REPORT OF THE DEVELOPMENT PROGRAM FOR GALLE FISHING PORTS AND ITS LANDING EQUIPMENT IN CEYLON

SEPTEMBER 1964

OVERSEAS TECHNICAL COOPERATION AGENCY OF JAPAN

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Preface

The Government of Japan, in response to a request from the Ceylon Government, entrusted to the Overseas Technical Cooperation Agency (OTCA) the task of conducting a preliminary survey in the Ceylon. The OTCA, fully realizing the importance of the Development Program for Galle Fishing Ports and its Landing Equipment in Ceylon, organized a six-member team of experts and dispatched it to the Ceylon on February 24, 1964 for a one month on-the-spot survey under the leadership of Mr. K. Kitahara,

The OTCA, which was established on July 1, 1962, serves as an executing agency of the Japanese Government to conduct Japan's government-level technical cooperation to Asia, the Near and Middle East, Africa and Latin America. Its principal activities are acceptance of overseas trainees, assignment of technical experts, establishment of overseas technical cooperation centers and the conducting of preliminary surveys for development projects.

It is my sincere hope that this report will prove to be useful in the field of technical help to the Development Program for Galle Fishing Ports and its Landing Equipment in Ceylon and will also help to foster closer technical ties and better understanding between the Ceylon and Japan.

Lastly, on behalf of the OTCA, I wish to take this opportunity to express our greatest appreciation and sincere thanks to the various agencies of the Ceylon Government for their invaluable help and cooperation given to the Survey Team, without which it would not have been possible for the Team to conduct a smooth survey on the spot.

September 1964

Shin-ichi Shibusawa

Director General
Overseas Technical Cooperation Agency

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1. Purpose and summary of investigation

1 - 1 Purpose of investigation team

The purpose of the investigation team is to execute by means of the Japanese Government fund 'Entrusted expenses for investigation prior to investment' a basic investigation with regard to the fishing port of Galle, laying stress on its port and land facilities.

1 - 2 Historical review

The technical cooperation between Japan and Ceylon was commenced by Japan's formal participation in October 1954 in the Colombo Plan and has hitherto achieved many results in various branches.

In accordance with the Colombo Plan technical cooperation in fishing has been afforded in the form of dispatching Japanese specialists to Ceylon and receiving trainees into Japan.

Next, at the request of the Ceylonese Government in connection with its long-team plan of promoting marine product industry to invite Japanese specialists, an investigation team, headed by Mr. Iiyama and consisting of eight members in all, after having made a field survey over a period of two months, that is, from February to April in 1958, submitted a recommendation report which was supposed to be a basis of the 10 - year plan of developing the Ceylonese fishing industry.

Again, an agreement between Japan and Ceylon was concluded on 20th March, 1961 on establishing a training center of fishery technics at Negombo which is situated in the suburbs of Colombo, for the purpose of executing the training in handling fishing implements, conducting know-how of fishery, and operating marine engines for fishing boats. The training involves the dispatch of eight Japanese specialists and provision of training ships, marine engines, and fishing implements.

Furthermore, during the three months of January, February, and March 1960 a Japanese investigation team, which was headed by Mr. Sobajima with seven other members and sent to cooperate in the development planning of fishing ports in Ceylon, made field

surveys of sixty-nine fishing bases, selecting seventeen of which as suitable sites proposed for building fishing ports, resulting in the submission of a recommendation report to that effect.

As we have seen above, Japan has offered various kinds of technical assistance in promoting the fishing industry of the country. The Government, while deciding the above-mentioned 10-year plan of developing the fishing industry for the purpose of securing the domestic food supply, which goes with the increased production of rice, is now intent on the encouragement of the fishing industry, which necessitates the introduction of motive power in the industry together with quick completion of fishing ports.

The construction plan of the fishing port of Galle forms port of this 10-year plan, and West Germany, during January and February in 1963 also made an investigation of the port, on the basis of which the Ceylonese Government is now commencing the construction works of the port as part of the enlargement plan of the commercial port of Galle.

However, the Government, finding inadequate the German recommendation regarding the land facilities plan of the fishing port as a base of deep-sea fishing, has requested the Japanese Government to conduct a field investigation to help towards making a synthetic plan of constructing the whole facilities which include also those on the sea.

1 - 3 Organization of investigation team

The investigation team which was headed by Mr. K. Kitahara consisted of five other members, each of whom taking charge of the part of work assigned as follows:

Name	Title	Assignment
Kozo, Kitahara	Chief, 2nd section, Research Division, Fisheries Agency, Ministry of Agriculture and Forestry, Government of Japan	Fishery in general
Itsuro Sakai	Senior civil engineer, Construction Section, Fishing Port Division, Fisheries Agency	Fishing port

Toshio Sato	Senior engineer, Planning Section, Fishing Port Division, Fisheries Agency	Fishing port
Yoshio Yamaguchi	Professor, Tokyo University of Fisheries	Fishing and Circulation of marine products
Kazuo Tanaka	Assistant Professor, Tokyo University of Fisheries	Processing and treatment of marine products, Refrigeration, cold storage, and ice making
Hiroshi Kai	Overseas Technical Cooperation Agency	Accountant and liaison

1 - 4 Itinerary and activities of team

The team was engaged in the investigation work for thirty days, leaving Tokyo on 24th of February, 1964, arriving at Colombo on the following day, staying at Colombo for fifteen days, at Galle for five days, and spending ten days for the inspection of fishing ports in various parts of the country. The detail of its itinerary is shown in Table 1.

Table 1

List of activities of team

Date			Important activities	Place of lodging
Feb.	24	Mon.	9.20 a.m. departure from Tokyo. 8.00 p.m. arrival at Singapore.	Singapore
"	25	Tues.	3.00 p.m. departure from Singapore. 6.20 p.m. arrival at Colombo.	Colombo
"	26	Wed.	Visit of Embassy of Japan and Ministry of Land, Irrigation & Power for arrangement of program.	"
"	27	Thurs.	In the morning, visit of Department of Fisheries for confirmation of purpose and scope of investigation. In the afternoon, inspection of Ice chamber of Ocean Food Co., Fishing port of Mutwal and state-managed ice chamber.	"

Date			Important activities	Place of lodging
Feb.	28	Fri.	In the morning, inspection of Cannery and Can manufacturing plant. In the afternoon, visit of Port Commission of Colombo and Department of Irrigation.	Colombo
"	29	Satur.	6.00 a.m. inspection of fish market, second visit of ice chamber of Port Mutwal.	"
Mar.	1	Sun.	Investigation of fishing port of Galle.	"
"	2	Mon.	Inspection of Fisheries Training Center of Negombo, two fish markets and shipyard	"
"	3	Tues.	Visit of Fisheries Research Institute of Dept. of Fisheries.	"
"	4	Wed.	Departure from Colombo. Inspection of fishing ports on the way; Panadura, Kalutara, Beruwala, and Palupitiya. 3.00 p.m. arrival at Galle. Visit of Port Commission.	Galle
"	5	Thurs.	Field investigation of fishing port of Galle. Visit of Municipal Office, Observatory, and Power Substation.	"
"	6	Fri.	Field investigation of fishing port of Galle.	"
"	7	Satur.	"	"
"	8	Sun.	"	"
"	9	Mon.	9.00 departure from Galle for Hambantota, on the way inspection of fishing ports, Weligama and Mirissa, and ice making plant of Matara.	Hambantota
"	10	Tues.	9.00 a.m. departure for Tissamaharama, market investigation.	Tissamaharama
"	11	Wed.	9.00 a.m. departure for Nuwara Eliya, investigation of Cannery (Dan Food Co.)	Nuwara Eliya
"	12	Thurs.	9.00 a.m. departure for Trincomalee. investigation of fishing port.	Trincomalee
"	13	Fri.	9.00 a.m. departure for Jaffna. investigation of fishing ports, Jaffna and Kaits	Jaffna
"	14	Satur.	8.30 a.m. departure for Anuradhapura, Kankesanthurai, Pedro Bank; investigation of fishing ports.	Anuradhapura

Date			Important activities	Place of lodging
Mar.	15	Sun.	7.00 a.m. Departure for Polonnaruwa for investigation of state-managed fishpond.	Polonnaruwa
"	16	Mon.	9.00 a.m. Departure for Colombo	Colombo
"	17	Tues.	Visit of Embassy of Japan, summary report to Ambassador, visit of Port Commission.	"
"	18	Wed.	Visit of Fishries Institute of the Dept. of Fisheries, purchase of data at Sales Agency of Government publications.	"
"	19	Thurs.	Inspection of stated-operated fishpond of Negombo, inspection of ice-making plant.	"
"	20	Fri.	Visit of Dept. of Fisheries (discussion with Director) and Fish Sales Union.	"
"	21	Satur.	2.00 p.m. Departure for Kandy, market investigation	Kandy
"	22	Sun.	9.00 a.m. Departure for Colombo, market investigation	Colombo
"	23	Mon.	Preparation for homeword trip. Bidding farewell to people concerned.	"
"	24	Tues.	8.00 a.m. Leaving hotel 10.20 a.m. Departure from airport for Japan.	

1 - 5 Cooperators in Ceylon

During its stay in Colombo the team was accorded with assistance and cooperation regarding the investigation and with opportunities of discussing various matters by many persons in various fields. The team hereby express its deep sense of gratitude for the kindness of those principal persons whose names are given as follows:

Hon. D.R.L. Balasuriya, Director of the Department of Fisheries

Hon. L.P. Tisseverasinghe, Deputy-director of the Department of Fisheries

Dr. A.C.J. Weerekoon, Director of the Fisheries Institute

Dr. K. Sivasbramanian, Researcher of the Fisheries Institute

Mr. E. P. P. Jayasuriya, Manager of the Ceylon Co-operative Fish Sales Union

Mr. A. N. S. Kulasinghe, Engineer of the Port Commission of Colombo

Hon. T. B. E. Senevirantne, Director of the Department of Irrigation

His Excellency Jiro Takase, Japanese Ambassador to Ceylon

Mr. M. Soejima, Secretary, Embassy of Japan

Mr. Nozaki, Under-secretary, Embassy of Japan

Mr. Tatsuo Abe, Chief Manager, Fisheries Training Center, Negombo

Mr. Shigeru Jimbo, Staff member, Fisheries Training Center, Negombo

Mr. Hidenosuke, Kaneko, Staff member, Fisheries Training Center, Negombo

Mr. Yosuke Ogawa, Managing Director, Jegnus Fishing Co., Ltd.

1 - 6 Data purchased or presented

	Title of data	Date of publication	Publisher
1.	A Colored Atlas of Some Vertebrates from Ceylon Fishes	1952	P. E. P. Deraniyagala of Direction of National Museums, Ceylon
2.	The Marine and Fresh Water Fishes of Ceylon	1955	Department of External Affairs, Canbera
3.	The Ten-year Plan	1959	National Planning Council, Ceylon
4.	The Report on Fishing Ports in Ceylon	May, 1960	Mission of International Engineering Consultants Association, Japan
5.	Ceylon Year Book	1961	Department of Census and Statistics, Colombo, Ceylon
6.	The Short-term Implementation Programme	1962	Department of National Planning
7.	Statistical Abstract of Ceylon	1962	Department of Census and Statistics
8.	Report of the Board of Directors for Food	1962	The Ceylon Co-operative Fish Sales Union
9.	Administration Report of the Director of Fisheries for 1961 - 62	Aug., 1963	D. R. L. Balasuriya, Esq.

10.	Report on the Fishery of Ceylon and Possibilities of Development under Special Consideration of the Construction of Fishing Ports in Galle and Trincomalee	Nov. 1963	Dr. Tiews. Bundesforschungsanstalt fur Fisherei Hamburg and Engineer K. Minnemann, Head of the Technical Department of the Fischereihaven Betriebsgesellschaft m.b. H. Bremerhaven
11.	Estimates of the Revenue and Expenditure of the Government of Ceylon for the Financial Year, 1st October 1963 to 30th September	1964	
12.	Yearbook of Fisheries Statistics 1962	1963	Food and Agriculture Organization of the United Nations
13.	Research on the Fisheries of Ceylon	1964	Embassy of Japan in Ceylon compiled with the Assistance of Mr. S. Jimbo Fisheries Training Center, Negombo
14.	Report to the Minister of Industry and Fisheries on the Promotion of Marine Product Industry of Ceylon	April 1961	Japanese Investigation Party under the Colombo Plan
15.	Report of the Investigation Ship 'Shoyomaru' 1960	May 1961	The 2nd Section, Ocean Division, Fisheries Agency
16.	Series of Economic and Technical Cooperation-Ceylon		Asia Association
17.	Manual of Ceylon	Dec. 1961	Compiled by the Ministry of Foreign Affairs
18.	Report on the Investigation of Bonito Fishing in the neighboring waters of Ceylon and Maldive Islands	May, 1962	Overseas Fishing Cooperative Association
19.	Report on the investigation of Fishing Grounds in Southeastern Asia (Ceylon and Madras, India)	April, 1962	Yamaguchi Prefecture
20.	Report on the Investigation of Fishing Port of Manila (Navotas District) of the Philippines	July, 1963	Overseas Technical Cooperation Agency
21.	Published by the Fisheries Research Station Colombo, Fishes of Ceylon	1954	A.S. Mendis
	Ceylon Beach Seine Fishery	1956	P. Canagaratnam & J.C. Medcof

Chemical Analysis of Ceylon Fishes	1957	A. W. Lantz and C. Gunasekera
General Features and Productivity of the Wadge Bank Trawl Fishery	1957	S. Sivalingam & J. C. Medcof
Mechanization of Fishing Craft & the Use of Improved Fishing Gear	1958	E. R. A. De Zylva
A guide to the Fisheries in Ceylon	1960	G. H. P. DE Blum

2. General recommendation on marine product industry of Ceylon

2 - 1 Study and investigation on marine product industry and enrichment in contents of education

The Ceylonese marine product industry has bright prospects in view of the great demand for the product and of the abundant resources with sufficient chance of future exploitation. However, the development of the industry presupposes study and investigation together with the enrichment in the contents of education.

Motor-driven fishing boats have been introduced quite recently, which is resulting in the gradual increase in the haul of fish. This state of things quite resembles that of Japan in the early years of this century when motor-driven boats were first imported, and, running exactly parallel to it, the haul also began to increase. Since then the Japanese fishing has continued to make a rapid progress every year, the powerful factor of which may be attributed to the results of study and investigation as well as the repletion of education. (The first fisheries laboratory in Japan which belonged to one of the prefectures was established in 1894, and later fisheries laboratories were opened one after another in each prefecture. The Fisheries Institute, which was managed by the Government, was established in 1897 as an integrated organ of experimental research and education. Later in 1929, part of the organ was separated from it to be an independent Central Laboratory relieved of educational function.) In Ceylon of to-day there is attached to the Fisheries Department the Fisheries Institute, which has only seven or eight researchers, without even a single ship of research and experiment; and we are told that an experiment ship of 80 - 90-ton class will be built next year. (In Japan we have fisheries laboratories in all administrative sea-districts, which are eight in number, with 700 staff-members, of which 300 are researchers. In addition we have such special institutes as those of fishing ships and pearl. The local governments have 76 marine product laboratories with staff-members amounting to 2,600, of which 1,200 are researchers and equipped with 100 research ships.) As regards fisheries education there is in Ceylon neither a higher fisheries school, a university having fisheries faculty, nor even a fisheries high school. (In Japan we have two fisheries

colleges, twelve universities with fisheries faculty or section together with higher fisheries schools in every prefecture facing the sea.)

The total catch of fish in Ceylon is one-eightieth of that of Japan, while the number of Ceylonese engaged in fishery amounts to one-tenth of that of Japan. This is to great a difference between the two countries, which indicates the necessity of attaching importance to the fisheries education.

2 - 2 Training of technicians

The present know-how of the Ceylonese fishery is still in a primitive stage and many of the Ceylonese ways of processing and treating marine products are unclean. In order to get rid of such state of things and convert it to a reasonable and up-to-date industry which is highly productive the training of fisheries technicians is indispensable.

As stated above, in accordance with the agreement concluded between Japan and Ceylon on 20th of March, 1961 concerning the establishment of a training center of fisheries technics, technical training of handling fishing implements, conducting know-how of fishing, and operating marine engines for fishing boats have been executed since 1963. Although the term of the agreement had expired already in March this year, it was extended by another eighteen months, as the actual commencement of training had been delayed.

Such training is actually indispensable in Ceylon, but it is a matter for regret that the trainers who have finished the course are not given ample scope of their technique. It would be advisable for the Ceylonese Government to send more fitted trainees to the Center or to consider the use of those who have completed the course by appointing them as 'Extension Officer'. (There are twelve 'Extension Officers' now in Ceylon who are responsible for the guidance of marine engine operation and the circulation of marine products. This may be called an advanced system of administration in the Southeastern Asia.)

However, it is needless to say that neither training nor education can expect their immediate results in a short time. We believe it pertinent to maintain and utilize this center in future in some shape or form. For instance, it can be converted to a fisheries school. It is also important to train technicians not only of fishery but of processing and

treating marine products, bringing-up of culturists is important, too.

2 - 3 Consolidation of production and circulation organizations of marine products

In Ceylon there are 241 co-operative associations of marine product industry, of which 93 are production associations, 81, production and sales ones, and 67, finance and sales ones. Numerous as they are, the greater part of them are of only nominal character, some of them having been organized merely for the purpose of getting the loan of the Government. It is said that only ten or so of them are efficient in actual business activities. Such state of things is due to the lack of knowledge or fund on the part of fishermen or to the absence of qualified leaders in this line of business.

Generally speaking, the social position of fishermen in Ceylon is comparatively low and their voice in politics is weak. Then, it seems to be especially important that their organizations in the form of cooperative associations are consolidated step by step in future.

The circulation of marine products is also in a state of tardy progress. Owing to the shortage of proper fishing ports to land the catches in large quantities dealings in fish are being carried out by brokers trouging around the so-called fishing centers, which are nothing but those dry beaches at the mouths of lagoons. Part of the products are sold on the spot and part forwarded to Colombo. Such towns as Colombo, Negombo, Galle, Jaffna, etc. have fish markets. Not all of the ways of dealing in such markets can claim to be sanitary.

As there is no retail store of fish, consumers are purchasing either at the above-said markets or from hawkers. There are dealers in fish called mudalalies, some of whom are said to possess a pretty large sum of capital, wielding political influence, supplying fishermen with fishing necessaries, and controlling the circulation of products. But reality of the matter can not be easily made clear.

In 1952 the Ceylon Co-operative Fish Sales Union was organized with the Director of the Fisheries Department as its interlocking Director. It is a semi-official organ to sell imported refrigerated fish to such consumers of large quantity as hospitals, etc. Later, it has gradually come to sell to consumers in general, and at the same time it is procuring fishing implements for fishermen. The result of its activity is improving every year as under.

Gross proceeds

1952	Rs	516,604	(¥ 39,000,000)
1956	"	3,525,713	(" 190,000,000)
1960	"	3,911,439	(" 295,000,000)
1962	"	4,301,141	(" 325,000,000)

As regards the price of marine products it is seen that the sum received by producers are generally either one half of or less than those paid by consumers.

Table 2. Producers' sale price

Rs per lb. Parenthesized figures: ¥ per Kg

Kind of fish			Eastern Province	Northwestern Province
Japanese	Ceylonese	English		
Sawara	Thara	Seer	1.30 (220)	1.35 (225)
Aji	Paraw	Travally	0.70 (117)	0.70 (117)
Kamasu	Jeela	Sea Pike	0.70 (117)	0.70 (117)
Basho Kajiki	Thalapatha	Sail Fish	0.70 (117)	0.50 (84)
Maguro	Kerawalla	Tuna	0.70 (117)	0.55 (92)
Makajiki	Kappara	Marlin	0.70 (117)	0.50 (84)
Kasago	Mullet	Rock fish	0.50 (84)	0.40 (67)
Same	Kirimara	Shark	0.40 (67)	0.35 (59)
Kigi	Anguluwa	Cat fish	0.20 (34)	0.25 (42)
	Kossa	Grouper	0.20 (34)	0.35 (59)
	Hurulla		0.40 (67)	0.40 (67)
Nishin sonota	Herring varieties		0.30 (50)	0.30 (50)

Table 3 Wholesale and retail price in Colombo

Kind of fish		Wholesale price	Retail price
Sawara	Thara	1.70 (285)	2.50 - 3.00 (420 - 500)
Shima-aji, Hira - aji	Paraw	1.30 (220)	2.00 - 2.50 (340 - 420)
Kamasu	Jeela	1.30 (220)	2.00 - 2.50 (340 - 420)
Basho Kajiki	Thalapatha	1.10 (185)	2.00 - 2.50 (340 - 420)
Maguro	Kerawalla Tuna	1.10 (185)	2.00 (370)
Makajiki	Kappara	1.00 (168)	2.00 (340)
Kasago	Mullet	0.70 (117)	1.50 - 1.75 (250 - 300)
Same	Kirimara	0.50 (84)	1.00 - 1.25 (168 - 210)
Kigi	Angula	0.40 (67)	0.60 - 0.75 (100 - 126)
	Kossa	0.40 (67)	0.70 (117)
	Hurulla	0.60 (100)	1.25 - 1.50 (210 - 250)
Nishin sonota	Herring Varieties	0.60 (100)	1.00 (168)

2 - 4 Replenishment of various facilities

In Ceylon, unlike Japan, such places on the coast are rarely found as forming bays fitted for fishing ports; it follows that a large sum of fund is needed for building fishing ports. This is probably the reason for the tardy construction works of the facilities in the seventeen proposed sites for fishing ports which were recommended by the Japanese fisheries investigation team some time ago. Actual construction works have just started in the fishing port of Galle, and the planning of the fishing ports, Tangalle and Beruwala is now under way. It is reported that an investigation of building a proper jetty was made in Trincomalee.

At present Mutwal alone is a useful fishing port in Ceylon which is worthy of the name. The figures of the landing of fish in this port are as follows:

(data: Fisheries Dept. Ceylon)

Supplier	Quantity lb.
Maple Leaf (Trawler)	1,307,110
Braconglen (")	1,061,002
Japanese tuna ships (for Ceylon Co-operative Fish Sales Union Ltd.)	961,819
Ocean Food & Trades Co.	1,172,558
Jegnus Fishing Co.	1,350,159
Total	5,852,648
	(Ton 2,650)

The above figures show that only 2,650 tons out of the total haul of Ceylon, which amounts to 80,000 tons, are landed in Mutwal and the rest are landed at various beaches in small quantities.

It is not too much to say that the replenishment of fishing port facilities is the indispensable condition of modernized circulation system. In Japan nearly two-thirds of the national budget for fisheries items are appropriated for the expenses for fishing port matters. (In 1964 Japan's total expenditure budget for fishery items is ¥18,000,000,000 of which nearly ¥10,000,000 are appropriated for fishing port matters.) The budget of Ceylon Fisheries Dept. for the fiscal 1963 - '64' is Rs 10,700,000, and, besides this amount, the budget of Colombo Port Commission amounts to Rs 4,300,000.

Some fishing ports in Ceylon, if equipped with such basic facilities as breakwaters, jetties, etc., will prove useful fishing bases in future for up-to-date fishing ships which are motor-driven; and these bases, if provided on the one hand with such corresponding equipments as auction markets, plants of cold storage, refrigeration, processing and treating marine products, and ship repairing, etc., and on the other, if managed by reasonable systems of production and sale, will bring about a rapid progress in the Ceylonese fishing industry.

As regards the cold storage and refrigeration equipments, the existing capacity is much limited. We find nothing but the following:

In Mutwal a stated-operated 500-ton cold chamber (besides, fish freezing of daily 20 tons and ice-making of daily 15 tons), a 1,000-ton cold chamber (besides fish freezing of daily 15 tons, ice-making of daily 20 tons, and storage of 150 tons of ice) of the Ocean Food & Trade Co. in the suburbs of Mutwal, a 300-ton cold chamber of the Ceylon Cold Stores Co., and a 250-ton cold chamber of the Marketing Department in Colombo. Other equipments are of small-scale ones for the temporary storage of fish in such towns as Kandy, Trincomalee, Matara, etc. The total ice-making capacity in Ceylon is said to amount to 250 tons a day, but those plants do not appear to be in full operation. Furthermore, the price of ice is high in spite of its poor quality. (According to our investigation the ice price is Rs 80 - 90 per ton which is more than three times that of Japan). It is hoped that the use of ice is duly recognized and ice-making -plants are built where fishing is going on briskly.

There are more than thirty shipyards in Ceylon, some noteworthy ones of which are found in the Northern Province where fishing is active. However, particular importance must be attached to the lack of ship repairing plants. If it takes a pretty long time to repair motor-driven ships which are imported with great pains, their working days will have to be extremely limited. This will often lead to a deficit in the management of enterprises. Therefore, special consideration is needed regarding the repair and maintenance of ships.

3. Condition of location of the fishing port of Galle

3 - 1 Economic conditions of location

3 - 1 - 1 Economic conditions of location for a fishing port

Galle is situated at the southwestern tip of the island of Ceylon, projecting far toward the center of the Indian Ocean, facing the Gulf of Bengal on the east and the Arabian Sea on the west; it is known from the early days as the key point of trade between East and West.

Although there are only a few spots in this country which can be useful ports, Galle, ranking with Colombo and Trincomalee, is a naturally qualified port and has been prosperous as a trade base these several centuries. With its population of 75, 000 it is now a center of politics and economics in the Southern Province.

Because of its geographical position and climate the southwestern part of this country forms a wet zone which not only produces the three major products, which are black tea, rubber and palm, but its flat field, which composes nearly two-thirds of the whole arable land of this country, is fitted for agriculture; it also contains various kinds of industry, though of small-scale ones. This is the reason why the district is populated by nearly 70% of the whole population.

Galle is 72 miles from Colombo and has many important towns behind. This means that it has a land of great consumption within the range of 100 miles, and, from the view-point of fisheries economics, it is well qualified as a fishing port, too.

3 - 1 - 2 Conditions of location as a fishing port

Galle is known as the birth place of bonito fishing in Ceylon; and along with such fishing bases as Balapitiya, Dodanduwa, Matara, Tangalle, etc., and as their center it has been a prosperous center of bonito fishing over two hundred years. As nearly 40-50 % of the total bonito haul of Ceylon is landed in this district, here is a branch office (Divisional Fisheries Inspector) of the Fisheries Department for the guidance and control of the fishing in the Southern Province.

Not only in the Southern Province but also throughout the country all types of the fishing of this country are those of primitive, small-scale and coastal ones along the continental shelf which surrounds the island of Ceylon within the range of 100 fathoms. Especially in the Southern Province the continental shelf is narrow in breadth which restricts the area of the fishing grounds, as compared with those of the Northern Province centering around Jaffna which has a pretty wide continental shelf linking with the Peninsula of India. Consequently the southern fishing is carried on in such poor forms as the sardine fishing by means of coastal seines and that of bonito which was referred to above. Accordingly the haul is also poor, amounting to not more than 10,000 tons, which correspond to only 14% of the total catch of Ceylon.

Such being the case it is true that we can not expect much of the coastal fishing in the Southern Province, but as for that type of fishing which aims at such blood fish as offshore bonitos, tunas, swordfish, sharks, etc., it has ample possibilities of development, as there are abundant resources. The fact is however, that the conventional fishing has been conducted by means of extremely small-size and primitive oru' or recently imported mechanized boats of 2-3 ton class which can sail out on the sea only five or six sea miles from the coast, and during the wet monsoon season, have either to move out to other districts or give up sailing for fishery. That is why their working days are extremely limited. Even when large-size fishing ships are introduced to cope with the above-said situation, the trouble is that there is no port with available facilities to accomodate them, which has hitherto checked the progress of the Ceylonese fishing to such as extent that it has had to be always pegged at a primitive stage. If large-size fishing ships could be introduced by means of constructing for their accommodation a fishing port at Galle, which is endowed with natural qualifications for the purpose, then the southern fishermen who have already thorough experience and adequate technique and now provided with up-to-date ships which are sea-worthy even during the monsoon season, would find no difficulty in breaking new fishing grounds offshore to double the present amount of catch by operating all the year round.

As regards the deep-sea fishing Galle has the fishing banks of Indian Ocean within the range of 1, 000-1, 500 sea miles, which can be reached by only 5-7 days' navigation. This means that Galle is qualified for the base of tuna fishing so far as the distance is concerned.

Such being the case Galle can meet the conditions of a base for offshore and deep-sea fishing as well which aim at the'blood fish.' Galle may be said to be possessed of the possibilities of developing such kind of fishing.

3 - 1 - 3 Conditions of transportation

Since transportation has to be carried on under the worst condition of tropical high temperature special measures must be taken to maintain the freshness of fish. Freight from Galle consists principally of fresh fish and refrigerated or iced-up stock which need either refrigerator van or such motor-cars, or sometimes the stock must be packed with ice. In the case of forwarding from Galle the principal destination is Colombo which is 72 miles away, and the quantity being daily 20-30 tons, the proper means of transportation are lorries; it is all the more so because the road is paved and maintained well. Thus the equipment of refrigerator cars is necessary for the transportation of ice for fresh fish and refrigerated stock.

Railway runs from Matara to Colombo by way of Galle and from Colombo further to the northern and central districts. This will enable the transportation to such districts during the northeastern monsoon season when the catch is poor in the eastern districts.

3 - 1 - 4 Scope of hinterland

The Districts which lie within the range of 70-80 miles from and centering around Galle and contain more than 400, 000 population respectively are:

District	Population
Colombo District	1, 708, 726
Kalutara "	523, 550
Ratnapura "	421, 555
Galle "	524, 369
Matara "	413, 431

And further in the backgrounds of those Districts the following Districts which are densely populated, with Kandy ranking first:

District	Population
Kegalle District	471,605
Kurunegala "	626,336
Kandy "	840,382
Nuwara Eliya District	325,254

These Districts are all less than 150 miles away, which can be the hinterlands of Galle within practicable range of transportation. Their total population amounts to 6,000,000, who will have to be yearly supplied with fish as much as 108,000 tons, if we assume the yearly ingestion per head of fish to be 18 Kg (40 lb.). Even when the total catch of whole Ceylon, which amounts to 84,000 tons, is supplied to those Districts, there will still be a deficit of 24,000 tons, which corresponds either to the total catch of 48 trawlers (yearly haul per trawler: 500 tons) or to that of 75 tuna fishing ships (yearly naul per ship: 320 tons). Therefore, we suppose as follows:
However huge the quantity of the fish to be landed at Galle may be, there will be no heavy fall in the price, if only the transportation is satisfactory. When we think of such a large demand for fish we feel that the task imposed on Galle is really important. This port should not rely solely on deep-sea fishing alone, but it should at the same time break new fishing grounds of offshore fishing. In that event the scale of the port facilities are expected to be further enlarged in future, when the present plan of fishing port construction will prove unsatisfactory.

3 - 2 Natural conditions of location

3 - 2 - 1 Geography

3-2-1-1 Topography

Galle is a coast town facing Galle Bay, which is embraced on the one hand by Point Galle projecting 900 meters south-south-eastward from the coast to the west of the central part of the town, and on the other by Point Watering stretching southeastward of the

town. The breadth of the bay mouth is about 1, 500 meters, the width about 1, 300 meters and the depth of the water at the mouth is 12-13 meters. In the central part of the bay are Island Gibbet and Point Glosenberg which divide the bay in two parts.

The distance between Point Galle and Is. Gibbet is about 1, 200 meters, and that between the island and Point Watering is 1, 500 meters, the length, 1, 200 meters.

Point Galle is of hill-shape and 10-12 meters above the sea-level, covering the southwestern surface of Galle Bay and screening completely the southwestern wind during the monsoon season.

Around the tip of this Point are scattered rockbeds which are 1-2 meters above the sea-level at low tide. These reefs develop further south-south-eastward until their end parts become the scattered reefs Mee Meti Yaua, which are 4. 5 meters under water, forming a western passage of ships which is 10 meters deep along the scatterd reef of Katuda Rock which lies 280 meters southeastward. In addition to this passage there are two other courses of ships at the mouth of the bay which are in the central part and on the eastern side respectively, extending through scattered reefs in groups of lines.

The coast line between Point Galle and Island Gibbet which lies in the central part forms a belt of sand beach which is 50-60 meters wide starting at the water-line. The beach has a gentle slope of about 1/50 as far as 300 meters from the water-line. We hear that no increase of beach area is found throughout the year.

Island Gibbet is a small island, the lower part of which is about 4 meters above sea-level; some palm trees grow there; 250 meters away from it and to it east Point Glosenberg projects from the coast.

There are several separate shoals in the bay between Glosenberg and Watering. The coast forms a sand beach which is 40 meters wide from the water-line, and the slope of the sea-bottom is 1/80. , Like the above-said beach no movement of the beach is recognizable all the year round.

The top soil of the bay (both sand beach and sea bottom) is fine sand which will hold ship anchors well.

There are two rivers discharging into the bay. One of them, the Moragoda, which will have to do with the area of the present construction plan, is the so-called marshy river whose slope is hardly recognizable as far as 5 kilometers upstream and is not always flowing. As its discharge during the monsoon season is said to be small, it will not give rise to the question of burying the bay with washed-away earth and sand.

3-2-1-2 Geology

As the investigation of geology around Port Galle has not been made yet, its accurate knowledge is not available. However, judging from the submerging condition of cellars of the quay wall of the commercial port there must be generally a good psammic foundation there with a coral reef below it. Some parts of the construction site are a fine sand layer of 6-10 meter thickness with a silt layer just below and further below a coral reef. This makes us to anticipate the irregular direction of shore-reefs, when we notice, at the same time, the numerous scattered reefs around Is. Gibbet and in the bay. At any rate an investigation about the details will be necessary in future.

As for service water for the port,it is indeed possible to make use of ground water by drilling tubular wells, but in case of simultaneous need of a large quantity water supply by means of waterworks is indispensable. Regarding this waterworks and the correlated supply system we are told that the plan has been already decided. From an economic viewpoint we suppose that a further investigation of ground water is necessary. In case the above-said investigation of geology is made it is desirable to conduct that of headwaters as well.

3-2-1-3 Earthquakes, tidal waves, and abnormal tides

It is true that earthquakes sometimes occur in Galle, but they have been generally too weak and slight to be recorded. As for tidal waves and abnormal tides, it may be assumed that they are negligible, although it is unable to conclude difinitely due to lack of observation records.

3 - 2 - 2 Atmospheric phenomena

According to the meteorological observatory of Galle the rainfall, atmospheric pressure, temperature, humidity, and direction of wind are shown in Table 4.

Table 4 Atmospheric phenomena of Port Galle

Month	Rainfall			Atmospheric pressure		Temperature		Average Humidity %	Percentage of direction of wind									
	Total rainfall in.	Max. rainfall of the day in.	Days of Rainfall	Highest mb	Lowest mb	Average of day's highest of	Average of day's lowest of		Time	N	NE	E	SE	S	SW	W	NW	Calm
1	6.58	2.38	13	1013.6	1006 3	83.2	72.6	88	08.30	21	36	14	2	2	2	10	5	10
									17.30	0	11	14	6	3	21	37	3	3
2	4.66	1.61	11	1014.2	1007.5	84.3	73.6	88	08.30	21	33	16	3	3	2	5	17	0
									17.30	0	0	2	7	16	30	38	9	0
3	1.24	0.43	10	1014.2	1007.0	86.0	74.6	90	08.30	13	47	18	6	0	2	5	6	3
									17.30	0	10	14	18	13	14	24	6	0
4	7.67	2.44	16	1012.9	1006.3	87.1	75.5	88	08.30	2	13	10	13	3	7	40	8	3
									17.30	0	0	0	8	7	40	40	5	0
6	7.60	1.86	20	1014.9	1007.4	84.7	77.2	84	08.30	0	0	0	0	0	8	85	7	0
									17.30	0	0	0	0	0	7	87	7	0
7	14.95	2.64	28	1012.0	1005.6	83.6	75.7	86	08.30	2	2	5	2	0	0	84	6	0
									17.30	0	0	0	0	0	0	97	3	0
8	9.81	2.10	26	1012.1	1006.4	84.1	77.0	84	08.30	2	0	0	0	2	3	79	10	0
									17.30	3	2	0	0	0	10	81	5	0
12	14.35	4.84	19	1014.4	1005.9	83.7	74.0	90	08.30	19	19	14	2	0	3	5	8	0
									17.30	0	0	13	10	13	24	14	13	3

Note. 1. Of the values shown above those of rainfall, atmospheric pressure, temperture, and average humidity are based on the data of 1963, those of the direction of wind, 1956.

2. Omission of figures of May, September, October, and November is due to unavailability of data.

3 - 2 - 3 Oceanic phenomena

3-2-3-1 Tides

The tide of Ceylon is influenced by the diurnal inequality of tide both in the time and height, and the tidal range is small everywhere along the coast of the whole island. The height of tide at Galle is 2 feet (61 cm) at the spring tide and 1.67 feet (51 cm) at the neap tide. The water-level of the port is 6.17 feet (188 cm) below the bench-mark of Galle which is 0.2 feet (6.1 cm) below the average low-tide surface at the spring tide.

3-2-3-2 Tidal currents

The littoral currents in the neighboring waters of Galle consist of such sea currents as flowing eastward along the coast during the wet monsoon season and flowing in the opposite direction during the dry monsoon season.

3-2-3-3 Waves

Throughout the year there are prevailing westerlies to which the direction of waves is subject and those wheeler waves are the principal ones inside the bay coming from the mouth of the bay which is open southward.

No data of investigation as to the waves is available up to now and it is impossible to obtain accurate knowledge of the wave height inside the port. Generally speaking, however, the length of waves seems to be 75 m., the period 14 - 15 seconds, the height about 2 m., and the direction often suth westward.

The offshore breakwater now under construction was originally designed to be as high as 12 ft (3.6 m.). In view of the fact that the part of the breakwater constructed in accordance with the above design have suffered no damage all through the monsoon season and that a number of houses built on the beach 1-2 m. above the sea surface at low tide have never been washed away by the waves, it may be justifiable to assume that the height of the waves in front of the breakwater is no more than 4 m. at the heighest.

3-2-3-4 Inflow of earth and sand and movement of beach

In the depth of the bay a fishing port is now being built in parallel with the construction of a commercial port. The river Moragoda, which was referred to above, is the only river discharging into this part of the port. No serious question is expected to

arise from the earth and sand washed away by this river, as they are limited in quantity. The sand in this district, however, is so fine that it is apt to be moved even by the smallest waves, and the beach, which has hitherto under gone little movement, will be changed to some extent during the construction now under way of the offshore breakwater and its sub-breakwater; especially, there will be a considerable change in the vicinity of the sub-breakwater on the beach side. For this reason it may be necessary to build some equipments on the beach outside the port extending as long as about 270 m. and starting at the sub-breakwater. The equipments are for the purpose of protecting the beach including the revetments etc. to protect the dwelling houses on the beach.

4. Plan of port and land facilities; its idea and object

4 - 1 Principle and object in view

4 - 1 - 1 Principle and idea of Ceylonese Government concerning the fishing port

The development plan of the Ceylonese fishing industry is now under way along the line of the ten-year development plan, as part of which is being executed the construction of the fishing port of Galle, aiming as its basic principle at the self-sufficiency and increased catch of fish that presuppose various conditions to be met for the base of deep-sea tuna fishing in the Indian Ocean.

The idea of the Ceylonese Government lies in an increased number of fishing vessels: 10 tuna fishing ships of 100 - 120-ton class in accordance with the initial plan and 5 small-size trawlers to be imported, as already decided, from Jugoslavia, together with 3 more fishing vessels to be imported from other countries. If such an increased number of vessels are to utilize the fishing port of Mutwal which is now a base of trawlers, it will prove too narrow for them. So it is anticipated that at least 3 of them will have to land their hauls at Galle. That is why the Government's plan of the fishing port of Galle is of such a scale as capable of accommodating 13 deep-sea fishing ships in all (including the above-said 3). Supposing that the catches consisting of about 5, 000 tons by tuna ships and of about 2, 400 tons by trawlers are landed at the fishing port, the Government is attempting the quick construction of necessary facilities for processing and treating the products together with expediting the other land equipments, all of which corresponding to the above-mentioned quantity. The Government further expects in future to increase the number of fishing ships and landing stages including their enlargements.

With such an object in view the Government has invested a sum of Rs 6, 600, 000 in the construction of the fishing port in the adjacent area of the commercial port of Galle. Part of the breakwater has been already completed and early in 1965 the landing stage (90 m. x 12 m.) and reclamation of its adjacent sea-shore are expected to be completed. Such construction plan is based on the report of the German investigation team and the actual construction works are now being executed by the Colombo Port Commission of the

Government.

However, the construction of the land facilities is within the jurisdiction of the Fisheries Department which has not yet decided any concrete plan of its execution. Incidentally the management of those land facilities will be carried out either by the Government or co-operative associations.

4 - 1 - 2 Requests by Ceylonese Government

As we stated above the sea facilities of the fishing port of Galle is in a stage of completion in 1965. It is obvious now that any far-reaching revision, although there may be some, is impracticable concerning the location of the port as a whole, its scale and arrangement, or the type, structure, length and breadth of the quay walls to bring vessels alongside, and also the building site of the facilities in the background is naturally limited.

Accordingly the scope of activity of the investigation team at this r ›ment is limited to the actual investigation works and planning of the land facilities in the ba ground, which means the planning within this limited site of various facilities corresponding to the above-mentioned scale of the port and capable of functioning more than enough for the purpose. In connection with such actual planning the Ceylonese Government has requested as follows:

1. The following equipments to process and treat catches of 10 deep-sea tuna fishing ships and 3 trawlers:
   a. Refrigeration, cold storage and ice-making plant.
   b. Fish meal and fish oil factory.
   c. Cannery.

2. Various facilities covering over-all necessities of a fishing port.
   a. Repairing shop for fishing vessels.
   b. Warehouse of fishing implements.
   c. Equipments for port administration.
   d. Loading and unloading equipments.
   e. Feeder equipments for fuel oil, water, and ice.
   f. Welfare equipments for seamen. (canteen, lodging, etc.)

3. Equipments for transportation and circulation of products.

   a. Auction market.

   b. Refrigerator truck, etc.

   c. Parking area of vehicles, various warehouses, etc.

4. Requests for pertinent advices on business management plan and over-all administration of fishing port as a whole.

5. Precise plans possible of immediate starting and ordering, preferably attached with specifications, drawings, etc.

6. Completion of these facilities in 18 months owing to necessity of quick realization of self-sufficiency and increased catch of fish.

4 - 1 - 3 Opinion of team and its principle of planning

It is quite appropriate that Galle has been selected as the base for deep-sea fishing, and especially for tuna fishing when viewed in the light of conditions of location not only of the fishing industry but of economic situation. However various problems seem to be lying latent in the course of actualizing the idea and policy of the Ceylonese Government.

The investigation team, after having worked for over a month has arrived at the following views:

(1) Tuna fishing ships to be accommodated at Galle.

In order to run at a profit the tuna fishing having its base at Galle at least eight times of fishing navigation a year is necessary by the complement consisting of all Ceylonese and the fishing baits (now imported from Japan) must be procured in Ceylon. Such conditions can not be met immediately.

(2) Use of Port Galle by trawlers

It is desirable that the trawlers will utilize Port Mutwal and Port Trincomalee as their bases which are situated nearest the trawling fishing grounds or the continental shelf connecting with the Wadge Bank, Pedro Bank, and the Continent of India. Furthermore, the existing land facilities for trawlers in Mutwal are considerably large capable, by some

replenishments, of accommodating five more trawlers to be imported from Jugoslavia and of functioning the land facilities more than enough.

However, in view of the fact that Port Mutwal is now being utilized by the existing trawlers and tuna fishing ships other than those to be newly introduced, the investigation team presupposes that such trawlers may sometimes also utilize Galle.

(3) It may be significant for the future of the Ceylonese fishing industry that Port Galle is equipped with a basin, which means that the port will be able to function as the base not only of deep-sea but of offshore fishing.

(4) Regarding the cannery industry which the Government earnestly hopes for the team has reached a conclusion that the plan of establishing a cannery is better be postponed until a proper time in future when the plant operation to schedule has been assured. The reason is as follows:

At the present moment all necessary cans must be imported, running at a profit of the plant can not be expected unless the plant can operate throughout the year, which means, that this plant plan is precarious unless a reliable supply of tuna, the material of same kind, can be expected at all seasons.

On the basis of the above views the investigation team has taken up the task of planning, modifying on the one hand the Government plan and adopting on the other as much as possible its requests. The planning is as follows:

(1) In consideration of the character of Galle as a base for deep-sea tuna fishing together with the use by trawlers at the same time the haul landing of these deep-sea going ships is to be conducted at the jetty now on the point of construction. In order to endow the port a character as a base for offshore fishery at the same time in the Southern Province, a new inner breakwater and moorings are to be built within the port area which has been already decided.

(2) The fish landed are to be all ice-stored, part of which is to be sold on the spot, another part to be iced-up and forwarded to places of consumption, and the rest, frozen ice-stored or processed and treated. Such necessary facilities as auction markets, ice chambers, refrigeration plants, and treatment plants are to be planned.

(3) Ice-making plants are so planned as to supply enough ice to tuna fishing ships, trawlers, small-size boats of offshore fishing, and transportation of fresh fish.

(4) Measures for the perfect use of wastes resulting from the treatment of fish bodies are to be planned.

(5) Cannery plant is excluded from the plan at the present moment, the plant site alone will be reserved.

(6) Unloading and transporting equipments of fresh fish landed from fishing ships are to be so planned as to be suited for the landing stages; the operation of such equipments is planned to be simple, quick and efficient.

(7) In planning the treatment of fish special importance is attached to the sanitary equipments, making satisfactory the washing process with fresh water and the disposal of its slops.

(8) Planning of warehouses of ship fittings and fishing implements.

(9) Facilities for port management and such equipments for the welfare of seamen of tuna ships as canteens, lodgings, etc.

(10) Repair and supply equipments for the hulls and engines of ships, and machines and instruments of treatment plants should be given thorough consideration. They must be planned perfectly so as not to check the running of fishing enterprises.

(11) The plan must be possible of immediate realization and the scale of equipments must be such as capable of yieding profit.

(12) Making out fishing plans for fishing ships and cost estimates of the plants on land.

4 - 2 Object in view

4 - 2 - 1 Principle of planning

In planning the land facilities of a port the scale and haul of the fishing ships to utilize the port are the important factors to determine its contents and scale. That is to say, depending on the type and number of the ships, and on the kind and haul quantity of

fish in Galle, the quantity and way of processing and treating fish are determined. Again, by the fishing plan of these ships is calculated the quantity of supply, loading and unloading which determine in turn the scale of necessary facilities to function. That is why such basic data must be thoroughly studied before making plans. However, not all of the expected ships are to be obtained simultaneously, as the Government hopes, but may reach Galle severally in number and time. The team, therefore, makes a plan of the whole facilities at this moment, depicting their completed styles in mind, but designs each portion of the facilities to be independent of the other and yet capable of being added to one by one according to the stage of construction progress.

4 - 2 - 2 Plan of deep-sea tuna fishing

a) Size of fishing ship

The long-line fishing of tuna in Ceylon is now being operated by two fisheries companies, Ocean Food and Trade Co. and Jegnau Co., whose records of fishing, distance of the fishing grounds, rate of catch, balance of business, convenience of hull repair, etc. have been deliberately considered in every aspect in order to draw a conclusion as to the proper size of a tuna fishing ship as follows:

Gross tonnage	about	100 t. (wooden)
Length	"	26 m.
Breadth	"	5.5 m.
Depth	"	2.6 m.
Fish hold capacity (cold storage)	"	100 m^3 (cooling at -5°C)
Full oil tank capacity	"	40 m^3
Fresh water tank capacity	"	20 m^3
Main engine, diesel		250 HP x 1
Refrigeration equipment		4" x 4" x 2 x 1 (NH^3)
Complement		23

b) Yearly fishing plan

Navigation days (to and from fishing ground)	10 d.	
Operation days	24 d.	(4 days for test of proper waters)
Loading, supply, anchorage days	6 d.	
Total	40 d.	

If 8 times of operation are executed yearly,

Navigation days (to and from)	10d. x 8 =	80d.
Operation days	24d. x 8 =	192d.
Loading, supply, anchorage days	6d. x 8 =	48d.
Repair days on shipway		45d.
Total		365d.

c) Yearly catch plan

Employing 400 bowls of long-line (each with 5 fishhooks) per ship and assuming the rate of catch to be 3.1% on the basis of the latest records and average weight of one tune to be 80 lbs., the yearly catch is calculated as follows:

Total fishhooks of one time navigation

400 (bowl) x 5 (fishhook) x 20 d. = 40,000 (fishhook)

Total number of tuna catch

40,000 x 3.1/100 = 1,240

Total weight of catch

1,240 x 80 (lb) = 99,200 (lb) ≒ 100,000 lb ≒ 40 ton

Total yearly catch per ship

100,000 lb x 8 (time of navigation) = 800,000 lb ≒ 320 t.

Total yearly catch of 10 ships

800,000 lb x 10 = 8,000,000 lb ≒ 3,200 t.

d) Yearly business plan of a tuna fishing ship

1. Cost of one ship (including fishing implements) ... 800,000 Rs

2. Yearly proceeds

800,000 lb x 0.60 Rs = 480,000 Rs

3. Expenses

Fuel oil consumption is calculated at 160 gallons per hour HP, and during operation at 60%; specific gravity of heavy oil is 0.92, its price per gallon (4.5 l) being estimated at Rs 0.65,

$$\frac{(160\text{gr.} \times 24\text{h} \times 250\text{HP} \times 80\text{d.}) + (160\text{gr.} \times 24\text{h} \times 250\text{HP} \times 192\text{d.} \times 0.6)}{1,000} = 187,392\text{kg}$$

$$\frac{187,392\text{ kg}}{0.92 \times 4.5} = 45,264\text{gal.} \times 0.65\text{ Rs} = 29,422\text{ Rs}$$

Mobile oil ..... 5,097 Rs

2% of fuel oil consumption at 5.63Rs/gal.

45,264 x 0.02 x 5.63 = 5,097 Rs

Fresh water (20 tons per one time navigation at 1.7 Rs/t.)... 272 Rs

20 x 8 x 1.7 = 272 Rs

Fishing bait (substitue fish for refrigerated saury - pike)... 25,920 Rs

To be procured in Ceylon at 0.08 Rs per one fish

400 (bowl) x 5 (hook) x 20d. = 40,000 (number of bait)

Reserved bait 500

Number of bait fish per navigation 40,500

40,500 x 8 x 0.08 = 25,920 Rs

Ice (20 t for one time navigation at 50 Rs/t)

20 x 8 x 50 = 8,000 Rs ..... 8,000 Rs

Personnel expenses ..... 74,400 Rs

Skipper, Chief Engineer		500 x 2 x 12 =	12,000 Rs
Officer (5)		400 x 5 x 12 =	24,000 Rs
Seaman (16)		200 x 16 x 12 =	38,400 Rs
Total	23		74,400 Rs

Board of crew ..... 33,120 Rs

4 Rs x 23 x 30 x 12 = 33,120 Rs

Replenishments of fishing implements ..... 20,480 Rs

Long line 400 (bowl) x 80 Rs = 32,000 Rs

Short line 4,800 x 2 Rs = 9,600 Rs

$$41,600 \times \frac{30}{100} = 12,480 \text{ Rs}$$

Other accessories at 1,000 Rs for one time navigation

1,000 Rs x 8 = 8,000 Rs

20,480 Rs

Expendables 16,400 Rs

(4,800Rs for deck, 10,400Rs for engine, 1,200Rs for wireless)

Unloading and sales commission (5% of proceeds) 24,000 Rs

480,000 x 0.05 = 24,000 Rs

Insurance for crew	10,000 Rs
Insurance for ship	20,000 Rs
Repair of ship (inspection in dock)	50,000 Rs
Depreciation of ship (10%, 800,000 Rs x 10%)	80,000 Rs
Interest (8%, 800,000 Rs x 0.08)	64,000 Rs
Total expenses	461,111 Rs
Income	480,000 Rs
Profit	18,889 Rs

4 - 2 - 3 Plan of offshore fishing

As stated in 3 - 1 - 2 the offshore fishing in the Southern Province centering around Galle is best fitted for long-line fishing of shark, swordfish, and bonito. When bonito is in season, that is from March to May, bonito angling is conducted, too. Fishing is possible all the year round and also safe even during the southwestern monsoon season. However, the ship size must be more than 10 tons at least for this purpose. Wooden ships of this class may be built in Ceylon, without ordering from abroad if only a little amount of technical guidance is given, judging from the present standard of shipbuilding technique of Ceylon. Regarding the number of such ships, a plan of operating about 50 such ships has been made, as the capacity of the basin to be built for them will be limited, that is, it will be able to accommodate 50 such ships at most, in view of the total area of the fishing port

now under construction.

In Ceylon there is hardly any investigation made now concerning offshore fishing or hardly any data to be the basis of planning. That is why the records of the test fishing conducted by the Training Center of Fishery have been utilized for reference. The records show that 30 - 50 bowls of implements (each with 5 fishhooks) could gain the results, that is, the following rates of catch: maximum, 17%, minimum, 7%, and the average, 12%. In every test fishing 1 - 2 tunas were caught, and the biggest catch was ten. On the basis of such records we adopt the rate of catch of 7% which seems safe and reliable, and assuming the average operation days to be 20 monthly, we calculate as follows:

(a) Type of fishing ship

Gross tonnage ..... 10 ton (wooden Ketch type)

L x B x D ..... 13m. x 3.5m. x 1m.

Main engine (diesel) ..... 30 HP x 1

Insulated fish hold capacity ..... 8 m^3 (also used for living fish hold)

Complement 6

(b) Operation plan

Navigation (to and from) 6 hours (10 - 20 sea miles)

Operation ..... 10 hours (50 bowls of implements)

Total hours of operation per day ..... 16 h.

(c) Total days of operation per year 20 d x 12 = 240 d

Assuming that 50 bowls of long-line (each with 5 fishhooks) are employed, the rate of catch, 7% and major kind of catch, shark with average weight of 50 lbs.,

Total number of fishhook per ship 50 x 5 = 250

Total number of catch per ship day $250 \times \frac{7}{100} = 17.5$

Total quantity of catch per ship day 17.5 x 50 = 875 lb ≒ 0.4 ton

Total quantity of catch per ship month 875 lb x 20 = 17,500 lb ≒ 8 t.

Total quantity of catch per ship year 17,500 lb x 12 = 210,000 lb ≒ 96t.

Total quantity of catch of 50 ships per year 210,000 x 50 = 10,500,000 lb. ≒ 4,800 t.

(d) Yearly business plan of 10-ton offshore ship

1. Cost of ship 50,000 Rs

   Cost of fishing implement 50 x 100 Rs 5,000 Rs

   Total 55,000 Rs

2. Yearly proceeds (income)

   875 lbs x 20d. x 12 x 0.3 Rs 63,000 Rs

3. Expenses

   Heavy oil 2,894 Rs

   $\frac{160gr \times 30HP \times 16h \times 20d}{1,000}$ = 18,342 kg

   $\frac{18,432}{0.92 \times 4.5}$ = 4,452 gal

   4,452 gal. x 0.65 Rs = 2,894 Rs

   Mobile oil 501 Rs

   4,452 x 0.02 x 5.63 Rs = 501 Rs

   Fishing bait 3,600 Rs

   50 x 5 + 50 = 300 (number of bait fish)

   at 0.05 Rs per fish

   300 x 20 x 12 x 0.05 Rs = 3,600 Rs

   Ice 1,200 Rs

   Ice: a quarter of fish weight is consumed

   96 ton x 1/4 x 50 Rs = 1,200 Rs

   Replenishment of fishing implements 1,000 Rs

   Replenishment rate: 20%

   50 x 100 Rs x 0.2 = 1,000 Rs

   Expendables 100 Rs

   Personnel expenses 26,400 Rs

   500 Rs x 2 (person) = 1,000 Rs
   300 Rs x 4 (person) = 1,200 Rs
   Total 6 2,200 Rs x 12 = 26,400 Rs

   Board of crew 8,640 Rs

   4 Rs x 6 (person) x 30 x 12 = 8,640 Rs

   Sales commission 3,150 Rs

5% of proceeds 63,000 Rs $\times \frac{5}{100}$ = 3,150 Rs

Repair of ship	1,000 Rs
Depreciation of ship	5,500 Rs
55,000 Rs $\times \frac{10}{100}$ = 5,500 Rs	
Interest	4,400 Rs
55,000 Rs $\times \frac{8}{100}$ = 4,400 Rs	
Total expenses	58,385 Rs
Income	63,000 Rs
Profit	4,615 Rs

4 - 2 - 4 Plan of trawling

Navigation plan of trawlers

In view of the record, shown in Table 5, of five years' operation conducted by Ceylones trawlers, it may be quite reasonable to calculate on the assumption that 15 times of navigation is executed a year, the catch of each time is 35 tons (3 tons per day), and price of fish, Rs 1,000 per ton.

(a) Operation plan

Navigation days (to and from)	2 d.
Operation	12 d.
Loading, supply and anchorage	6 d.
Total	20 d.

Yearly operation plan

Navigation days (to and from) 2 x 15 = 30 d.

Operation days 12 x 15 = 180 d.

Table Trawlers' operation records of latest 5 years

Name of vessel	Year	Time of navigation	Quantity of catch (t)	Amount of catch (Rs)	Catch per one time navigation (t)	Proceeds per one time navigation (Rs)	Average price per ton (Rs)
Branconglen	1958	13	553	845,000	43	65,000	1,500
	1959	20	751	836,000	38	42,000	1,100
	1960	12	525	689,000	44	57,000	1,300
	1961	(2)	(65)	(64,000)	33	32,000	1,000
	1962	14	521	513,000	37	37,000	1,200
	Average	* 15	* 597	* 721,000	39	48,000	1,200
Maple Leaf	1958	16	361	541,000	23	34,000	1,480
	1959	20	540	614,000	27	31,000	1,240
	1960	13	533	611,000	41	47,000	1,140
	1961	20	795	913,000	40	46,000	1,150
	1962	14	563	520,000	40	37,000	920
	Average	17	558	639,800	34.2	39,000	1,140
Remarks	* Mark of Branconglen for 1961 considered an exceptional case and not contained in average value.						

Loading, supply, anchorage days 6 x 15 = 90 d.

Repair, dock inspection days 65 d.

Total 365 d.

(b) Quantity of catch (at 35 tons per one time navigation)

Yearly catch per ship 35 x 15 = 525 t.

Yearly catch of 3 ships 525 x 3 = 1,575 t.

Note: As for trawlers to be imported from Jugoslavia, details are unavailable; our calculation is made on the assumption that those trawlers are, for convenience' sake, of 325-ton class, equipped with a 350 HP engine and cold storage holds, and manned with complement consisting of 26 crewmen.

(c) Business plan of trawler

1. Cost of ship (including implements) 1,000,000 Rs

Ship 950,000 Rs

Fishing implements	50, 000 Rs	
Total	1, 000, 000 Rs	(based on German plan)

2. Gross proceeds 525, 000 Rs

35 t (catch of one time navigation) x 15 (time of navigation)

x 1, 000 Rs = 525, 000 Rs

(Average price per ton of fish from trawlers at 1, 000 Rs)

3. Expenses

Heavy oil 44, 313 Rs

$\frac{160 \times 24 \times 350 \times 210}{1,000}$ = 282, 240 kg.

$\frac{282,240}{0.92 \times 4.5}$ = 68, 174 gal.

68, 174 gal x 0. 65 Rs = 44, 313 Rs

Mobile oil 7, 676 Rs

Fresh water 510 Rs

One time navigation 20t x 15 x 50 Rs = 510 Rs

Ice 15, 000 Rs

20t (one time of navigation) x 15 x 50 Rs = 15, 000 Rs

Replenishments of fishing implements

and ship fittings 20, 000 Rs

Personnel expenses 81, 600 Rs

Skipper, Chief Engineer	500 Rs x 2 x 12 =	12, 000 Rs
Officer (5)	400 Rs x 5 x 12 =	24, 000 Rs
Crewman (19)	200 Rs x 19 x 12 =	45, 600 Rs
Total	26 persons	81, 600 Rs

Board 37, 440 Rs

4 Rs x 26 (person) x 30 x 12 = 37, 440 Rs

Maintenance of ship 40, 000 Rs

Insurance for Crew 10, 000 Rs

Insurance for Ship 20, 000 Rs

Unloading commission 26, 250 Rs

5% of proceeds 525, 000 Rs x $\frac{5}{100}$ = 26, 250 Rs

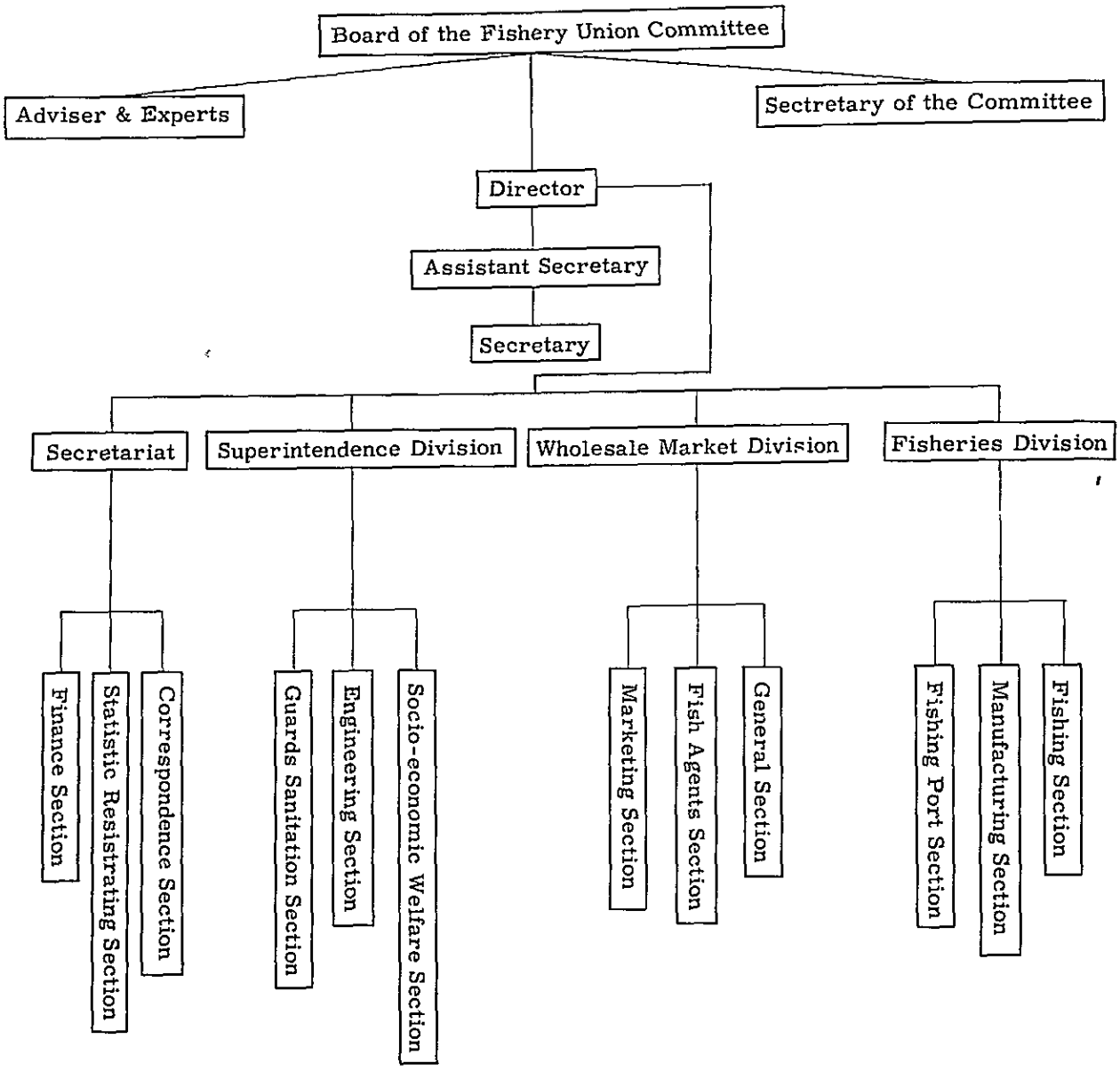
Depreciation of ship (10%, 1, 000, 000 x 0. 1)	100, 000 Rs
Interest (8%, 1, 000, 000 x 0. 08)	80, 000 Rs
Total expenses	482, 789 Rs
Income	525, 000 Rs
Profit	42, 211 Rs

4 - 2 - 5 Circulation plan

It is desirable that the management and administration of the fishing port, fishing industry, process and treatment plants, sales of products, etc. are executed under a systematic organization. The Government is contemplating running these business either under its direct management or through the Ceylon Cooperative Fish Sales Union. There are merits and demerits in each case of management; Government, private enterprises, or Co-operative associations. The important point is how to ensure good management by a perfect system. Under the circumstances management by cooperative associations is considered most proper at this moment, as the low price of fish must be realized by making the intermediate margin of profit as small as possible.

As systematic management can not be expected under the conventional structure of associations, the following system has been planned, as shown in Table 6.

Table 6 Organization of management & administration



5. Construction plan of fishing port of Galle

5 - 1 Presupposition of planning

The western part of the bay of this port is already in use as a commercial port where loading and unloading work is conducted offshore, which is naturally inefficient, and no kind of noteworthy equipments are found except some landing stages and sheds. This is the reason why the Ceylonese Government has made a plan as follows:

Construction of a quay with two berths for 1,000-ton class vessels on the northern side of Island Gibbet which lies in the middle of the commercial port. This is for the convenience of the commercial port.

Reclamation of the space between Is. Gibbet and Point Glosenberg to be equipped with such land facilities as sheds and harbor railway in parallel to the construction of three jetties (landing stage type) for the convenience of the fishing port accompanied with the reclamation of their adjacent sand beach.

Such part of this plan as the breakwater, quay, dredging of the roadstead, and reclamation is now in the course of construction.

Such state of things and the request of the Ceylonese Government to make the facilities available as soon as possible have made the investigation team to proceed along the line of already fixed plan as well as in consideration of preventing future obstacles in the use and management of the port both for fishing and commercial purposes.

5 - 2 Conditions of executing works

The construction works of harbors and ports in Ceylon is, in principle, directly executed by the Government, the case of Port Galle being no exception; part of such simple works as require no heavy machines (for instance, in Galle, making of concrete blocks, collection of stone blocks for breakwaters, and their transportation) are conducted by contract work. Sometimes such kind of works as require considerably high technique and a large sum of cost is executed by international bid.

Generally speaking, there is a shortage of technicians while labor is in excess and

amply supplied. Such construction materials as Portland cement and rolled steel are imported, which make the construction cost comparatively high.

5 - 2 - 1 Labor

As stated above, labor is abundant, but its will-to-work, skill, etc. are unknown. It is difficult to judge the labor efficiency, as there is no such wages system as the so-called efficiency system.

The standard wages of workers in Galle (direct employee of Government) are as follows:

Labor helper; Rs 2.10 - 7.10

Labor; Rs 4.20 - 5.20

Carpenter; Rs 7.20

Note: The above sums are the standard wages and according to the contents of the work they range from Rs 2.10, the lowest to Rs 7.10, the highest. Consequently there is no such classification of trade as concrete worker, reinformcement bar worker, earthworks narvy, etc., but those of the skilled workers happen to do that kind of work.

Diver; basic salary (without outfit) per head month; Rs 400, and additional bonus according to the achievements in work ranges from Rs 600 to Rs 800

Electrician, Rs 225 per month

5 - 2 - 2 Principal construction materials

The purchase prices of principal materials for construction in Galle are as follows: (No import duties are imposed on Portland cement and steel materials, which are directly landed in Galle)

Portland cement	per ton	Rs 170
Sand	per m^3	" 25
Gravel	"	" 32

Stone blocks (coarse) Rs 70 - 80 for 2 - 3 tons

5 - 2 - 3 Machinery

Of the construction machinery for the construction works of harbors and fishing

ports neither heavy machines nor such operation-ships as crane-ships and dredgers are owned by private enterprises, but they all belong to the Government. Those in use now at Galle for the works of the harbor and fishing port as follows:

Capital crane 5

Bucket dredger

Pump

Grab dredger

Batcher plant

As regards the repair of machines simple repair work is possible on the spot, but that of foreign-made machines may take a pretty long time, as the procument of their parts is difficult owing to the extreme restriction of import by the government.

The supply of electric power for construction works is abundant. It is difficult to obtain fresh water owing to the inadequate equipments of waterworks; the water for concrete works at the building site is at present supplied by tubular wells (about 3 m. deep) pumping up ground water.

5 - 3 Plan of fishing port facilities

5 - 3 - 1 Presuppositions

Presuppositions for planning the fishing port are as follows:

Fishing ship (the base being at Galle)

Kind of ship	Number	Type (ton)	HP	Complement
Tuna ship	10	100	250	23
Mechanized ship of small size	50	10	30	6

Catch

Tuna ship	2 tons per ship day. 40 t. per 1 time navigation. 8 times navigation per year. 10 ships' catch per year: 3,200 t.
Mechanized ship of small size	0.4 ton per ship day. 240 operation days per year. 50 ships' catch per year: 4,800 t.

Note: 1. Navigation days for one operation of a tuna ship are 40; 5 to the fishing ground, 5 for test of proper waters, 20 for operation, 5 to port, and 5 for anchorage.

2. Unloading equipments and moorings for tuna ships are the jetties planned and now constructed by the Government.

3. In addition to the above-said tuna fishing ships and mechanized ships of small size, trawlers having their base at Mutwal may sometimes enter into Galle.

5 - 3 - 2 Facilities plan

In accordance with the above-mentioned presuppositions the following port facilities are planned as under:

5 - 3 - 3 Basic facilities

5-3-3-1 Outer block facilities

Inner Breakwater: 280 m. Pier head height + 2.00 m

Western (also used as jetty): 70 " Pier head height + 1.00 m

Eastern ("): 70 " Pier head height + 1.00 m

5-3-3-2 Sea area facilities

Roadstead: 23,000 m^2

5-3-3-3 Moorings

2-meter unloading space: 220m Pier head height + 1.00 m

Note: out of this 220 m. 70 m. for exclusive landing space, the rest 150 m. for moorings

Basis of calculation

Exclusive landing space for catch: 70 m.

Total weight of landed catch: 0.4 t. per ship day

50 ships per day 20 t.

Kind of fish: bonito, shark, etc. unit weight assumed about 20 kg.

Size of ship: 1.3 m. (length) x 3.5 m. (breadth) x 1.0 m. (depth)

Way of landing by simple crane, with ship lying alongside

Time of landing:

(a) Unit time of landing operation by simple crane is 1.5 min. 40 times of operation per hour is possible, but efficiency here assumed 1/2 of such figures.

(b) Unit number of sharks hanged by one operation is 3.

(c) landing time of one ship: 300 kg ÷ 60 kg x 3 min = 15 min.

(d) adding shift time of ship to the above, landing time of one ship is 20 min.

Extension required

a) Extension required in case of simultaneous landing of all ships

13 (m. per ship) x 50 (ship) = 650 m.

Extension planned

Assuming landing operation to be finished in 3 hours

650 m – (180 min. ÷ 20 min.) = 72 m.

This length of 72 m. is cut short to be 70 m.

Landing space for moored ships 150 m.

Extension of moorings required (with ship lying fore and aft)

4 (m. per ship) x 50 (ship) = 200 m.

Extension of moorings planned 150 m.

Due to conditions of position of fishing port planned length is cut short to be 150 m.

Number of ship capable of moorings. 150 m. - 4 m. (per ship) = 37.5 = 37

note: 50-37 = 13 these 13 ships are accommodated at eastern and western

breakwaters (capable of 10 ships' coming alongside) or pulling up on slipway (enough space for 9 ships)

Slipway

Slipway is planned for use of 2 months for one ship.

Unit required: 50 (number of ship) x 2 (month per ship) – 12 (month) = 8.3

Unit planned: 9

Area per unit: 4 m x 13 m = 52 m^2 x 2 = 104 m^2 = 110 m^2

Space required: 9 x 110 = 990 m^2 = 1,000 m^2

Area of slipway planned

Repairing equipments for fishing ships are built adjacent to slipway, the space required being supposed 1,000 m^2; the area of slipway planned:

Shape 50 m x 40 m = 2,000 m^2

Jetty 90 m

The above-said moorings are for mechanized ships of small size. As for 10 tuna fishing ships with their base in this port, the jetty planned by the Government is prepared for their use. The scale is examined as follows: In this case the size of ship is assumed 26 m (length) x 5.5 m (breadth) x 2.6 m (draft)

Berth required (in case of use by ships in orderly succession)

365 d. - (34 d x 8) = 93 d. anchorage days

(Anchorage days x number of ships) ÷ 365 d = 2.5 ≒ 3 berth

Extension required

3 berth x (length of ship + clearance) = 3 x 30 = 90 m

Jetty planned

6 berth ... 180 m (90 m on one side)

Quay of landing required (in case of use by all ships simultaneously)

as for 3 berths, 3 ships come alongside, and the rest or 7 ships, fore and aft.

180 m - 90 m = 90 m > (breadth of ship + clearance) x 7 = 7.5 x 7 = 52.5 m

as for 6 berths, 6 ships come alongside, and the rest 7 fore and aft at Rest Quay at neck of jetty.

Berth for landing catch

10 (number of ship) x 8 (time of navigation) x 2 (day) = 160 d.

160 x 3/365 = 1.31= 2 berth

note: 3 is rate of occupation

In case of trawlers whose base is in Mutwal happening to enter into this port owing to circumstances in Mutwal, the jetty and revetment can offer enough space for their accommodation.

5 - 3 - 4 Functional facilities

5-3-4-1 Refrigeration, cold storage, and ice-making plant

Cooling apparatus and storage room of cooled stock

Presupposition: out of 20 t/d (catch per day of mechanized ship 4,800t÷240d = 20t/d)

10t are cooled; the rest 10 tons, sold as they are.

Capacity required: 10 t/d, and

10 days' quantity of cooled stock is stored, that is 100 t; together with baits, etc. total storage planned amounts to 200 t.

Freezing apparatus and storage room of frozen stock:

Presumption: Catch of tuna fishing ships and trawlers is treated; plant operation days are 25 per month or 300 d/year.

Capacity required:

Average catch of tuna ship assumed to be 10.7 t/d. (3,200 t − 300 d. = 10.7 t/d)

Assuming tuna to be sliced into fillet at yielding rate of 60%, 6.42 t/d are frozen.

Catch of trawler is considered likewise: (at yielding rate of 50%)

1,575t−300d = 5.25 t/d 5.25 t/d x 0.5 = 2.625 t/d

Freezing of shark fin and liver from tuna ship and mechanized ship is assumed to be 10 t/d

Total of the above quantity amounts to 19.045 t/d; freezing capacity required per day amounts to 20 t, and

30 days' quantity of above-said quantity together with baits, etc/ amounting to

100 t; total quantity 700 t. are stored.

Ice-making apparatus and quantity of stocked ice

Capacity required:

ice for tuna fishing ship

1/2 in weight of catch required .... 1,600÷300 = 5.3 t/d

ice for trawler

1/1.75 in weight of catch required ..... ÷300 = 3.0 t/d

ice for mechanized ship

1/4 in weight of catch required ..... 1,200÷300 = 4 t/d

In addition, ice required for sale, transportation, etc. of catch by near-by fishing boats assumed respectively to be 2 t and 4.7 t, amounting to 6.7 t in total.

total of above figures is 19 t; capacity required is 32 t/d. and

out of 20 t/d 5 t/d are consumed daily and 20 days' quantity of the rest 15 t; total 300 t. are stored.

The above figures are tabulated as Table 7 and Figure 3 with an idea of plant layout.

5-3-4-2 Fish meal and shark liver oil plants

Presuppositions

Fish meal plant is supplied with as material 4.28 t of wastes from tuna fishing ships and 2.625 t of wastes from trawlers, amounting to 6.905 t/d in total, or 7 t/d.

Note: 10.7 - 6.42 = 4.28 t/d

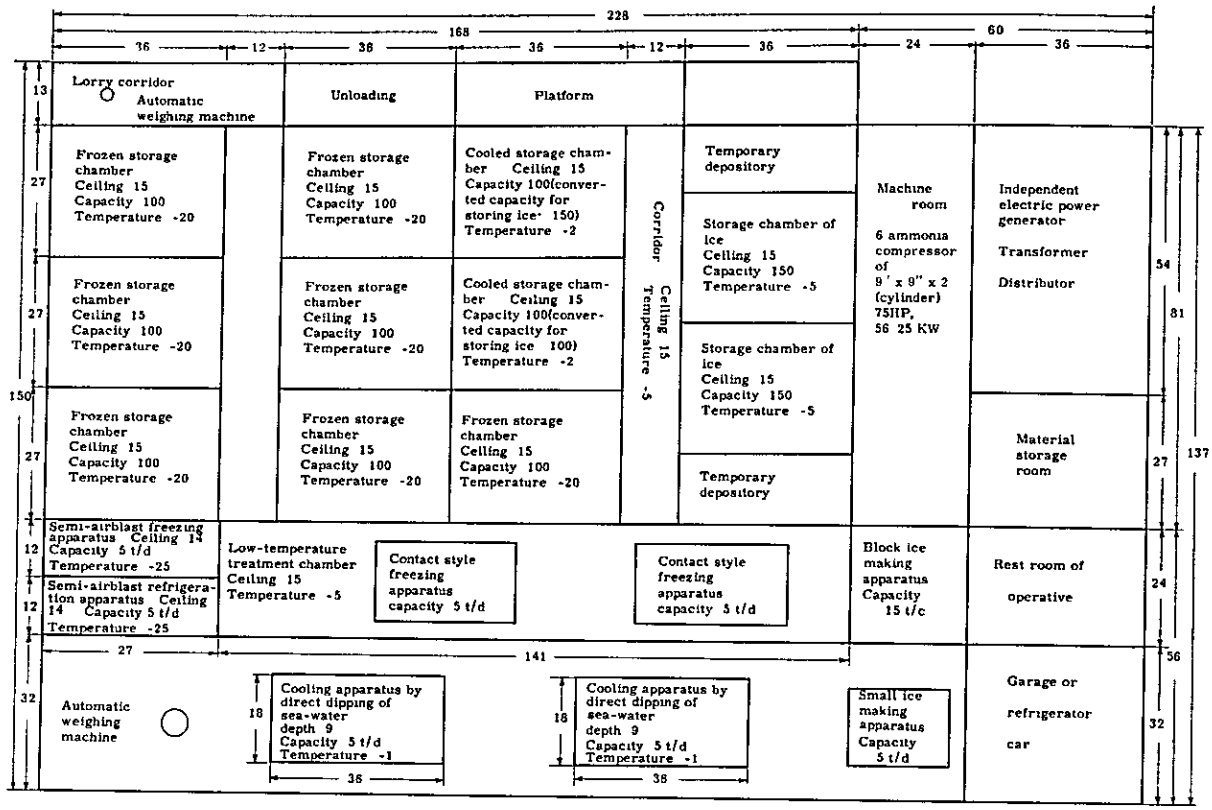
5.25 - 2.625 = 2.625 t/d

Table 7 Capacity of refrigeration, cold storage and ice-making plant to be built in Galle

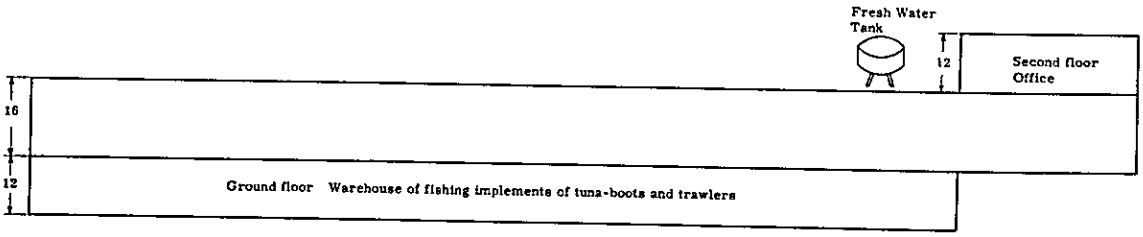
Nomenclature	Type	Capacity	Refrigeration capacity Refrigeration ton	Temperature °C	Remarks
1. Cooling apparatus	Cooling apparatus by direct dipping of sea-water	5 t/d x 2 = 10t/d	10	0	
2. Cooled storage chamber	Cooling by unit cooler	100t x 2 = 200t	10	More than - 2	In case converted to ice stock 150t x 2 = 300t
3. Freezing apparatus	Contact type freezing apparatus Semi-airblast type freezing apparatus	5 t/d x 2 = 10 t/d 5 t/d x 2 = 10 t/d total 20 t	80	Less than - 25	
4. Frozen stock chamber	Cooling by hairpin coil	100t x 7 = 700 t	70	Less than - 20	
5. Ice-making apparatus	Block ice making apparatus Small ice making apparatus	15 t/d 5 t/d total 20 t/d	40	- 10	112 lbs frozen ice Brine of $CaCl_2$ employed
6. Ice storage chamber	Cooling by hairpin coil	150t x 2 = 300t	6	Less than - 5	
7. Low-temperature treatment chamber & corridor	Cooling by unit cooler	100t x 2 = 200 t 356t x 1 = 356 t total 556 t	14	Less than - 5	

Total 230 refrigeration ton

Figure 3 An example of plant layout of refrigeration, cold storage and ice-making in Galle



Floor plan



Elevation

Unit of length ft
Unit of capacities ton
Unit of temperature °C

Note:

1. The above Table shows that the total load of refrigeration capacity is 230 refrigeration tons. As a vertical, low-speed ammonia compressor with the size of 9" x 9" x 2 (cylinder) has a refrigeration capacity of 43.0 t at 300 r.p.m., six such compressors (43.0 x 6 = 258.0) can stand the above load. In practice those compressors are employed as follows: one for the cooling apparatus, cooled storage chamber, storage chamber of ice, low-temperature treatment chamber, and corridor; two for freezing apparatus, two frozen storage chamber; one exclusively for ice-making apparatus. As this compressor is of 75 HP and driven by a motor of 56.25 KW, six such motors are necessary. The cooling is conducted by direct expansion method.
2. As electric current is often cut off in Ceylon, an independent electric power plant (diesel engine driven) is prepared with a capacity of 120 KW which corresponds to two compressors for the purpose of constant operation of the cooled storage chamber and frozen storage chamber in case of current cut-off.
3. The condenser is of fresh water cooling type designed to conserve water either by combining a cooling tower to recirculate water or by attaching an evaporation type.

4. Regarding the heat insulation device of each apparatus and chamber, if it is made of carbonized cork boards, they must be one-inch thicker than those in Japan. In practice expanded polystyrene is recommendable.
5. Part of refrigeration, ice storage and ice-making plant is made two-storied to utilize the upstairs as an office room. Generally speaking, some space is prepared under the base floor for fear of freezing-up; this is made high enough to be used as a warehouse of fishing implements. It must be ventilated well. A fresh water tank is placed on the roof of this plant.
6. According to the German plan the capacities are as follows:

Cooling: 0 t/d Cooled storage: 404.25 t Freezing: 24 t/d Frozen storage: 378.0 t Ice-making: 60 t/d Ice storage: 0 t

Shark liver oil plant is supplied with 2 tons of shark livers daily; 1 ton from tuna

fishing ships and 1 ton from mechanized boats.

Note: Weight of shark liver is about 1/10 of its own weight.

Tuna fishing ships catch as many sharks as tunas; these sharks are thrown away after having extracted their livers.

1/2 of the catch of mechanized boats are sharks.

Capacity required:

According to the presuppositions the capacity of treating materials in the fish meal plant is 10 t/d and in the liver oil plant, 2 t/d.

Output

Fish meal plant

Fish meal 7 t/d x 0.2 = 1.4 t/d

Fish oil 7 t/d x 0.05 = 0.35 t/d

Fish soluble 7 t/d x 0.05 = 0.35 t/d

Note: 7 t means quantity of material; 0.2 and 0.05 are yielding rates of material.

Shark liver oil 2 t/d x 0.4 = 0.8 t/d

Note: 0.4 is yielding rate of material.

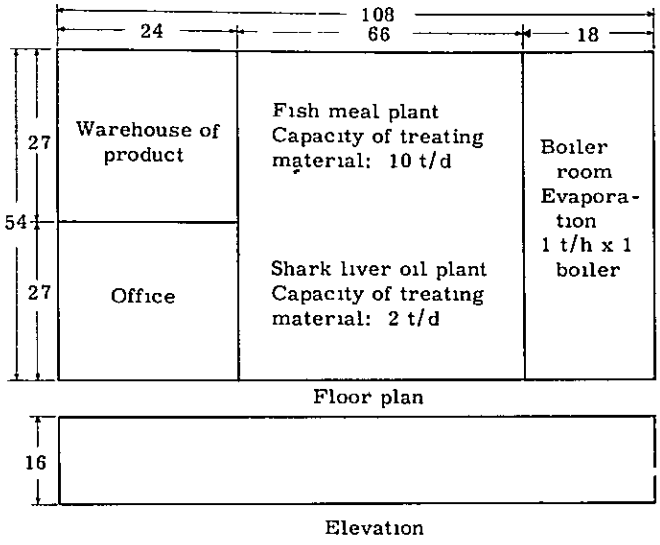
Above figures are tabulated as Table 8 and the arrangement of the plant is shown in Figure 4.

Table 8 Capacity of fish meal and shark liver oil plant in Galle

Nomenclature	Type	Capacity t/d	Remarks
1. Fish meal manufacturing plant	Press type fish meal plant	Treatment of material Waste: 10 or 7 Output Fish meal 1.4 Fish oil 0.35 Fish soluble 0.35	
2. Shark liver oil manufacturing plant	Boil-down type liver oil plant	Treatment of material Shark live: 2 Output Shark liver oil 0.8	

Note: According to the German plan, the fish meal plant is supposed to have a capacity of treating material of 15 t/d. It treats the waste of 15 t/d, out of which 24% is made into fish meal (in practice it is whole meal mixed with fish soluble), and 4% into fish oil.

Figure 4 A layout example of fish meal and shark liver oil plant in Galle



5-3-4-3 Solardrying space of shark fin

Presuppositions

Supply of material

From mechanized boat	10t/d x 0.07 =	0.7t/d
From tuna fishing boat	10t/d x 0.07 =	0.7t/d
Total		1.4t/d

Note: 0.07 is weight percentage of shark fin to total weight of shark

Output of dried shark fin

1.4t/d x 0.3 = 0.42t/d

Note: 0.03 is weight percentage of dried shark fin to untreated one.

Planned area of solardrying space of shark fin

Treatment capacity per unit space:

25 kg/m^2

Space required:

1,400 kg 25 kg/m^2 = 56 m^2

Number of days required for drying is supposed 25

56 x 25 = 1,400 m^2 ... space required

Space planned:

60m x 25m = 1,500 m^2

5-3-4-4 Repair plant of fishing ship and implements

As a matter of course parts of the hull, machine, fishing implements of mechanized boats, and machines and implements of tuna fishing ships are supplied enough for their repair. In addition equipments for casting, forging, sheet metal working, steel plate working, welding, hand-finishing, and machine-finishing are planned, too. Those equipments are of course used for reparing the machinery of the refrigeration, cold storage and ice-making plant and fish meal and shark liver oil plant.

Space planned: 50 x 40 = 2,000 m^2

5-3-4-5 Warehouse of fishing implements for mechanized boat of small size (site alone proposed)

As we have already stated, fishing implements of trawlers and tuna fishing ships are to be stored on the ground floor of the refrigeration, cold storage, and ice-making plant. Here, the area alone of the space required for the warehouse of the mechanized boats are calculated; one small warehouse for each boat.

Unit scale: 4m x 2m = $8m^2$ x 2 = $16m^2$

Space required: $16m^2$ x 50 = $800m^2$

Area planned: 40m x 25m = 1,000m^2

5-3-4-6 Common operation yard (site alone proposed; yard for reparing fishing line and net)

Space of land is secured for the purpose of drying and repairing fishing implements.

Area planned: 40m x 25m = 1,000m^2

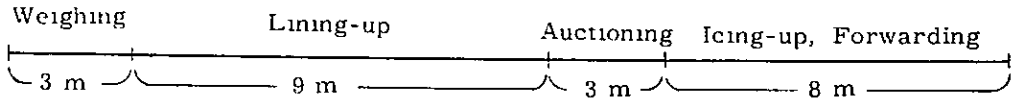
5-3-4-7 Welfare equipments for seaman (site alone proposed)

Equipments for the lodging of seamen of tuna fishing ships while they are in port and for the rest room of fishermen in general are planned.

A private room of about $30m^2$ for each fisherman of tuna ships is prepared. Due to the limit set by the size of the reclaimed land only such portion of land as wide as about $1,500m^2$ can be alloted for the equipments. However, the space will do, if the first floor is used as the rest room and the upstairs for lodging purpose. If the house is one-storied, at least $2,500m^2$ is necessary.

5-3-4-8 Auction market of catch (disposal office)

In case of auctioning the catch through a disposal office in future the floor width of the disposal place is 25m and utilized as follows:



Area required

Sharks are lined up one by one. Size of one shark is assumed to be 20 cm wide and 1.5m long.

Disposing capacity per unit length:

Length wise $1.00 \times 0.9 \div 0.20 = 4.5$

Crosswise $9.00 \times 0.7 = 1.50 = 4.2$

therefore $4.5 \times 4.2 = 18.9 \fallingdotseq 19$ (number of shark)

Landing quantity per day is 20t, and if assumed that the whole quanity consists of sharks only and one shark weight 20 kg, 1,000 sharks are supposed to be landed daily.

$1,000 \div 19 = 50m$ .... extension required

Area required: $25 \times 50 = 1,250m^2$

Area planned:

$25 \times 60 = 1,500m^2$

5-3-4-9 Management equipments and parking area for car

An area of $1,500m^2$ is secured for the management equipments of the port and the parking space for vehicles for the transportation of catch or materials for fishing

operation. The building is preferably more than two-storied and the first floor is kept for parking space.

5-3-4-10 Fuel oil tank

Capacity: 270 t

Basis of calculation:

Mechanized ship of small size	50 ÷ 7.5 KL	
Tuna fishing ship	2 x 40 =	80 KL
Trawler	1 x 40 =	40 KL
Total		127.5 KL

The capacity of the tank is made double the above figures.

Size of tank: 7m (diameter) x 7m (height)

5-3-4-11 Machine oil storehouse

A storehouse to contain 50 t of mobile oil is built.

Note: The fuel oil tank and machine oil storehouse are built in front of the Western jetty on the reclaimed ground built separately from the main reclamation works.

5-3-4-12 Fresh water tank

Quantity of water supply: 170t

Size: 6m (diameter) x 6m (height)

Basis of calculation:

Tuna fishing ships	for 2 ships 40t
Trawler	for one trawler 20t
Mechanized ship of small size	for 50 ships 0.3 x 50 = 15t
Total	75t

2 days' supply is 150t to which a suplus of 20t is added

Note: The fresh water tank is located on the roof of the refrigeration, cold storage, and ice-making plant, from where through a feed-pipe line is led the water to the jetty to be fed through feed-pipe cocks.

5-3-4-13 Outdoor depository

Outdoor depositiory (site alone) of 1875m^2 (75m x 25m) is prepared at the rear

of the mooring quay as a depository for fish boxes, temporary depository for the catch at crowded hours and for ship supplies before sailing.

5-3-5 Summary of various facilities

Each of the above-mentioned equipments is tabulated as Table 9.

5-3-6 Conditions of constructing facilities of fishing port of Galle

1. Sufficient pressure strength of the ground.
2. Good and abundant fresh water.
3. Sufficient electric power (especially power-lines).
4. In Galle both temperature and humidity are said to be high and the air to contain much salt. It is a matter for concern that the electrical system will fall in a poor condition by forming green rust. Measures must be taken against such trouble.
5. The land facilities are so managed that the yearly operation rate of each plant may be maintained high through the constant and sufficient supply of fish.

Table 9 Kinds of land facilities to be constructed in Galle and their approximate costs of construction

Classification	Quantity	Length x Breadth x Height m	Floor space m^2	Approximat cost Rs (¥)	Remarks
1. Refrigeration, cold storage and ice-making plant	1	70x50x5	3500	400 (3)	Part of the building is two-storied, upstairs is for the use of office. Part of ground floor is warehouse of fishing implements of tuna ship, and trawler. Fresh water tank is on the roof.
2 Fish meal and shark liver oil plant	1	35x17.5x4	612 5	100 (0 75)	Including boiler room
3 Solardrying space of shark fin	1	60 x 25	1500	-	Space of land only
4. Repairing plant of fishing ship and implements	1	50x40x4	2000	100 (0.75)	Machine and fishing implements only for tuna ship and trawler All of hull, machine, and fishing implements for mechanized boat
5. Warehouse of implements of mechanized boat	1	-	Site space (1,000)	-	Warehouse of fishing implements of tuna ship and trawler is built in the ground floor of refrigeration, cold storage and ice-making plant
6. Repairing space of line and net	1	40 x 25	1000	-	Space of land only
7. Lodging and canteen for seamen	1	-	Site space 1500	35 (0.25)	Two-storied, first floor is for canteen, upstairs for lodging
8 Auction market	1	60x25x4	1500	27 (0.2)	-
9 Parking space and port administration equipment	1	-	1750	27 (0.2)	Two-storied, first floor is garage, upstairs, for management and administration equipment of port
10. Fuel oil tank	1	7(D)x7(L)	-		Heavy oil A 270t
11. Machine oil storehouse	1	10x10x4	100	14 (0.1)	Mobile oil 50t
12. Fresh Water tank	1	6(D)x6(L)	-		On the roof of refrigeration, cold storage and ice-making plant Fresh water 170 t.
13. Outdoor depository	1	75 x 25	1875		Space of land only
14. Refrigerator lorry	4	(5t x 4)	-	35 (0 25)	Garage is in refrigeration, cold storage and ice-making plant
15. Lorry	4	(5t x 4)	-		One is equipped with ice-crusher and one, ice-making machine

Note: Rs in this Tabel 9 represents Rs 10,000 and parenthesized ¥ stands for ¥ 100,000,000.

Total 7,380,000 Rs (550,000,000 ¥)

Table 10 Approximate construction cost of equipments in Galle for mechanized ship of small size

Classification of works	Quantity	Unit price ¥ 1,000	Amount ¥ 1,000	Amount Rs	Remarks
Inner Breakwater	280 m	500	140,000	1,866.700	
Eastern Jetty	70 m	250	17.500	233,300	
Western Jetty	70 m	250	17,500	233,300	
Landing space of -2.0 M	220 m	250	55,000	733,300	
Slipway	50 m	150	7,500	100,000	
Dredging of -2.0 M	18,500 m^3	0.3	5,550	73,300	
Reclamation	21,500 m^3	0.5	10,750	143,300	*
Road	W=20m L=858m W=15m L=110m W=10m L=175m	3	61,680	822,400	**
Total			315,480 316,000	4,205,000	

* Such quantity of earth only as dredged from the basin; this is utilized in reclamation works

** Subtracting the quantity of utilized earth after dredging from the quantity employed in the reclamation works at the back of the landing space

6. Income, expenses, and business balance of land facilities in Galle

6 - 1 Refrigeration, cold storage, and ice-making plant

The management of this plant is divided into two forms; direct management and management on commission basis. Here, the latter form is taken up, and by calculating its income and expenses, its business balance is examined.

6 - 1 - 1 Income

6-1-1-1 Cooling apparatus

Assuming the cooling charge including the treatment charge to be 100 Rs/t and the cooling capacity of 10 t/d to operate yearly 120 days, yearly income is:

100 x 10 x 120 = 120,000 Rs/y

6-1-1-2 Cooled storage chamber

Assuming the cooled storage charge including the handling charge to be monthly 50 Rs/t and the cold storage capacity 200 t to operate yearly 12 months and 30% of the total dimensions of the chamber to be utilized, yearly income is:

50 x 200 x 12 x 0.3 = 36,000 Rs/y

6-1-1-3 Freezing apparatus

Assuming the freezing charge including the treatment charge to be 200 Rs/t and the freezing capacity of 20 t/d to operate yearly 120 days, yearly income is:

200 x 20 x 120 = 480,000 Rs/y

6-1-1-4 Frozen storage chamber

Assuming the frozen storage charge including the handling charge to be monthly 100 Rs/t and the capacity of 700 t of frozen storage to operate yearly 12 months and 30% of the total dimensions to be utilized, yearly income is:

100 x 700 x 12 x 0.3 = 252,000 Rs/y

6-1-1-5 Ice-making apparatus

Assuming the price of ice to be 50 Rs/t and the ice-making capacity of 20 t/d to operate yearly 300 days, yearly income is:

50 x 20 x 300 = 300,000 Rs/y

6-1-1-6 Ice stocking chamber

No income

Note 1. Comparison of above figures with those of similar facilities of Mutwal (Rs/t)

	Galle	Mutwal
Cooling charge including treatment charge	100	100
Cooled storage charge including handling charge	50	80
Freezing charge including treatment charge	200	240
Frozen storage charge including handling charge	100	100

Incidentally, according to the German plan this plant is run by direct management.

2. The current price of ice in Colombo is 80 - 90 Rs/t. It is estimated at 50 Rs/t in this report.

6 - 1 - 2 Expenses

6-1-2-1 Rate of electric power

There are two kinds of electric power; power of power-line and that of light-wire. The electric power for the fishing port of Galle is 132, 000 v at the power station and 11, 000 v at the substation, which is stepped down by transformer in the case of power-line to 416 - 460 v, three-phase alternating current of 50 cycles, and in the case of light-wire to 220 - 230 v, single-phase current of 50 cycles. Generally speaking, the greater part of the power rate of plants is due to the power-line, while the rate due to light-wire occupies only a small percentage of the rate. Here, we treat only of the rate of power-line. First of all, we must calculate the yearly consumption of each apparatus and chamber.

Refrigeration capacity to the cooling capacity 1 t/d of the cooling apparatus is a approximately 1 refrigeration ton, which requires about 2 HP or 1. 5 KW, that is, 36. 0 KWh for 24 hours.

Assuming that this apparatus with the cooling capacity of 10 t/d operates yearly 120 days, the yearly consumption of electric power by the cooling apparatus is:

36. 0 x 10 x 120 = 43, 2 00 KWh/y

Refrigeration capacity to the cooled storage capacity of the cooled storage chamber is approximately 0.05 refrigeration ton, which requires about 0.1 HP or 0.075 KW, that is, 1.8 KWh for 24 hours.

Assuming that this apparatus with the cold storage capacity of 200 t operates yearly 365 days, the yearly consumption of electric power by this apparatus is:

1.8 x 200 x 365 = 131,400 KW/y

Refrigeration capacity to the freezing capacity 1 t/d of the apparatus is approximately 4 refrigeration tons which require about 8 HP or 6 KW, that is, 144.0 KWh for 24 hours.

Assuming that this apparatus with the freezing capacity of 20 t/d operates yearly 120 days, the yearly consumption of electric power by this apparatus is:

144.0 x 20 x 120 = 345,600 KWh/y

Refrigeration capacity to the frozen storage capacity of 1 t is approximately 0.1 refrigeration ton which requires about 0.2 HP or 0.15 KW, that is, 3.6 KWh for 24 hours.

Assuming that this chamber with the storage capacity of 700 t operates yearly 365 days, the yearly consumption of electric power by the frozen storage chamber is:

3.6 x 700 x 365 = 919,800 KWh/y

Refrigeration capacity to the ice-making capacity of 1 ton is approximately 2 refrigeration tons which require about 4 HP or 3 KW, that is, 72 KWh for 24 hours.

Assuming that this apparatus with the ice-making capacity of 20 t/d operates yearly 300 days, the yearly consumption of electric power by this apparatus is:

72.0 x 200 x 300 = 432,000 KWh/y

Refrigeration capacity to the capacity of 1 ton of the ice stocking chamber is approximately 0.02 refrigeration ton which requires about 0.04 HP or 0.03 KW, that is, 0.72 KWh for 24 hours.

Assuming that this apparatus with the ice-making capacity of 300 t operates yearly 365 days, the yearly consumption of electric power by this chamber is:

0.72 x 300 x 365 = 78,840 KWh/y

Supposing any articles are deposited in the low-temperature treatment chamber and

corridor, refrigeration capacity to the depositing capacity of 1 ton is approximately 0.025 refrigeration ton which requires about 0.05 HP or 0.0375 KW, that is, 0.9 KWh for 24 hours.

Assuming that this chamber with the depositing capacity of 556 t operates yearly 365 days, the yearly consumption of electric power by the low-temperature treatment chamber and corridor is:

0.9 x 556 x 365 = 182,646 KWh/y

Summing up the above figures, yearly consumption of electric power is:

43,200 + 131,400 + 345,600 + 919,800 + 432,000 + 78,840 + 182,646 = 2,133,486

= 2,133,500 KWh/y

If the power rate is estimated at Rs 0.1 per KWh, yearly power rate is:

0.1 x 2,133,500 = 213,350 Rs/y

6-1-2-2 Water rate

Fresh water is divided into two kinds; drinking water and industrial water. The temperature of water in Galle is as high as that of atmosphere, that is, 28 -32°C. The principal use of water is for the cooling of refrigerator, the material of ice making, and treatment of fish. The quantity of water required is approximately 2 t/h or 48 t/d, half of which is drinking water and the rest industrial.

Assuming that water is used yearly 300 days, the yearly consumption is:

Industrial water 24 x 300 = 7,200 t/y

Drinking water 24 x 300 = 7,200 t/y

Assuming the water rate to be at 2.25 Rs/t for industrial water and 5.55 Rs/t for drinking water, the yearly rate is:

Industrial water 2.25 x 7,200 = 16,200 Rs/y

Drinking water 5.55 x 7,200 = 39,960 Rs/y

Summing up the above figures, the total yearly rate is:

16,200 + 39,960 = 56,160 Rs/y

6-1-2-3 Personnel expenses

The personnel necessary for the operation of this plant is as follows:

plant director ... 1; chief engineer ... 1; chief electrical engineer ... 1; mechanician ... 6 (in 3 shifts by two), electrical engineer ..... 1; refrigeration and cold storage operator ... 8; ice-making operator ... 6 (in three shifts by two); office clerk ... 4.

Monthly payment to each is tabulated in Table 11.

Table 11 Monthly payment list of plant personnel

Classification	Month payment Rs	Number	Total payment Rs
Director	1,000	1	1,000
Chief Engineer	800	1	800
Chief Electrical Engineer	800	1	800
Mechanician	450	6	2,700
Electrical Engineer	450	1	450
Refrigeration & Cold Storage Operator	300	8	2,400
Ice-making Operator	400	6	2,400
Office Clerk	400	4	1,600
Total		28	12,150 Rs/m

As shown above, the total payment for 12 months is

12,150 x 12 = 145,800 Rs/y

Assuming the bonus is equivalent to the sum of two months' payment, it is:

12,150 x 2 = 24,300 Rs/y

The above two items are summed up and the yearly personnel expenses amount to 145,800 + 24,300 = 170,100 Rs/y

6-1-2-4 Expenses for repair and expendables

Expenses for repairing damaged equipments are estimated yearly at Rs 20,000 and

those for such expendables as ammonia, refrigeration oil, waste, calcium chloride, packaging material, and other miscellaneous articles are at Rs 60, 000. By summing up the above two items we get the yearly expenses for repair and expendables as follows:

20, 000 + 60 000 = 80, 000 Rs/y

6-1-2-5 Insurance premium

As shown in Table 9 the construction cost of the refrigeration, cold storage, and ice-making plant is Rs 4, 000, 000. As two kinds of insurance, fire and accident, must be effected in this case, the fire insurance premium is estimated at yearly 1/1000 of the cost of construction, and that of accident at its 1.3/1000.

Fire insurance premium $4,000,000 \times \frac{1}{1000} = 4,000$ Rs/y

Accident insurance premium $4,000,000 \times \frac{1.3}{1000} = 5,200$ Rs/y

By summing up these items we get the yearly insurance premium.

4, 000 + 5, 200 = 9, 200 Rs/y

6-1-2-6 Depreciation and interest

The construction cost of the above-mentioned plant is roughly divided into two items, Rs 2, 000, 000 for the building and Rs 2, 000, 000 for the machinery and equipments. Depreciation of the cost must be effected separately for each item; the depreciation rate of the building cost is 3/100 (33 years' depreciation) and that of the machinery and equipments 6/100 (17 years' depreciation). Therefore

Depreciation of building $2,000,000 \times \frac{3}{100} = 60,000$ Rs/y

Depreciation of machinery $2,000,000 \times \frac{6}{100} = 120,000$ Rs/y

These two items are summed up to get the yearly total of depreciation.

60, 000 + 120, 000 = 180, 000 Rs/y

The annual rate of interest for the construction cost is estimated at 6/100 and its amount is.

$4,000,000 \times \frac{6}{100} = 240,000$ Rs/y

Thus the yearly depreciation and interest amount to

180,000 + 240,000 = 420,000 Rs/y

6 - 1 - 3 Examination of business balance

Collecting the above-mentioned amounts of income and expenses and examining their balance we get the following Table 12.

Table 12 Business balance of refrigeration, cold storage, and ice-making plant in Galle

Classification	Item	Amount Rs/y
Income	1. Cooling apparatus	120,000
	2. Cooled storage chamber	36,000
	3. Freezing apparatus	480,000
	4. Frozen storage chamber	252,200
	5. Ice-making apparatus	300,000
	Total	1,188,000 (¥ 1.)
Expenses	1. Electric power rate	213,350
	2. Water rate	56,160
	3. Personnel expenses	170,100
	4. Repair and expendables	80,000
	5. Insurance premium	9,200
	6. Depreciation and interest	420,000
	Total	984,810 (¥ 2.)
Balance		239,190 (¥ 3.)
Repayment		200,000 (¥ 4.)
Profit		39,100 (¥ 5.)

note: (¥ 1) = ¥ 89,100,000/y (¥ 2) = ¥71,160,000/y

(¥ 3) = ¥17,940,000/y (¥ 4) = ¥15,000,000/y (¥ 5) = ¥2,940,000/y

As stated above, the construction cost of this plant is Rs 4,000,000. Even when this sum of fund is raised on loan at an annual interest rate of 6% and repayed out of the profit accruing from the refrigeration, cold storage, and ice-making plant in the amount of Rs 200,000, and, likewise, out of the profit from the solardrying plant of shark fin, which will be explained later, in the amount of Rs 200,000, that means, if the total repayment yearly Rs 400,000 is effected for a period of ten years, yet yearly profit of Rs 39,190 is obtained. This amount of profit corresponds to 3.3% of the gross proceeds, which are yearly Rs 1,188,000, as shown in Table 12.

That is: Rs 39,190– Rs 1,188,000 x 100 = 3.3%

Incidentally, the German plan leaves such repayment and profit out of consideration.

6 - 2 Fish meal and shark liver oil plant

The fish meal and shark liver oil plant is, as a matter of fact managed directly by the proprietor. Its yearly income and expenses are estimated and their balance examined.

6 - 2 - 1 Income

As stated above the average output per day of the fish meal plant is as follows:

Fish meal	1.4 t/d
Fish oil	0.35 t/d
Fish soluble	0.35 t/d

Assuming that their respective prices are 700 Rs/t for fish meal, 600 Rs/t for fish oil, and 400 Rs/t for fish soluble and that this plant operates yearly 300 days, the proceeds are:

Fish meal 700 x 1.4 x 300 = 294,000 Rs/y

Fish oil 600 x 0.35 x 300 = 63,000 Rs/y

Fish soluble 400 x 0.35 x 300 = 42,000 Rs/y

By summing up these items we get the yearly income from the fish meal plant.

294,000 + 63,000 + 42,000 = 399,000 Rs/y

As stated above the average output per day of the shark liver oil plant is 0.8 t/d of shark liver oil.

Assuming that the shark liver oil price is 1,200 Rs/t and this plant operates yearly 300 days, the yearly income of the shark liver oil plant is.

1,500 x 0.8 x 300 = 288,000 Rs/y

6 - 2 - 2 Expenses

6-2-2-1 Electric power rate

As in the case of the refrigeration, cold storage, and ice-making plant, the power-line of 416-440 v three-phase alternating current of 50 cycles is employed here and the power rate here is that of power-line only.

The total motor of this plant requires about 36 HP or 27 KW, that is, 648 KWh for 24 hours. This plant is assumed to operate yearly 300 days and its yearly consumption of electric power is

$$648 \times 300 = 194,400 \text{ KWh/y}$$

The total motor of the shark liver oil plant requires about 12 HP or 9 KW, that is, 216 KWh for 24 hours. This plant is assumed to operate yearly 300 days and its yearly consumption of electric power is

$$216 \times 300 = 64,800 \text{ KWh}$$

The above two items are summed up and we get the yearly consumption of electric power.

$$194,400 + 64,800 = 259,200 \text{ KWh/y}$$

Here the power rate is estimated at Rs 0.1 per 1 KWh and the yearly power rate is

$$0.1 \times 259,200 = 25,920 \text{ Rs/y}$$

6-2-2-2 Fuel cost

Fuel cost means the cost of the boiler fuel to generate steam for heating. The steam consumption of the fish meal plant is about 0.53 t/h and that of the shark liver oil plant, about 0.07 t/h; total of both 0.6 t/h. This is the reason why a boiler with evaporation of 1 t/h is equipped as shown in Figure 4. In case this boiler is of horizontal tubular type with a heavy oil burner, the consumption of fuel oil is 0.07 t/h which means 1.68 t/d. Assuming that this plant operates yearly 300 days, the yearly consumption of fuel is

$$1.68 \times 300 = 504 \text{ t/y}$$

Here the cost of heavy oil is estimated at 100 Rs/t and the yearly fuel cost is

$$100 \times 504 = 50,400 \text{ Rs/y}$$

6-2-2-3 Water rate

As in the case of the refrigeration, cold storage, and ice-making plant, fresh water, which means drinking water, is employed in this plant. Its principal use is for the boiler and about 2 t/h or 48 t/d are consumed.

This plant is assumed to operate yearly 300 days and the yearly consumption of water (drinking water) is

48 x 300 = 14, 400 t/y

Here the water rate is estimated at 5. 55 Rs/t and the yearly water (drinking water) rate is 5. 55 x 14, 400 = 79, 920 Rs/y

6-2-2-4 Personnel expenses

The personnel of this plant consists of as follows:

Plant chief 1,

Chief engineer 1,

Mechanician 4 (in two shifts by two),

Material handler 2 (in two shifts by one),

Product handler 2 (in two shifts by one);

Boiler man 2 (in two shifts by one)

Office clerk 2

Monthly payment for each of them is tabulated as Table 13.

Total yearly payment is

6, 900 x 12 = 82, 800 Rs/y

Bonus in the sum equivalent to the amount of two months' payment is

6, 900 x 2 = 13, 800 Rs/y

Table 13 Monthly payment of personnel of fish meal and shark liver oil plant

Classification	Payment Rs/m	Number	Total Payment Rs/m
Plant Chief	1, 000	1	1, 000
Chief Engineer	800	1	800
Mechanician	450	4	1, 800
Material Handler	400	2	800
Product Handler	400	2	800
Boiler man	450	2	900
Office clerk	400	2	800
Total		14	6, 900 Rs/m

These two items are summed up to make the yearly personnel expenses

82, 800 + 13, 800 = 96, 600 Rs/y

6-2-2-5 Expenses for repair and expendables

Expenses for reparing damaged equipments are estimated at yearly Rs 20, 000 and those for such expendables as machine oil, waste, packing material, and other miscellaneous

articles at Rs 10,000. These two items are summed up to make the yearly expenses for repair and expendables.

$$20,000 + 10,000 = 30,000 \text{ Rs/y}$$

6-2-2-6 Insurance premium

As shown in Table 9, the construction cost of the fish meal and shark liver oil plant amounts to Rs 1,000,000. Both fire and accident insurance must be effected, and yearly premium for fire insurance is 1/1,000 of the construction cost and that for accident insurance its 1.3/1000. Then

$$\text{Fire insurance premium } 1,000,000 \times \frac{1}{1000} = 1,000 \text{ Rs/y}$$

$$\text{Accident insurance premium } 1,000,000 \times \frac{1.3}{1000} = 1,300 \text{ Rs/y}$$

These two items are summed up to make the yearly insurance premium of

$$1,000 + 1,300 = 2,300 \text{ Rs/y}$$

6-2-2-7 Depreciation and interest

The construction cost of fish meal and shark liver oil plant consists roughly of Rs 500,000 for the building and Rs 500,000 for the machinery. Depreciation of the cost is considered in two ways, depreciation of the building is yearly 3/100 (33 years' depreciation) of the cost and that of the machinery 3/100 (17 years' depreciation). Then

$$\text{Depreciation of building } 500,000 \times \frac{3}{100} = 15,000 \text{ Rs/y}$$

$$\text{Depreciation of machinery } 500,000 \times \frac{6}{100} = 30,000 \text{ Rs/y}$$

These two items are summed up to amount to the yearly depreciation of

$$15,000 + 30,000 = 45,000 \text{ Rs/y}$$

The annual rate of interest is estimated at 6% of the construction cost. Then

$$\text{Interest } 1,000,000 \times \frac{6}{100} = 60,000 \text{ Rs/y}$$

The sum of depreciation and that of interest are summed up to make a total of

$$45,000 + 60,000 = 105,000 \text{ Rs/y}$$

6-2-2-8 Cost of material

While the refrigeration, cold storage, and ice-making plant is managed on a commission basis, the fish meal and shark liver oil plant is directly managed by the

proprietor. That is the reason why the purchase of material is necessary in this plant. The material of the fish meal plant is the total of the waste, which amounts to 7 t/d, of the trawlers and tuna fishing ships. Assuming that the material price is 50 Rs/t and this plant operates yearly 300 days, the yearly cost of material is

$$50 \times 7 \times 300 = 105,000 \text{ Rs/y}$$

The shark liver oil plant depends on the livers of 2 t/d supplied by the tuna fishing ships and mechanized ships. Assuming that the material price is 100 Rs/t and this plant operates yearly 300 days, the yearly cost of material is

$$100 \times 2 \times 300 = 60,000 \text{ Rs/y}$$

These two items are summed up to make the yearly total of the cost of material

$$105,000 + 60,000 = 165,000 \text{ Rs/y}$$

6 - 2 - 3 Examination of business balance

The above-mentioned yearly income and expenses are collected and their balance is examined in Table 14.

Table 14 Business balance of fish meal and shark liver oil plant in Galle

Classification	Item	Amount Rs/y
Income	1 Fish meal plant	399,000
	2 Shark liver oil plant	288,000
	Total	687 000 (¥ 1)
Expenses	1 Electric rate	25,920
	2 Fuel oil cost	50 400
	3 Water rate	79,920
	4 Personnel expenses	96 600
	5 Repair & expendables	30,000
	6 Insurance premium	2,300
	7 Depreciation & interest	105,000
	8 Material cost	165,000
	Total	555,140 (¥ 2)
Balance		131,860 (¥ 3)
Repayment		100,000 (¥ 4)
Profit		31,860 (¥ 5)

As stated above the construction cost of the shark liver oil plant amounts to Rs 1,000,000. Assuming that a loan of this sum is made at 6 per cent interest per annum and its refund is made by ten years' instalments, that is yearly Rs 100,000, yearly profit of Rs 31,860 can still be expected. While the total proceeds are yearly Rs 687,000, as shown in Table 14, the amount of this profit corresponds to 4.6% of the proceeds:

$$\frac{31,860}{687,000} \times 100 = 4.6\%$$

According to the German plan, however, no shark liver oil plant is suggested, and neither the refund nor the profit of such plant is taken into consideration.

6 - 3 Solardrying equipment for shark fin

This equipment is of course directly managed by the proprietor. Here the yearly income and expenses are treated and the business balance is examined.

6 - 3 - 1 Income

As stated above the average output of dried shark fins are 0.42 t/d. Assuming that the price of the product is 6,000 Rs/t and that this equipment operates yearly 300 days, the yearly income is

6,000 x 0.42 x 300 = 756,000 Rs/y

6 - 3 - 2 Expenses

6-3-2-1 Personnel expenses

Only four persons are enough to manage this equipment. If monthly payment per head is 300 Rs/m, the monthly total is 1,200 Rs/m, and the yearly total is

1,200 x 12 = 14,400 Rs/y

Bonus equivalent to two months' payment is yearly paid.

1,200 x 2 = 2,400 Rs/y

These two items are summed up to be the yearly personnel expenses

14,400 + 2,400 = 16,800 Rs/y

6-3-2-2 Expendables

Cost of such expendables as packing material is yearly 2,000 Rs/y

6-3-2-3 Cost of material

As this equipment is directly managed by the proprietor, the material must be purchased. The material consists of the fins amounting to 1.4 t/d in total which is supplied by tuna fishing ships and mechanized ships. Assuming that the material price is 1,000 Rs/t and this equipment operates yearly 300 days, the yearly material cost is

1,000 x 1.4 x 300 = 420,000 Rs/y

6 - 3 - 3 Examination of business balance

The above-said yearly income and expenses are collected and their balance is examined in Table 15.

Table 15 Business balance of solardrying equipment of shark fin in Galle

Classification	Item	Amount Rs
Income	Solardrying of shark fin	756, 000 (¥ 1)
Expenses	1. Personnel 2. Expendables 3. Material	16, 800 2, 000 420, 000
	Total	438, 800 (¥ 2)
Balance		317, 200 (¥ 3)
Repayment (for Refrigeration, Cold storage, and ice-making plant)		200, 000 (¥ 4)
Profit		117, 200 (¥ 5)

Note: (¥ 1) = ¥56, 700, 000/y (¥ 2) = ¥32, 710, 000/y
(¥ 3) = ¥23, 790, 000/y (¥ 4) = ¥15, 000, 000/y
(¥ 5) = ¥8, 790, 000/y

As hown in Table 15, the yearly profit of this plant amounts to Rs 317, 200. Even when we suppose that Rs 200, 000 of this profit is appropriated for the repayment fund of the refrigeration, cold storage, and ice-making plant, there is still a sum of Rs 117, 200 of profit. As it is made clear by Table 15, the yearly profit corresponds to 15. 5% of the proceeds which amount to Rs 756, 000.

$$\frac{117,200}{756,000} \times 100 = 15.5\%$$

6 - 4 Reparing plant of fishing ships and implements

There is no need of gaining profit out of this plant, but it may necessary to decide the cost of repair work to ensure the income corresponding to its expenses. Principal items of expenses are as follows:

a. Electric power rate

b. Water rate

c. Personnel expenses

As shown in Table 16 the personnel of this plant consists of the following persons.

Plant director ... 1; Mechanician ... 8; Electrical engineer 1;

Office clork ... 1

Table 16 Payment to personnel of repairing plant

Classification	Monthly payment Rs	Number	Total payment Rs
Director	800	1	800
Mechanician	450	8	3,600
Engineer	450	1	450
Mechanician			
Clerk	400	1	400
Total		11	5,250 Rs/m

Total amount of yearly payment is

5,250 x 12 = 63,000 Rs/y

Bonus equivalent to two months' payment is

5,250 x 2 = 10,500 Rs/y

These two items are summed up to be the yearly payment.

63,000 + 10,500 = 73,500 Rs/y

d. Expenses for repairing and expendables

e. Insurance premium

As shown in Table 9 the construction cost of the repairing plant of fishing ships and fishing implements is Rs 1,000,000. Both fire and accident insurance must be effected and the yearly premium for the fire insurance is 1/1000 of the construction cost and that for the accident insurance its 1.3/1000. Therefore

Fire insurance premium $1,000,000 \times \frac{1}{1,000} = 1,000$ Rs/y

Accident insurance premium $1,000,000 \times \frac{1.3}{1,000} = 1,300$ Rs/y

These two items are summed up to make the yearly insurance premium.

1,000 + 1,300 = 2,300 Rs/y

f. Depreciation and interest

The construction cost of this plant is roughly divided into two parts; Rs 500,000 for

the building and Rs 500, 000 for the instruments, machines, and equipments. Depreciation must be effected for each part of the cost. Assuming the yearly depreciation of the building to be 3/100 (33 years' depreciation) and that for the instruments, machines, and equipments to be 6/100 (17 years' depreciation), each amount is:

Depreciation of the building $500,000 \times \frac{3}{100} = 15,000$ Rs/y

Depreciation of the machines, instruments, and equipments

$$500,000 \times \frac{6}{100} = 30,000 \text{ Rs/y}$$

These items are summed up to make the yearly amount of depreciation

$15,000 + 30,000 = 45,000$ Rs/y

The annual interest rate is assumed to be 6% of the construction cost and the amount of yearly interest is

$$1,000,000 \times \frac{6}{100} = 60,000 \text{ Rs/y}$$

Thus the total amount of yearly depreciation and interest is made by summing up the above two items

$45,000 + 60,000 = 105,000$ Rs/y

g. Cost of parts

h. Others

As stated above, the construction cost of this plant is Rs 1, 000, 000. If this amount of fund is raised on loan and repayed by ten instalments of yearly Rs 100, 000, the yearly repayment sum is Rs 100, 000.

7. Colligation of views of investigation team

The principal items which were requested of the team were a planning of the land facilities of the fishing port of Galle, and the Ceylonese Government has an already decided program as to the development of the port.

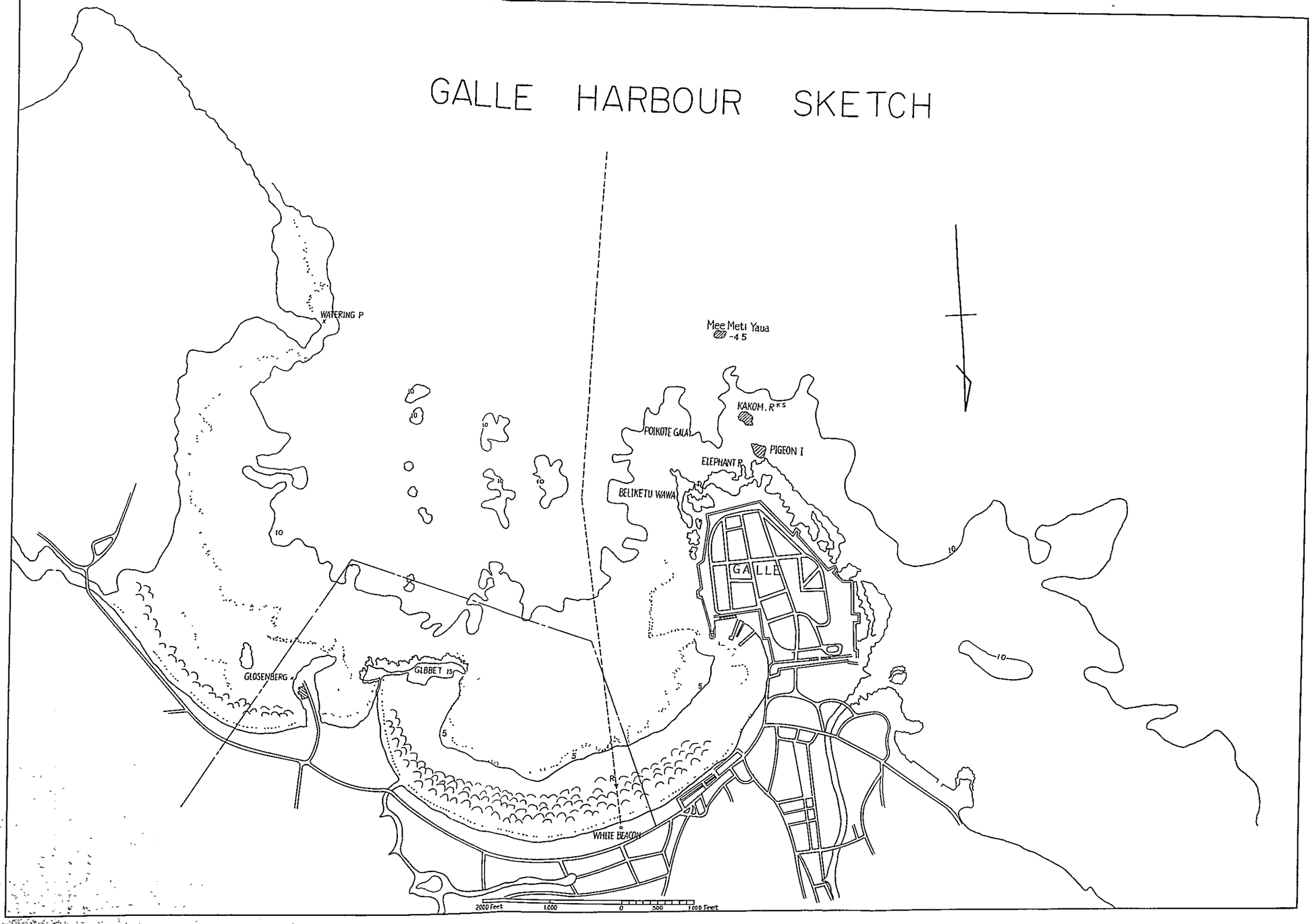
That is to say, it is on the point of constructing a jetty, as its initial program for the catch landing of 10 tuna fishing ships of 100 - ton class and of three trawlers.

The team has found it needless to make any far-reaching amendment of the program, but, accepting it as a presupposition and in addition to it, has planned to accommodate in the port 50 mechanized boats for offshore fishing together with planning the land facilities corresponding to these ships. However, the team can not help hesitating about the immediate and all-out execution of the plan.

Especially, regarding the tuna fishing ships it is difficult to attain the expected result in case they are operated by Ceylonese complement alone; it may be necessary to invite fishing technicians and seamen from Japan or other countries. But even in Japan it is becoming extremely difficult to secure the complement to man tuna fishing ships. Furthermore, steady running of fishing enterprises require careful investigation and preparation beforehand concerning the procurement of fishing ships, implements and baits.

Such being the case it may be taking chances for the Ceylonese Government to try to introduce at a time all of the ten tuna fishing ships. It would be advisable to attain its object by limiting the number of those ships to one or two in the beginning and increase it one by one according to the actual result of operating ships. Considering that the import of such fishing ships will be executed one by one over a certain period of time, each portion of the facilities has been so planned as to be added to in succession by making the portion independent of the other.

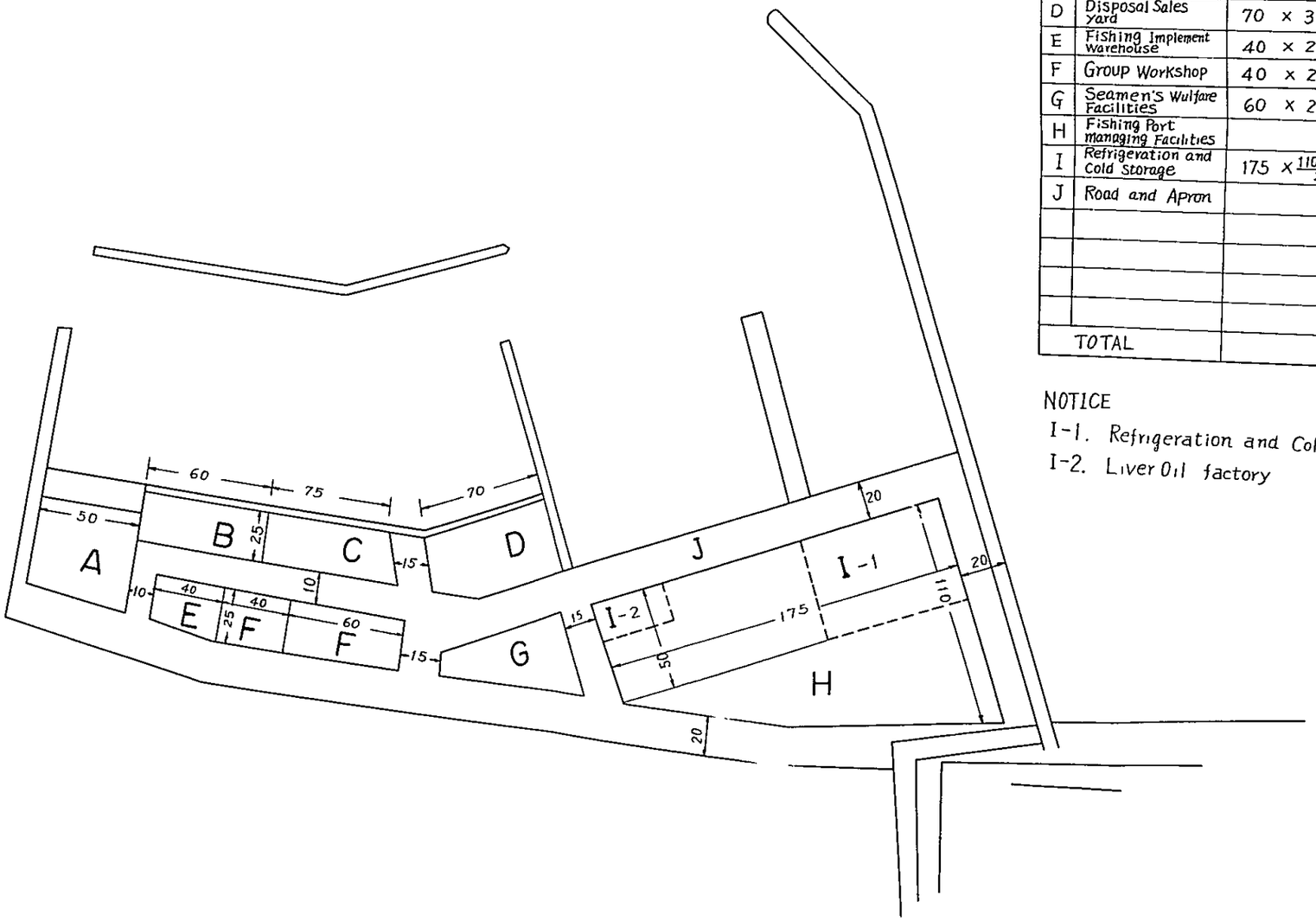
GALLE HARBOUR SKETCH



DRAWING FOR RECLAIMED LAND UTILIZATION PLANNING

UNIT : METER

LAND REQUIRED		AREA	
A	Fishing Boat Repairing yard	$50^m \times 40^m$	$2,000^{m^2}$
B	Sun-Dry Yard	60 × 25	1,500
C	Open Yard	75 × 25	1,875
D	Disposal Sales Yard	70 × 30	2,100
E	Fishing Implement Warehouse	40 × 25	1,000
F	Group Workshop	40 × 25	1000
G	Seamen's Welfare Facilities	60 × 25	1,500
H	Fishing Port Managing Facilities		1,750
I	Refrigeration and Cold Storage	$175 \times \frac{110+50}{2}$	14,000
J	Road and Apron		21,775
TOTAL			48,500



NOTICE

I-1. Refrigeration and Cold factory

I-2. Liver Oil factory

GALLE HARBOUR DEVELOPMENT INCLUDING FISHERY HARBOUR PROPOSAL

SCALE 1 : 6000
UNIT METER