuilding the economy and improving the social environment of Ceylon.

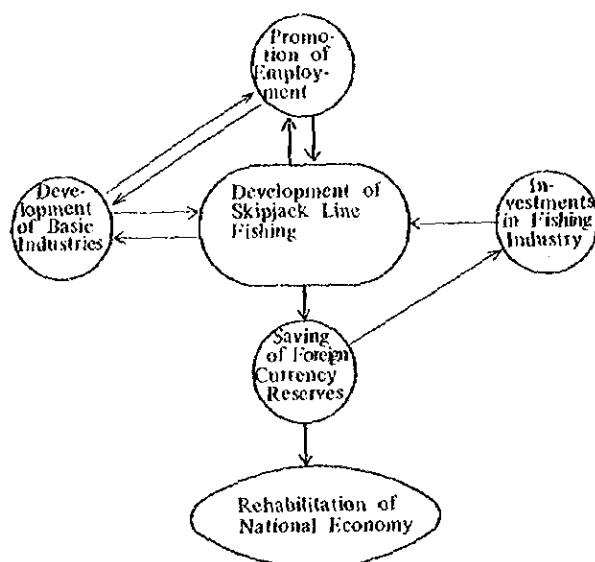


Fig. 8 Schematic Diagram of Comprehensive Effects

## 9. Advice to the Government of Ceylon

Fisheries education related with development of deep sea fishery cannot be expected to be a success if it is conducted independently, and also it is evident that no practical results can be obtained from the efforts made only by the assisting country. Therefore, the following are items to be expected by the Government of Ceylon.

- 1) The main factor that makes the planned project succeed is the coordination between all the organizations concerned. Therefore, the project should be pushed forward through organic and close cooperation between the Fisheries Department and its research stations, the planned new Senior Fisheries College and training boats.
- 2) A chief of Japanese experts must be appointed the Managing Adviser under the immediate control of the Director of the Fisheries Department to furnish him with advices on the execution of the project.
- 3) Efforts must be made for experiments and research on accustoming terapia to salt water for use as live bait for skipjack line fishing to salt water.
- 4) Investment of an amount equivalent to the foreign currency saving attained by skipjack pole and line fishing must be considered on a priority principle for development of the fishing industry.
- 5) Proper qualification must be given by the Fisheries Department etc. to the the graduates from the College at Negombo.
- 6) Some of the graduates from the College at Negombo must be employed by the Fisheries Department and government offices.
- 7) Cooperation requests must be made to the Asian Development Bank, the World Bank, etc. for loans necessary to build or purchase skipjack line fishing boats.

- 8) Two trainees from the fishing course and two others from the engine course are to be sent to Japan to study the handling and theories of driftnet, drag net, small trawl net, skipjack pole and line fishing, long-line fishing and also high and middle-speed engines of less than 100 P.S. and outboard motors of 30 P.S. or less. Upon their return to Ceylon, they are to give lectures at the fisheries training centers at the three places and also training other instructors.

### Postscript

Cooperation rendered by Ministry of Fisheries, Ministry of Education, Negombo Training Center, Fisheries Corporatives, Government Agents at various places was a great help to the team's survey activities. All the team members wish to express their heartiest gratitude to them.

## ANNEX

### 1. Organization of the Survey Team

	Name	Home Post	Assignment
Chief	Chikamasa Hamuro Doctor of Agriculture	Fishing Boat Laboratory Fisheries Agency	General Control
Member	Hatsuro Sonohara	International Cooperation Division, Economic Affairs Bureau, Ministry of Agriculture and Forestry	Fishery Education
Member	Saburo Masai	First Research Division, Fisheries Agency	Fishery Admini- stration
Member	Zensaku Noda	Yamada Fishery Cooperative, Iwate Prefecture	Fishing Operations
Member	Kenji Iwaguchi	Overseas Centers Division Overseas Technical Cooperation Agency	Coordination

### 2. Itinerary of the Survey Team

Date	Place of Visit	Outline of Activities
February 24 (Tuesday)	Kuala Lumpur	Left Tokyo and arrived at Kuala Lumpur
February 25 (Wednesday)	Colombo	Discussion with the Embassy of Japan about survey itinerary and activities on the next day.
February 26 (Thursday)	Colombo	Discussion with the Director of Fisheries and staff members on the purpose and scope of survey and individual interview with the Permanent secretary and Minister of Fisheries.
February 27 (Friday)	Colombo	Reconfirmation of the assignment of each member and discussion about collection of information.
February 28 (Saturday)	Colombo	Survey of the Negombo Training Center and fishermen's cooperatives. Visit to the Negombo Fish Market, boat yard and fishpond.
February 29 (Sunday)	Colombo	Discussion with Research staffs. Survey of the Fisheries Corporation. Visit to the Port of Mtoal. Arrangement with the Embassy of Japan.

Date	Place of Visit	Outline of Activities
March 1 (Wednesday)	Tangalle	Left Colombo for Galle. Visited the proposed site for construction of the Tangalle Training Center and fishermen's cooperative.
March 2 (Thursday)	Galle	Visited the fishermen's cooperative. Interview with the Government Agent, Galle.
March 3 (Friday)	Galle	Hamuro and Noda participated in an oceanic survey. Sonehara, Masai and Iwaguchi left Galle for Colombo and collected data and Materials.
March 4 (Saturday)	Galle	Hamuro and Noda participated in an oceanic survey. Sonehara, Masai and Iwaguchi interviewed with the Director of Planning of the Ministry of Education for information on education system.
March 5 (Sunday)	Galle	Hamuro and Noda visited fishing villages. Sonehara, Masai and Iwaguchi made Oceanic survey.
March 6 (Monday)	Galle	Preparation of interim report and discussion on it.
March 7 (Tuesday)	Colombo	Left Galle for Hikkaduwa, Beluwara and visited fishermen's cooperatives. Made arrangements with the Embassy of Japan and submitted an interim report.
March 8 (Wednesday)	Jaffna	Date, member of the Embassy staff, joined the survey team visited the proposed site for construction of a fishing port, boat yard, office of Divisional Fisheries Inspector, Union of Fishermens Cooperative Societies and proposed site for construction of a training center.
March 9 (Thursday)	Colombo	Visited the Kait Fish Market, two fishermen's cooperatives and FRP boat Yard built with Norwegian aid, dinner party by Director of Fisheries.
March 10 (Friday)	Batticaloa	Left Colombo for Batticaloa by Air. Visited proposed site for construction of a training center and several fishermen's cooperative societies.
March 11 (Saturday)	Colombo	Interviewed with the Government Agent of Batticaloa. Left Batticaloa for Colombo.
March 12 (Sunday)	Colombo	Preparation of a survey report.

Date	Place of Visit	Outline of Activities
March 13 (Monday)	Colombo	Meeting with the Director of Fisheries and staff members to discuss the results of surveys, and had an individual interview with the permanent secretary and Ministry of Fisheries. A interim report was submitted to the Ambassador of Japan. A farewell party held at the Official Residence of the Ambassador of Japan.
March 14 (Tuesday)	Singapore	Left Colombo for Singapore.
March 15 (Wednesday)	Tokyo	Left Singapore for Tokyo.

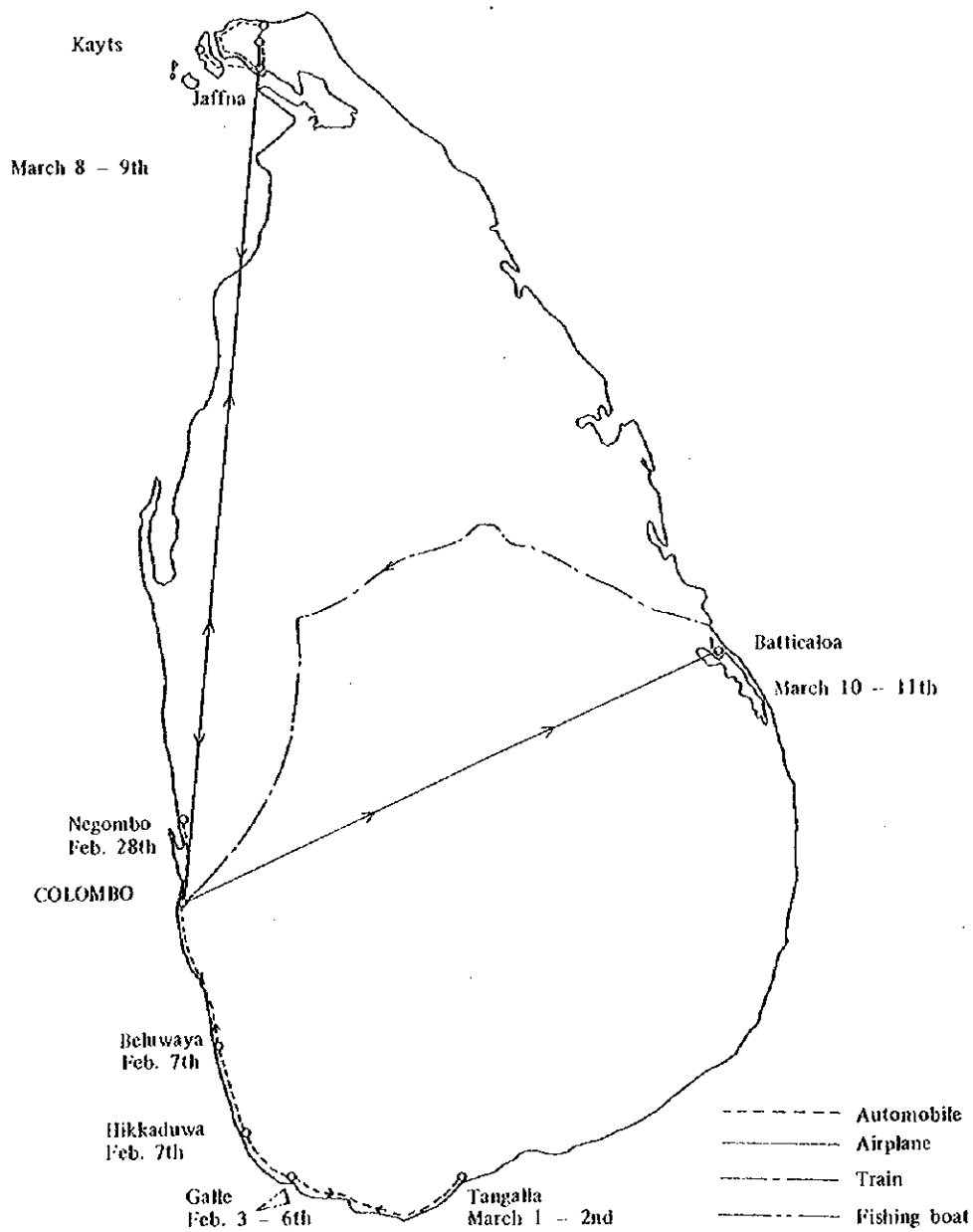


Figure 1. Survey Itinerary



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