BASIC DESIGN STUDY REPORT ON FISHERIES PROMOTION PROJECT IN THE PEOPLE'S REPUBLIC OF MOZAMBIQUE

FEBRUARY 1983

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to the request of the Government of the People's Republic of Mozambique, the Government of Japan decided to conduct basic design study on Fisheries Promotion Project and entrusted the study to the Japan International Cooperation Agency. The J.I.C.A. sent to Mozambique a survey team headed by Mr. Kazuo Takayama, Fishing Boat Division, Oceanic Fisheries Department, Fisheries Agency from October 18 to November 10, 1982.

The team had discussions with the officials concerned of the Government of Mozambique and conducted a field survey in Maputo and Zambezia. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the People's Republic of Mozambique for their close cooperation extended to the team.

February, 1983

Keisuke Arita

Keisuke Arita
President
Japan International Cooperation Agency

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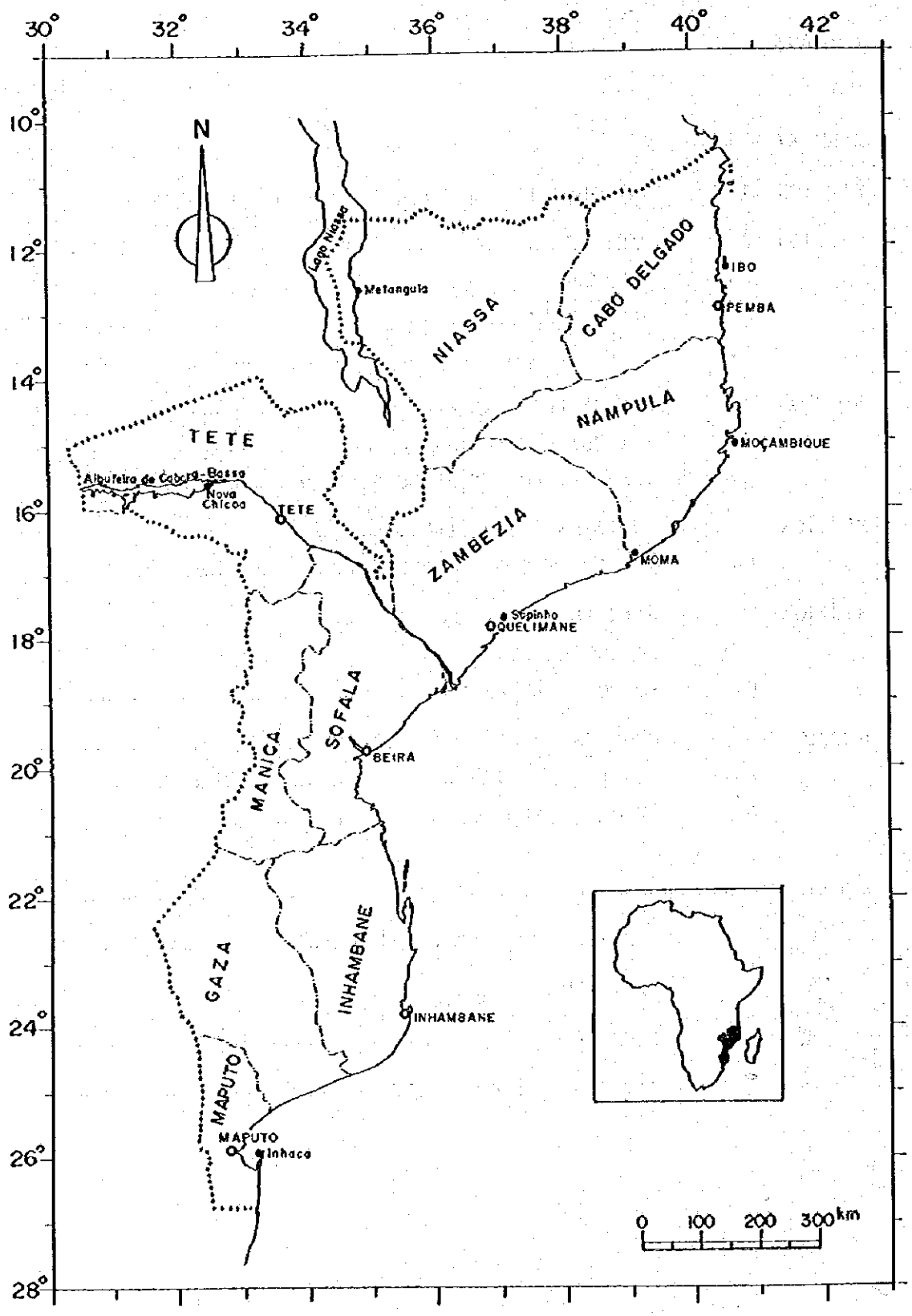
MAP OF MOZAMBIQUE



SUMMARY

The Peoples' Republic of Mozambique became independent in June, 1975 after some 400 years of Portuguese rule. The country's economy during the colonial era had been characterized by uneven industrial development and a heavy dependence on foreign countries, a situation which continued to prevail even after independence.

At the time of independence, there was a major exodus of Portuguese technicians and managers, leading to a decline in industrial output. In addition, as a result of the economic sanctions against Rhodesia from 1976 to 1979, foreign exchange earnings from transport and port services, which had been a major prop of the Mozambique economy, declined precipitously. On top of this, the country was beset by a series of natural disasters, such as floods and droughts, which dealt severe blows to agricultural and livestock production, thereby generating a serious domestic food crisis.

In order to extricate the country from these difficulties, the Government of Mozambique has developed and activated a 10 Year Plan (1981 - 1990), aimed basically at achieving self-sufficiency in foodstuffs, the development of export industries, and the development of energy resources. Thus, a major effort has been mounted to revitalize and develop the nation's economy.

Against this perspective, the fishing industry, supported by rich fishery resources along the country's long 2,420 km coastline, has taken on a very important role as a major source of foreign exchange, mainly through the export of shrimp, and as a key source of foodstuffs for the domestic market, as reflected by the fact that per-capita consumption of fish is now 3.3 kg/year, vs. only 1.8 kg/year for meat products.

Nevertheless, the reported volume of production of marine fisheries was only about 20,900 tons in 1981, nowhere near to satisfying domestic demand. This has forced the country to make imports of fish products.

As a result, the 10-Year Plan sets as an objective the doubling of per-

capita fish consumption by 1990 and thus seeks to promote and expand the country's fishing industry.

The Mozambique fishing industry may be divided broadly into industrial fisheries and small-scale fisheries. The former is centered on shrimp trawling, operated by public corporations and joint ventures. The present level of production has just about reached its maximum limits; for the time being, the industrial sector will be hard pressed just to sustain its present level of output.

The small-scale fisheries can be subdivided into quasi-industrial and artisanal fisheries geared primarily to domestic consumption. The Government of Mozambique, therefore, has formulated a plan giving priority to the development of these small-scale fisheries, with primary focus on the expansion of production through the modernization of artisanal fisheries.

As a basic approach to the development of the small-scale fisheries, various public corporations have been established in the fishery and related fields, including EQUIPESCA, CIMA, and NAVIPESCA, to focus on the production and supply of fishing vessels and gear and on the development of a distribution infrastructure for fishery products. In addition, Fisheries Complexes, under the aegis of the UDPPE, are being located in areas where artisanal fishermen are concentrated. Hand in hand with the organization of fishermen's cooperatives, these Complexes are aimed at revitalizing the artisanal fishery at both the production and distribution levels.

As of 1982, construction had been started on 5 such Complexes throughout the country, with another 3 Complexes planned from 1983.

For purposes of implementing the development plan for small-scale fisheries, the Government of Mozambique has asked the Government of Japan for cooperation in the form of grants-in-aid. Pursuant to this request, the Japan International Cooperation Agency (JICA) dispatched a Basic Survey Team to Mozambique between October 8 and November 10, 1982, which studied conditions in the fishing net industry, the boat-building industry, and, the Fisheries Complexes and conducted an

on-the-spot survey in the Sopinho area of Zambezia Province, which has been targeted for a Fisheries Complex. Views were exchanged with personnel in the Government of Mozambique.

As a result of on-the-spot survey and discussions between the survey team and concerned persons in Mozambique, the team considered it most appropriate to build a net-making facility on a site adjacent to that of the public net-making corporation (CIMA) in the capital, Maputo, to build a Fisheries Complex in Sopinho, and to furnish fishing supplies and materials to the artisanal fishermen in the latter area.

Following is a summary of the items to be constructed or furnished under this program:

1) Net-Making Facility:

Building Floor Area	: about 1,100 sq.m. Steel frame, single-story construction
Net-Making Machine	: 6 units
Spool Winder	: 1 unit
Bobbin Winder	: 1 unit
Depth Stretching Machine	: 1 unit of 30 tons
Boiler	: 1 unit
Auxiliary accessories and equipment	

2) The Sopinho Fisheries Complex:

Building Floor Area	: about 300 sq.m. Steel frame, single-story construction
Ice-maker (plate type)	: 1 unit of 2 ton/24 hour
Ice Storage Bin	: 1 unit of about 25 cu.m.
Refrigerator	: 1 unit of about 25 cu.m.
Generator	: 2 units of about 40 KVA
Auxiliary accessories and equipment	

3) Fishing Gear and Materials:

Engines	: 10 units of about 30 PS
Fish Finders	: 10 units
SSB	: 10 units
VHF/FM Transceivers	: 10 units
Radio Receivers	: 20 units
Nylon Multi-filament Netting	: 320 rolls
Polyethylene Multi-filament Netting	: 400 rolls
Related fishing gear and materials	

The proposed sites for the above construction program are all on public land, the acquisition of which for implementation of the subject plan has been assured. The sites are free of permanent encumbrances and can be easily prepared for construction. However, considering the instability of domestic supply of the necessary building materials, all materials are to be procured from abroad with the exception of aggregate cement, and blocks where local supply is felt to be secure.

We have allowed three months for the detail design, estimating, bidding, and contracting. Another 10 months will be required for manufacture of the various items of equipment in Japan, shipment to Mozambique, and local construction.

The net-making facility will be operated and managed by CIMA under the jurisdiction of Secretariat of State for Fisheries. In the existing CIMA facility, 19 net weaving units are already in operation. Although production efficiency is low, the facility has over 7 years of operating experience, so that no technical problems are anticipated in operating the new facility.

Annual operating costs for the net-making facility under this program are projected at 2.52 million MT/year (about U.S. $66,000), but, under the system employed by CIMA, the selling price for nets is always sufficient to cover production cost. Thus, no problems are anticipated with regard to achieving the break-even point.

With respect to the Sopinho Fisheries Complex, as in the case of the existing Complexes, management will be under the jurisdiction of the Small-Scale Fisheries Division (UDPPE) within Secretariat of State for Fisheries. Maintenance and checks of the ice-making and refrigeration equipment will be effected in cooperation with TECNIPESCA, which has considerable experience in operating this type of equipment. As a result, no technical problems will be encountered.

We expect that fishery training personnel can be drawn from the ranks of those who have graduated from the Fishery Training Center of Secretariat of State for Fisheries.

The Fisheries Complex is essentially an administrative service organ. Thus, despite the fact that certain activities do not lend themselves to profit-and-loss analysis, our tentative calculations indicate that, except for years when equipment must be replaced, the estimated annual operating costs of 2.64 million MT (some U.S. $ 70,000) can normally be covered by the sales of catch from Complex vessels.

Direct benefits to the national economy from the subject plan will include: import replacement on the basis of a growth in fishery production; an increase in the volume of fish distribution based on the construction of the new Fisheries Complex; and an increase in fish production through a diffusion of new fishing techniques and production by Complex vessels. The project will contribute significantly to the upgrading of the artisanal fishery, thereby helping to expand the range and volume of commercial fish species. We feel, therefore, that there is considerable significance in the Government of Japan implementing this grant-in-aid program.

We make the following suggestions to ensure the effective operation and development of the various facilities.

···· With respect to operation of the net making facilities, as a means of raising production efficiency, it will be necessary to assure stability in the supply of materials and replacement parts. And, to achieve proper management and personnel development, it will be necessary to improve the capability

of personnel via the use of overseas technical training programs.

- It would be desirable to have five of the 7.6 m class fishing vessels being built at NAVIPESCA yards assigned to the Sopinho Fisheries Complex as Complex-operated vessels. These vessels would conduct resource studies, pilot fishery operations, and offer operational guidance to fishermen.

- Complex vessel activities should be confined to the above mentioned operations. These vessels must not impact on the fishing operations of local artisanal fishermen by catching fish in the same waters using competing fishing methods.

- It would be best for the Fisheries Complex to be operated on the basis of a government budget. However, even if the facility were to be placed on a self-liquidating basis, it would be necessary to provide for governmental assistance at times of facility renewal.

SECTION 1 INTRODUCTION

The Peoples' Republic of Mozambique is located on the eastern coast of the African continent from 10°30' S to 27°00' S. It borders on South Africa, Swaziland, Zimbabwe, Zambia, Malawi, and Tanzania.

Mozambique has a coastline of some 2,470 km, but its fisheries, except for shrimp, have lagged in development. The bulk of the country's 44,000 artisanal fishermen use non-powered vessels with very antiquated gear.

Fish plays an important role as a source of animal proteins to the people of Mozambique, but domestic fish production does not even come near meeting demand. Thus, every year, precious foreign exchange must be allocated to the purchase of frozen and canned fish from abroad in large quantities.

In addition, the technicians and managers from the Portuguese colonial era left the country in large numbers at the time of independence, and this led to a drop in production. The country has also suffered major blows to its agricultural and livestock production from a succession of droughts, cyclones, and floods, giving rise to a serious domestic food crisis.

The Mozambique Government estimates that, as of March, 1982, the number of people suffering from these droughts and floods in the provinces of Nampula, Cabo Delgado, Mancia, Tete, and Sofala is in excess of 1.4 million.

For this reason, the Government of Mozambique has had to disburse increasing amounts of its scarce foreign exchange reserves for food imports and has been seeking aid in the form of foodstuffs from international agencies and various foreign countries. Imports of grains during the 1982 fiscal year totaled an estimated 382,000 tons, of which 161,000 tons were brought in under various aid programs.

The Peoples' Republic of Mozambique, in its Linhas Fundamentais Plano Prospectivo Indicativo para 1981-1990, has set a goal of doubling the

per-capita consumption of fish products from 1980 to 1990 and seeks to develop fisheries on the basis of this Plan. In particular, with regard to small-scale fisheries, the Government has established on a priority basis a UDPPE (Small Scale Fisheries Department) within Secretariat of State for Fisheries.

The Government's development policy for small-scale fisheries involves the establishment of Fisheries Complexes at each of the country's major concentrations of artisanal fishermen. Built around these Complexes will be efforts to organize fishery cooperatives, through which fishing equipment and supplies as well as technical assistance can be provided. This will permit the modernization of traditional fisheries as well as assistance to the livelihood of artisanal fishermen. At the same time, the intent is for these Fisheries Complexes themselves to engage in fish production as owners of the means of production with a view to expanding the overall production of fish by small-scale fisheries.

Pursuant to this program of small-scale fishery development, the Government of Mozambique had, by 1982, started the process of establishing these Fisheries Complexes in five locations around the country and, in 1983, plans to start the construction of three additional locations. With regard to the supply of fishing vessels and gear for use by small-scale fisheries, plans have been developed to establish, under the wing of Secretariat of State for Fisheries, a ship-building corporation (NAVIPESCA) and a net-making corporation (CIMA) and to bend all efforts to the expansion of fish production and the development of a distribution system.

The Government of Mozambique, in order to develop this program for the development of small-scale fisheries, has requested grants-in-aid from the Government of Japan. In response to this request, the Government of Japan has dispatched a basic design survey team *) led by Mr. Kazuo Takayama, Chief Fishing Boat Inspector, Fishing Boat Division, Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries. This team conducted a survey over a 25-day period between October 18th and

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*) Personnel of Fisheries Engineering Co., Ltd. participated in the survey team as consultants.

November 10th, 1982. The names of the team members and their itinerary as well as the names of the persons consulted during the investigation are given at the end of this document.

The objective of the survey was to consult with concerned parties in Mozambique regarding the fishery development plan to which the request has been addressed; to conduct a field survey in Mozambique on the basis of which a basic plan would be developed to implement an effective grant-in-aid program for facilities and fishing equipment needed for fishery development.

In the course of the discussions, there was an inquiry with regard to the provision of a hook production facility and a fishery research vessel for service in resource research and pilot operations. Both projects could make major contribution to fishery development. The hook facility, from the standpoint of improving self-sufficiency in fishing materials; the research vessel, from the standpoint of investigating the under utilized resources off the northern coast and introducing new fishing methods. However, owing to problems with the management plan and the setup for receiving technical assistance, it was agreed that these items would be eliminated from consideration at this stage.

SECTION 2 BASIC PLAN

2 - 1 Basic Policy

We have formulated the following basic policies in connection with the basic plan for this program:

(1) The Government of Mozambique seeks the development of a industrial fisheries centering on shrimp, as a means of earning foreign exchange and seeks also to develop small-scale fisheries chiefly as a means of providing its people with animal proteins and replacing the present imports of fishery products.

With regard particularly to small-scale fisheries, the Government is establishing Fisheries Complexes in various areas throughout the country of concentrated production activity by artisanal fishermen and is organizing fishermen's cooperatives and providing assistance to expand production and improve the livelihood of these fishermen.

Through the formulation of a basic design plan for this fishery development program, the Government of Mozambique has given top priority in its planning to raising the production of small-scale fisheries, particularly the production capability of artisanal fishermen.

(2) Economic cooperation at the governmental level between Mozambique and Japan has thus far centered on aid in the form of foodstuffs. There has been no economic cooperation on a project basis. For this reason, Japan has not had the opportunity to develop the basic information and background necessary to the implementation of economic cooperation on a project level, while the Government of Mozambique, for its part, was not entirely familiar with the procedures involved in a grant-in-aid program of the Japanese Government.

If the present plan materializes, this will be the first case of project-type economic cooperation and as such will play a very

important role in the future evolution of economic cooperation between Japan and Mozambique. In the hope of deepening the bonds of friendship between our two nations through implementation of this project, we have made a careful selection of project content and have developed a plan that can be definitively implemented without difficulty.

(3) In connection with the implementation of a plan for the development of small-scale fisheries, the Government of Mozambique has expressed the hope that aid from Japan be concentrated in Zambezia Province, which contains some 7,700 artisanal fishermen and in which the organization of fishermen's cooperatives is relatively well advanced.

This desire has been considered in connection with the Fisheries Complex and fishing equipment under this project and have, accordingly, decided to establish a Fisheries Complex in Sopinho of Zambezia Province and to provide fishing equipment and materials necessary to the operation of the Complex.

2-2 Basic Plan

2-2-1 A Net-making Facility

(1) Production Target

Based on data from the UDPPE, the number of fishing nets expected to be required by the small-scale fisheries in 1983 is about 300 tons, broken down as follows:

Table 2-1 Type of Net (tons)

Province	Nylon Multifilament	Nylon Monofilament	Polyethylene	TOTAL
Maputo	50.5	10	-	60.5
Gaza	28	-	-	28
Inhambane	64.5	-	-	64.5
Sofala	45.5	5	-	50.5
Manica	1.3	-	-	1.3
Tete	7.2	-	-	7.2
Zambezia	34	2	-	36
Nampula	22.2	6	16	44.2
Niassa	2.22	0.6	1.6	4.42
Cabo Delgado	4.44	1.2	3.2	8.84
TOTAL	259.86	24.8	20.8	305.46

120 tons of this total is for artisanal fishermen.

The breakdown, by type of netting, which is to become the production target for the net making facility under this program, is as follows:

Table 2-2 Production Target

(Multifilament Nylon Netting, Single-Knot, 100 Mesh Depth)

Twine	Mesh (Stretch) (inches)	Required Quantity (tons)
210 D/3	3	3
	3 1/2	2
	4	3
210 D/6	2	3
	3	3
	3 1/2	3
	4	5
	4 1/2	3
	5	5
210 D/9	2	18
	3	2
	4	3
	5	3

Twine	Mesh (Stretch)	Required Quantity
210 D/12	1	5
	1 1/4	1.5
	1 1/2	2.5
	2	3
210 D/15	1	5
	1 1/4	2
	1 1/2	2
	2	2
210 D/18	3	3
	4	3
	4 1/2	3
210 D/24	3 1/2	3
	4	3
	4 1/2	3
	5	3
Sub-total		100

Table 2-3 Production Target

(Monofilament Nylon Netting, Double-Knots, 100 Mesh Depth)

Monofilament Diameter (mm)	Mesh (Stretch) (inches)	Required Quantity (tons)
0.40	2	20

(2) Net-making Equipment

Following are the factors in the formula for computing the required number of machines, based on the above tables:

① The required volume of netting ÷ netting weight per unit length = required netting length

② Required netting length ÷ mesh length (knot-to-knot length) = required number of knots in a lengthwise direction

③ Required number of knots in a lengthwise direction (x) mesh depth = total number of knots

④ Total number of knots ÷ (revolutions (x) hours of operation(x) efficiency) = required number of shuttles

⑤ Required number of shuttles ÷ number of machine shuttles = required number of machines

Following tables (2-4, 2-5) show the results of these calculations for required netting length and the required number of lengthwise knots, as required for the various types of netting:

Table 2-4 Required Netting Length and Required Number of Lengthwise Knots by Type of Netting (Multifilament)

Multi-filament	Mesh Size (inches)	Mesh Size in knot-to-knot (m/m)	Weight per unit length (g/m)	Required Quantity (tons)	Required Netting Length (m/m)	Required No. of Lengthwise Knots
210/3	3	38	17.20	3	174,418,604	4,589,963
	3 1/2	44	16.99	2	117,716,303	2,675,370
	4	50	16.92	3	177,304,964	3,546,099
210/6	2	25	37.17	3	80,710,250	3,228,410
	3	38	35.31	3	84,961,767	2,235,835
	3 1/2	44	35.01	3	85,689,802	1,947,495
	4	50	34.77	5	143,802,128	2,876,042
	4 1/2	57	34.5	3	86,956,521	1,525,553
	5	64	34.23	5	146,070,698	2,282,354
210/9	2	25	59.46	18	302,724,520	12,108,980
	3	38	55.14	2	36,271,309	954,508
	4	50	53.91	3	55,648,302	1,112,966
	5	64	52.86	3	56,753,688	886,776
210/12	1	13	103.71	5	48,211,358	3,708,566
	1 1/4	15	96.99	1.5	15,465,511	1,031,034
	1 1/2	19	90.33	2.5	27,676,298	1,456,647
	2	25	83.64	3	35,868,005	1,434,720
210/15	1	13	130.47	5	38,322,986	2,947,922
	1 1/4	15	122.28	2	16,355,904	1,090,393
	1 1/2	19	114.12	2	17,525,411	922,390
	2	25	105.93	2	18,880,392	755,215
210/18	3	38	120.81	3	24,832,381	653,483
	4	50	117.09	3	25,621,316	512,426
	4 1/2	57	115.23	3	26,034,886	456,752
210/24	3 1/2	44	160.07	3	18,741,800	425,950
	4	50	157.95	3	18,993,352	379,867
	4 1/2	57	155.46	3	19,297,568	338,553
	5	64	153.00	3	19,607,843	306,372

Table 2-6 Required Netting Length and Required Number of Lengthwise Knots by Type of Netting (Monofilament)

Mono-filament	Mesh Size (inches)	Mesh Size in knot-to knot (m/m)	Weight per unit length (g/m)	Required Quantity (tons)	Required Netting Length (m/m)	Required No. of Lengthwise Knots
0.4	2	25	39.39	20	507,743,082	20,309,723

The multi-filament yarn to be used will be mainly 210 D/6, 210 D/9, 210 D/12, and 210 D/15, with 210 D/9 of particularly importance.

We have selected the following pitches for the net weaving unit: 9 mm class up to 210 D/9; 11 mm class for 210 D/12 to 210 D/15; and 14 mm class for 210 D/18 and above. Monofilament 0.4 mm corresponds to multi-filament 210 D/6.

The number of required knots in a lengthwise direction are:

Multifilament	210 D/3 to 210 D/9	Total	39,970,351 knots
	210 D/12 to 210 D/15	"	13,346,887 "
	210 D/18 to 210 D/24	"	3,073,403 "
Monofilament	0.4 m/m		20,309,723 "

With a 100 mesh depth, the total number of knots works out respectively to:

Multifilament	210 D/3 -- 210 D/9	3,997,035,100 knots
	210 D/12 -- 210 D/15	1,334,688,700 "
	210 D/18 -- 210 D/24	307,340,300 "
Monofilament	0.4 m/m	2,030,972,300 "

Operating hours, based on a 2-shift per day schedule with 8 hours/shift, will total:

8 hours x 2 shifts x 5 days x 52 weeks/year = 4,160 hours

The number of revolutions, based on 20 revolutions/minute for single knot and 18 revolutions/minute for double knot, works out to:

....single knots---

20 revolutions/min. x 60 min. x 4,160 hours = 4,992,000 revolutions

....double knots---

18 revolutions/min. x 60 min. x 4,160 hours = 4,492,800 revolutions

Efficiency will vary, depending on the skill level of the workers, the placement of the equipment, and the quality of the multifilament yarn, but we have projected efficiency at 75% for monofilament and for multifilament 210 D/3 - 210 D/9; at 65% for 210 D/12 - 210 D/15; and at 50% for 210 D/18 - 210 D/24.

On this basis, the required number of shuttles will be:

...multifilament--- 210 D/3 - 210 D/9

3,997,035,100 knots ÷ (4,992,000 rev. x 0.75) = 1,067 shuttles

...monofilament--- 0.4 mm

2,030,972,300 knots ÷ (4,492,800 rev. x 0.75) = 602 shuttles

...multifilament--- 210 D/12 - 210 D/15

1,334,688,700 knots ÷ (4,992,000 rev. x 0.65) = 411 shuttles

...multifilament--- 210 D/18 - 210 D/24

307,340,300 knots ÷ (4,992,000 rev. x 0.50) = 123 shuttles

Accordingly, the required number of shuttles will be:

...9 m/m pitch class net weaving unit	1,669 shuttles
...11 m/m " " " " "	411 "
...14 m/m " " " " "	123 "

Figuring the number of shuttles per machine at 420 shuttles for the 9 m/m and 11 m/m pitch classes and at 210 shuttles for the 14 m/m pitch class, the total number of machines required works out to:

... 9 m/m pitch class---

1,669 shuttles ÷ 420 shuttles = 3.97 units

rounded to 4 units

... 11 m/m pitch class---

411 shuttles ÷ 420 shuttles = 0.97 units

rounded to 1 unit

... 14 m/m pitch class---

123 shuttles ÷ 210 shuttles = 0.58 units

rounded to 1 unit

(3) Related Equipment Requirements

① Spool winder

The factors for calculating the number of spool winders (paper or wooden) for mounting the warp on the net weaving unit, are as follows:

1 grm of yarn of 1 denier ⇨ 9,000 m.

On this basis, we have:

1) Required volume of warp ÷ $\frac{\text{No. of deniers x no. of plies}}{9{,}000\ \text{m}}$ (D)

= required warp length

2) Required warp length ÷ average roll length per revolution

= required number of revolutions

3) Required no. of revolutions

(No. of machine revs. x operating hours x efficiency factor) = required number of spindles

4) Required no. of spindles ÷ number of spindles in the machine

= required number of machines

If we now assume an average of 30 cm of roll length per revolution, we arrive at the required number of revolutions, as follows:

Table 2-6 Required Number of Revolutions

Multifilament	Required warp tonnage	D	Required warp length (m)	Required No. of Revolutions
210 D/3	4	0.07	57,142,857	190,476,190
210 D/6 *)	21	0.14	150,000,000	500,000,000
210 D/9	13	0.21	61,904,761	206,349,203
210 D/12	6	0.28	21,428,571	71,428,570
210 D/15	5.5	0.35	15,714,285	52,380,950
210 D/18	4.5	0.42	10,714,285	35,714,283
210 D/24	6	0.56	10,714,285	35,714,283
TOTAL	50	--	327,619,044	1,092,063,479

*) including 0.4 m/m monofilament

Taking the number of revolutions at 400 per minute, and assuming an average 55% efficiency factor, the effective annual number of revolutions become:

400 Rev/min. x 60 min. x 16 hours/day
x 260 days/year x 55% =

99,840,000 revs/year x 55% = 54,912,000 revs/year

Accordingly, the required number of spindles becomes:

1,092,063,479 revs ÷ 54,912,000 revs. = 19.88
rounded to 20 spindles.

On this basis, we have set the number of spool winders at one unit of 20 spindles.

② Bobbin winder

Woof must be mounted on the net weaving unit by winding it around a bobbin. The factors for calculating the number of bobbin winders are as follows:

1) Required volume of woof ÷ $\frac{\text{No. of deniers x no. of plies}}{9{,}000\ \text{m}}$
= required woof length

2) Required woof length ÷ average roll length/revolution
= required no. of revolutions

3) Required no. of revs. ÷ (Machine revs x operating hours x efficiency factor)
= required no. of spindles

4) Required no. of spindles ÷ number of spindles per machine
= required number of machines

The required woof length is the same as that for warp. If we tentatively estimate the total roll length per revolution at 23.9 cm for 210 D/3 - 210 D/9; at 28.3 cm for 210 D/12 - 210 D/15; and at 28.5 cm for 210 D/18 - 210 D/24, we arrive at the required number of revolutions, as follows:

Table 2-7 Required Number of Revolutions

Multifilament	Required Woof length (m)	Average roll length per revolution (cm)	Required No. of revolutions
210 D/3	57,142,857	23.9	239,091,451
210 D/6 *)	150,000,000	23.9	627,615,062
210 D/9	61,904,761	28.3	218,744,738
210 D/12	21,428,571	28.3	75,719,332
210 D/15	15,714,285	28.3	55,527,508
210 D/18	10,714,285	28.5	37,593,982
210 D/24	10,714,285	28.5	37,593,982
TOTAL	327,619,044		1,291,886,055

*) including 0.4 m/m monofilament

Setting the number of machine revolutions at 400 revs/min. and the efficiency factor at an average 55%, the effective number of revolutions per year becomes:

400 revs/minute x 60 min x 16 hrs/day x 260 days/yr x 55%
= 54,912,000 revs/year

Accordingly, the required number of spindles becomes:

1,291,866,055 revs ÷ 54,912,000 revolutions = 23.5
rounded to 24 spindles

Thus, the number of bobbin winders becomes one unit of 24 spindles. But, depending on the selection of bobbin diameters, this number can be reduced.

③ Depth stretching machines; Boiler

The woven fishing nets must be given stretchability through heat processing to tighten the knots.

For stretch heat treatment lengthwisely, the equipment already owned by CIMA should be fully adequate. But

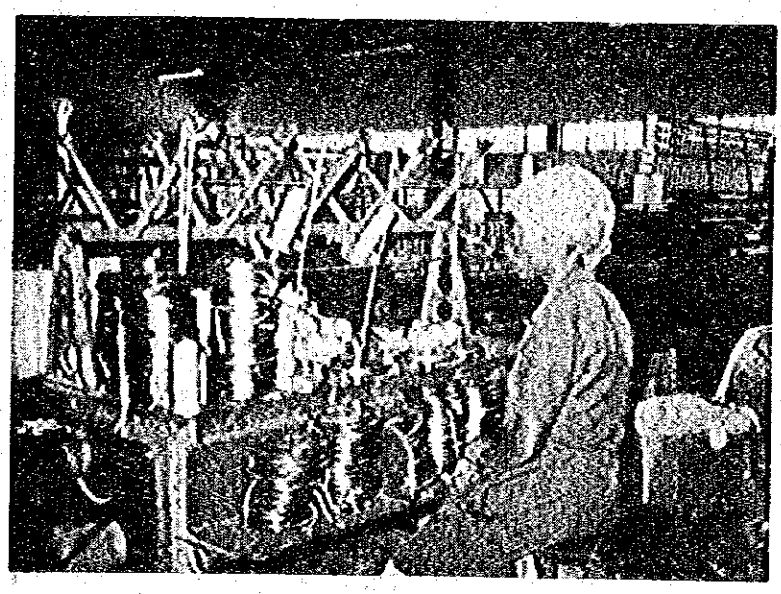
depth stretching machines along with steam-generating boilers will be installed to provide steam heat treatment and processing in a depthwise direction. The capacity is to be as follows:

Depth stretching machine

Maximum stretching capacity	30 tons or more
Effective width	about 2,300 m/m

Boiler

Amount of steam to be generated	700-1,000 kg/hour
Steam pressure	7-10 kg/cm^2

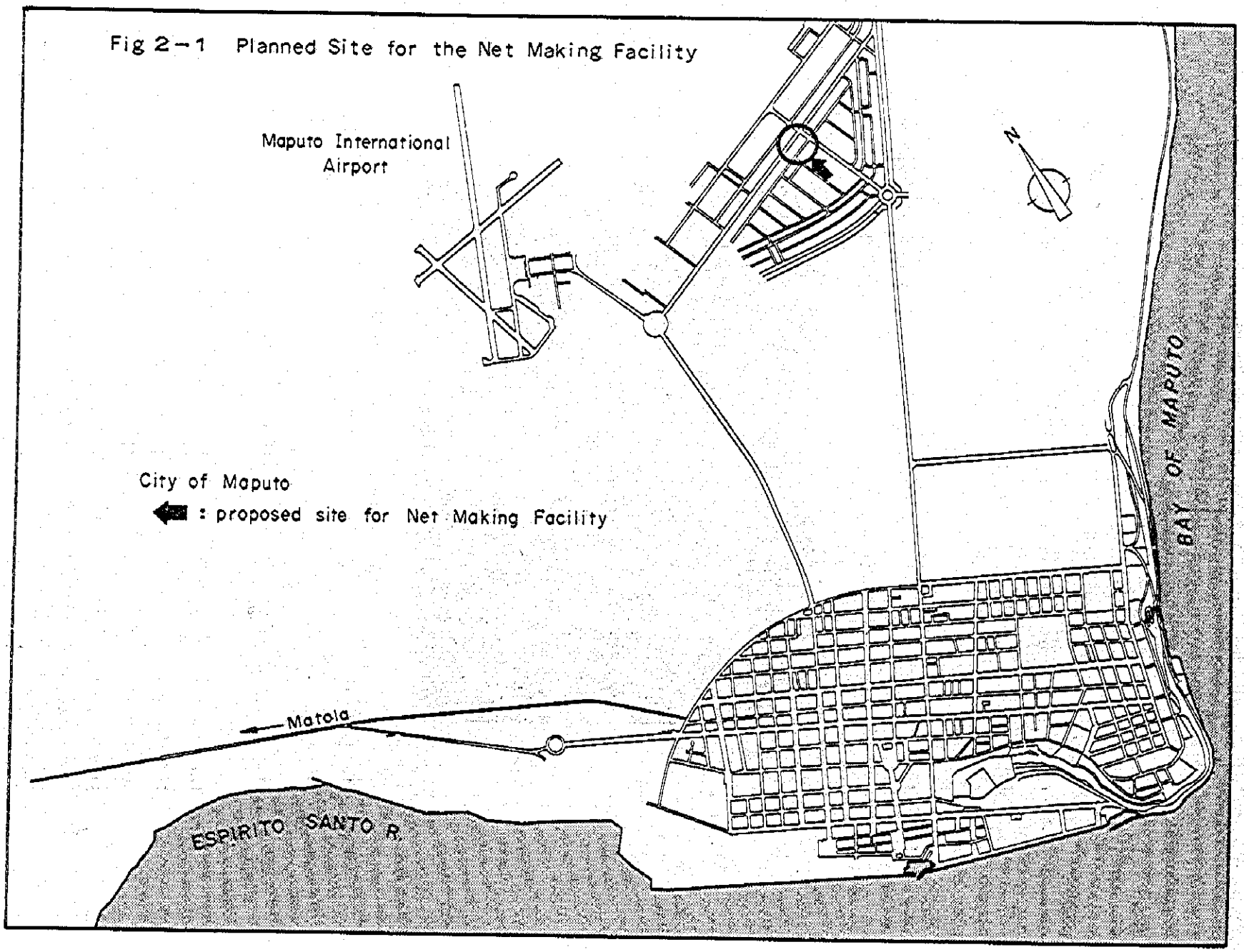


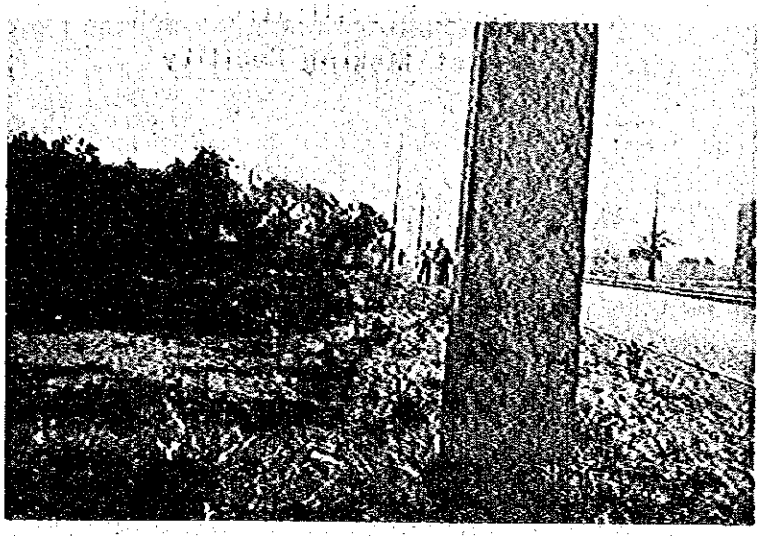
Existing Net Making Facility (CIMA)

(4) Site, Plot Plan and Structure of Building

The subject facilities are to be constructed to the east of the existing CIMA net producing facility. This site is located in an industrial area within the city of Maputo, fronting on the trunk road Forças Populares, which links the city with the Maputo airport. The address is 857 Forças Populares.

Fig 2-1 Planned Site for the Net Making Facility





Planned Site for the Net Making Facility

The net making facility is to be one-story steel frame construction and will incorporate a net workshop, a machine room, a material warehouse, a finished product warehouse, and a lavatory. There will also be a breezeway connecting the facility with existing structures.

In the inner portion of the net workshop, we plan to install the net weaver, spool winder and bobbin winder. Space will be provided near the entrance for inspection, repair, and packaging operations.

In order to shorten the length of pipes from the boiler, the depth stretching machine will be located on the side adjoining the machine room.

Following is an outline of the specifications for the net making facility:

Approximate Specifications for the Net Making Facility

1) Structures:

a) Floor space : about 1,087 m^2

Net workshop	: 840 m^2
Machine room	: 25 m^2
Material storage area	: 72 m^2
Warehouse for finished product	: 90 m^2
Room for storekeeper	: 25 m^2
Lavatory	: 35 m^2

b) Construction:

Main structure	: steel frame prefabricated single story
Roofing	: polyvinyl chloride coated metal sheet, roll roofing and corrugated
Siding	: insulated polyvinyl chloride coated metal sheet
Wall	: block masonry, mortar coated, paint finish
Interior floors	: mortar finish

2) Equipment:

Net weaving unit	: 9 m/m pitch class of 420 spindles -- 4 units
	: 11 m/m pitch class of 420 spindles -- 1 unit
	: 14 m/m pitch class of 210 spindles -- 1 unit
Spool winder	: 400 revolutions, 20 spindles 1 unit
Bobbin winder	: 400 revolutions, 24 spindles 1 unit
Depth stretching machine	: maximum stretch capacity 30 tons 1 unit
Boiler	: 700 - 1,000 kg/hr steam generating capacity 1 unit

Accessories and fittings for the above

2-2-2 The Sopinho Fisheries Complex

(1) Fields of Activity

According to the Government of Mozambique, the Fisheries Complexes are intended to improve the status of artisanal fishermen, accelerate the organization of fishermen's co-operatives, and engage on their own in fishery production. The goal overall is to raise production levels of small-scale fisheries.

The Fisheries Complex in Sopinho, for the construction of which assistance has been requested, is planned as the first such Complex in Zambezia Province. During the initial stages, its activities are to cover the following areas:

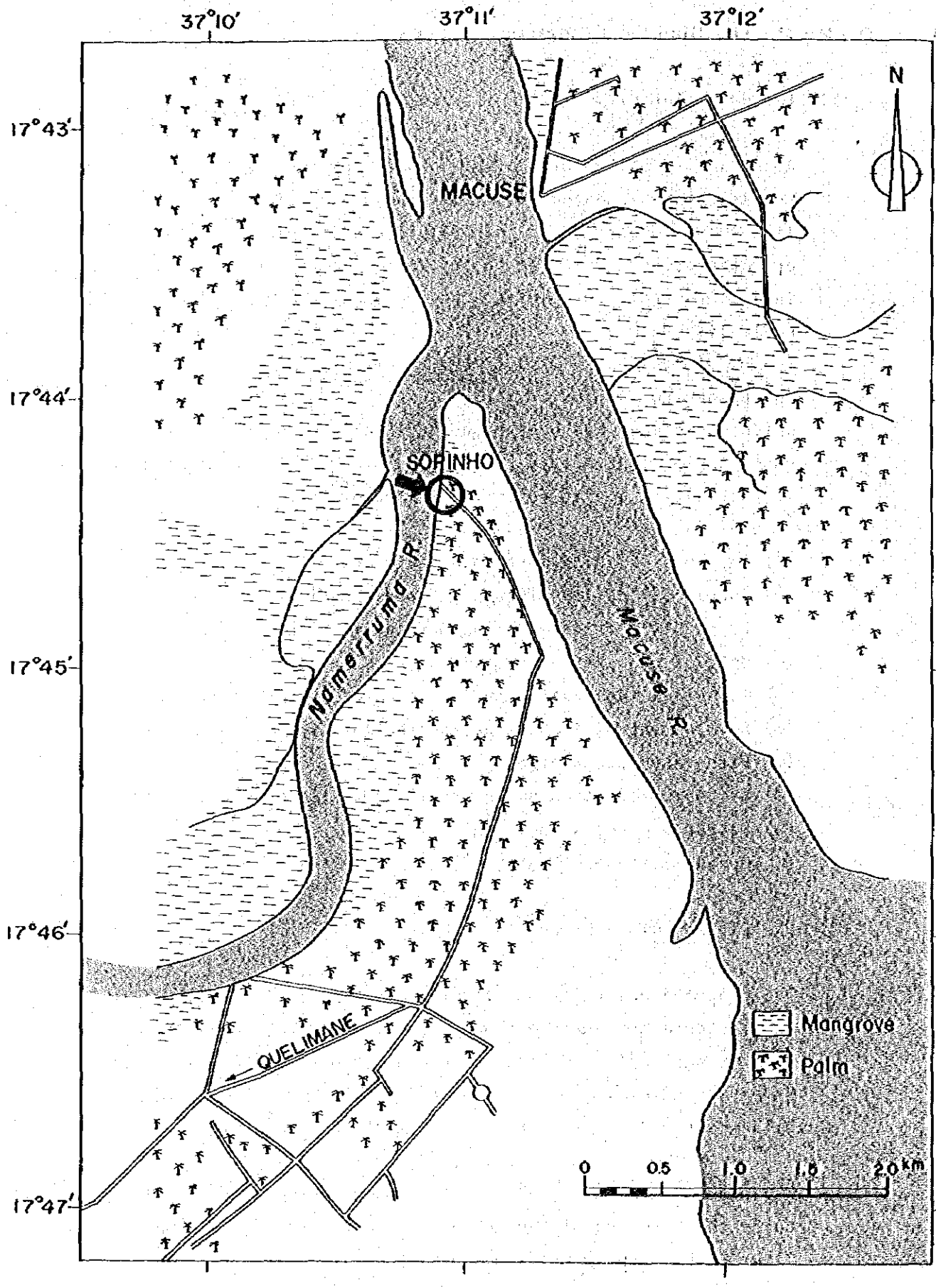
① Supply of fishing materials and gear.
② Supply of ice for storage and preservation of catch.
③ Purchase, refrigeration, and sale of catch.
④ Sale of everyday necessities.
⑤ Technical instruction and training of artisanal fishermen.
⑥ Development of fishing grounds; pilot fishing operations.
⑦ Fish resource studies.
⑧ Fishery production using vessels operated by the Complex.
⑨ Repair of vessels and engines.
⑩ Organization of fishermen's cooperatives.

(2) Description of the Proposed Construction Site

The proposed construction site for the Sopinho Fisheries Complex is located some 40 km northwest of Quelimane City on a river bank in the Sopinho district, surrounded between the Macuse and Namerruma Rivers. In the area are found large palm plantations with scattered plants for processing coconut crusts.

The site is linked by ferry to Macuse on the opposite shore and, being the terminus of the scheduled bus route from Quelimane City, is the transportation hub of the surrounding area.

Fig 2-2 Planned Site for the Fisheries Complex



Sopinho, next to the planned site for the Fisheries Complex

Around 4 km down the Macuse River, the river opens up into Sofala Bay enroute to the sea. Marine resources are abundant, particularly pelagic species, but the artisanal fishery, based on small-scale beach seining, is mainly confined to the river area, so that there has been no development of marine fisheries.

In Namacurra District, which is the core target area for the Sopinho Fisheries Complex, there are some 200 artisanal fishermen centered in Macuse, Licoar, Namacurra, and Ligoas. The number of fishing vessels is reported to total 160, but these include virtually no power or sail vessels, being largely canoes. As of October, 1982, there were no fishermen's cooperatives in Namacurra district.

The types of fishing gear we observed during our visit to the proposed construction site included beach seine nets and hand lines, but most of this appeared to be worn out. In particular, owing to a shortage of yarn for net repair, many torn nets were being used.

Quelimane City, which is the trading center of the district, is the provincial seat of Zambezia, with a population of 184,000.

Fish preservation facilities include refrigerators belonging to PESCOM. Their capacity totals 400 m^3, but 100 m^3 of this is not operating due to breakdowns.

With the exception of shrimp for export, catches landed by EMOPESCA and the joint venture, EFRIPEL, are distributed through direct outlets owned by PESCOM. Other local catches are sold at the public market.

Fish retail shop of PESCOM in Quelimane

Since there is no branch of EQUIPESCA in Zambezia Province, its functions in distributing fishing supplies are carried out by the Serviço Provincial de Pesca da Zambezia, which has jurisdiction over fishery administration. Gear are also sold at private stores, but, as of November, 1982, prices were extremely high: 4,116 MT (U.S. $ 110) for nylon gill nets (Dia. 0.4 mm, Mesh 75 mm, 100 mesh depth x 50 m length): 1,072 MT (U.S. $ 28) for synthetic rope (6 mm diameter) of 220 m; 15.50 MT (U.S. $ 0.41) per unit for synthetic resin floats.

(3) Basic Functions

The basic functions to be performed by the Sopinho Fisheries Complex will be classified as follows:

① Ice making and ice storage for use in preserving catches, to be provided to both artisanal fishermen and vessels operated directly by the Complex.

② Refrigeration equipment for preserving fresh fish landed by artisanal fishermen and Complex vessels.

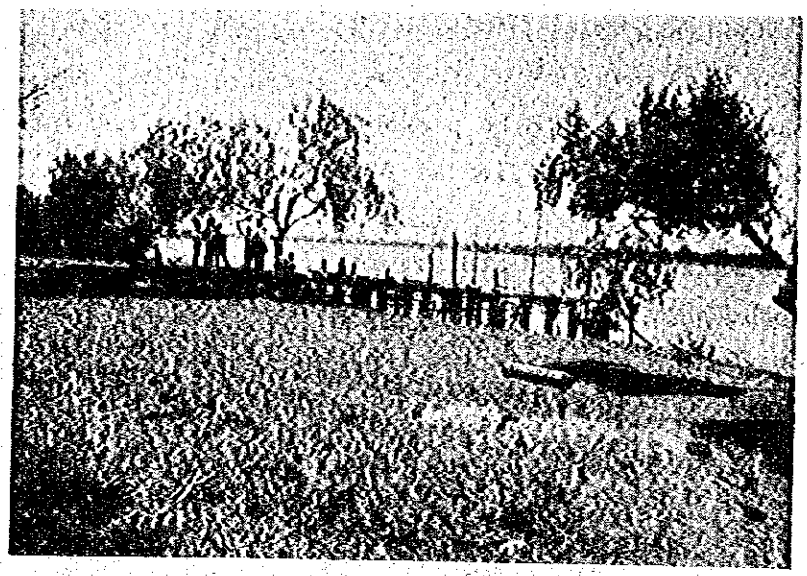
③ Facilities for the repair of fishing vessels.

④ Sale and storage facilities for fishing equipment, materials, and everyday necessities.

Fresh fish stored in refrigerators are to be shipped at regular intervals to Quelimane City via PESCOM carriers.

With regard to Complex operated vessels, it is hoped that 5 of the 48 wooden vessels (7.6 m class) being constructed by NAVIPESCA under the 1983 Plan will be earmarked for deployment to the Sopinho Fisheries Complex upon its completion. These Complex vessels are to provide technical guidance and training to the local fishermen through pilot operations demonstrating new fishing techniques.

Profits from the sale of catches are to be credited to the operating revenues of the Fisheries Complex as production. Supplementary supply and landings from shore facilities will be accomplished via a wooden jetty, approximately 7 m wide x 30 m long, which was expected to be completed during November, 1982.



Jetty

(4) Scale of the Facilities; Outline of Specifications

① Planned Production Volume

It is desirable that the capacity of the ice-making facilities, ice storage, and refrigerator be set on the basis of projected catch volume. The estimated landings by artisanal fishermen and Complex vessels are as follows:

We have applied a factor of 0.3 tons as the projected landings by artisanal fishermen. This is the national production average for artisanal fishermen. We believe, however, that, owing to statistical deficiences, the reported production of artisanal fishermen understates the true catch volume. It would not be unreasonable, in estimating the volume of landings at the Fisheries Complex, to conclude that this shortfall approximates the fishermen's own consumption. Also, the annual per capita production by artisanal fishermen in Zambezia Province in 1980 and 1981 came to 120 kg/year, which is considerably below the national average. Nevertheless, the introduction of a Fisheries Complex will help to accelerate the formation of

fishermen's cooperatives, so that the local fishery is expected to be invigorated. Thus, we can anticipate future increases in production volume. In order, therefore, to have some slack in the scale of the facilities, we have chosen not to apply the Zambezia average.

With regard to estimating landings from Complex vessels, given the absence of production data on motorized fishing vessels in the planned target area, we have used as a reference base the statistics of the predecessor Fishing Complex, SULPESCA, E.E. in Maputo province.

Of course, since the fishing grounds are different, resource conditions are also noticeably different, which will mean a change in catch composition. Nevertheless, we may anticipate that:

1) The main target species at the Sopinho Fisheries Complex will be anchovy (Stobphorus spp.), the main resource of Sofala Bank, with present stocks in the order of 300,000 tons. Fishing methods will be similar to those for Magumba (Hilsa kelee), the principal target species of SULPESCA.

2) We do not anticipate any major differences between the two Complexes in fishing effort, which is determined by fishing technology, including the use of other fishing methods, and the scale and operating days in a year of the fishing vessels.

We feel, therefore, that we can comfortably work on the above premises.

The annual average daily production per fishing vessel at SULPESCA (Maputo headquarters) during 1980 and 1981 came to 37 tons. The average number of operating days was estimated at 180.

Consolidating the above data, we can make the following estimates with regard to planned production:

Table 2-8 Projected Landing by Artisanal Fishermen

Number of Fishermen	Annual Production Per Fisherman	Total Annual Production
200	0.3 tons per fisherman	60 tons

Table 2-9 Projected Production by Complex Vessels

Number of Fishing Vessels	Annual Production Per Vessel	Total Annual Production
5	37 tons per vessel	185 tons

② Scale of the Principal Facilities; Specifications

1) Ice-Making Equipment

We have decided on a plate-type ice-making unit, after due consideration of catch volume, the relative ease or difficulty of operation, and durability.

Water supply for the ice-maker will be from both well and river water. Salinity will be high, particularly during periods of high tide, and so the ice-maker must conform to seawater use.

The condenser will be air-cooled. The volume of ice required for preservation when the artisanal fishermen deliver their catches to the Fisheries Complex has been estimated at 120 tons per year, which corresponds to twice the volume of landings during a maximum 3-day

period between catch and delivery to the Complex.

60 tons (planned landings) x 2 = 120 tons/year

The ice storage capacity aboard the Complex vessels will be 1.10 m^3. Thus, considering the shape of the ice, a bulk ratio of 0.6, and a usable space ratio of 0.5, we derive a total of 300 kg/vessel per trip, based on the following formula:

1.10 m^3 x 0.6 x 0.5 x 920 kg/m^3 = 300 kg

Figuring 3 days per trip and 60 trips per year per vessel, the amount of ice for preserving catch aboard Complex vessels may be projected at 90 tons/year, based on the following formula:

180 days(operating days per vessel) ÷ 3 =
60 fishing trips/year/vessel

300 kg/vessel x 60 trips/vessel/year x 5 vessels =
90 tons per year

For purposes of estimating the volume of ice for shipment of the catch landed at the Fisheries Complex, if we estimate two hours as the transport time from Sopinho to Quelimane City and add a comfortable safety margin, we can set the requirements at the same level as fish to be shipped--viz., 245 tons/year.

(60 + 185) tons x 1 = 245 tons/year

Totaling the above, and adding a 10% contingency allowance, we arrive at a total requirement of 500 tons, based on the following formula. Assuming 250 operating days per year, the required production capacity for the ice-making equipment would come to 2 tons/day.

(120 + 90 + 245) x 1.1 = 500 tons/year

500 days/year ÷ 250 days = 2 tons per day

2) Ice Storage Area

The peak supply of storage ice that can be anticipated per day would occur at a time when ice must be supplied simultaneously to fill artisanal fishermen and Complex vessels for shipment of catches.

If we assume that artisanal fishermen receive ice supplies once in every 3 day period for preservation purposes, then:

Number of time ice will be supplied .....

$$365 \div 3 = 122 \text{ times/year}$$

If we further assume that the supply per delivery is constant throughout the year, then the volume of ice per day at times of simultaneous supply to all receiving units will be:

Maximum daily supply of ice to artisanal fishermen:

$$\frac{120}{122} = 1.0 \text{ ton/day}$$

The maximum requirement per day for storage ice for Complex vessels would occur when all 5 vessels must be simultaneously resupplied.

Maximum ice supply per day to Complex vessels .....

300 kg x 5 vessels = 1.5 tons/day

If we assume 1 shipment per week for landed catch and 52 shipment days per year .....

Ice per day for shipment:

$$245 \div 52 \text{ days} = 4.71 \text{ tons/day}$$

Summarizing the above, the total daily ice requirement comes to:

$$1.0 + 1.5 + 4.7 = 7.2 \text{ tons.}$$

The storage space required to handle this requirement, after allowing for a 0.6 bulk ratio, a 0.7 usable space ratio, and a 30% contingency factor, works out to 25 m^3, based on the following formula:

$$7.2 \text{ tons} \div 920 \text{ kg/m}^3 \div 0.6 \div 0.7 \times 1.3 = 25 \text{ m}^3$$

The ice storage section will be placed behind the ice-making equipment and will be fitted with its own refrigeration unit. Temperature inside the storage compartment will be maintained at between $0^{\circ}C$ and $-5^{\circ}C$. The thickness of the insulation panel has been set at 100 mm, after due consideration of exterior climatic conditions, so as to lower the power consumption of the refrigeration unit.

3) Ice Distribution Facilities

There are no water mains at present in Sopinho. A simple well be dug inside the site area to provide water for the ice-maker for non-potable general usage. The use of river water may also be considered.

Judging by the typographical conditions in the Sopinho area and the condition of wells in the vicinity, we believe that the underground water conditions are good and that no problems will be encountered in digging the well.

It will be desirable to construct a well from which filtered water can be obtained. We have also provided for a water tank and a pump. The subject area is situated in a tidal area, with high salinity in both well and river water during periods of high tides. As a result, the tank, pump and pipes must all be salt-resistant.

The tank capacity will be about 1 m^3.

4) Refrigerator

Fish receipts are expected to be steady throughout the year. Assuming the number of shipments at 52/year, the required refrigeration capacity, based on a 0.5 bulk ratio for ice-packed fish and a 0.4 usable space ratio, can be estimated at 25 m^3, based on the following calculation:

$$245 \text{ tons/year} \div 52 \text{ shipments} \div 0.5 \div 0.4 = 25 \text{ m}^3$$

Temperatures within the refrigerator will be maintained at between $0^{\circ}C$ and $-5^{\circ}C$. As in the case of the ice-storage bin, installation panels will be 100 mm thick.

5) Generator

Power requirements for the above principal facilities and for lighting facilities will be as shown in the following table. Since there is no power supply as yet in Sopinho, we have had to specify a continuous generator.

Allowing for contingencies, the rated capacity of this generator has been set at 40 KVA per unit. Out of safety considerations, we have provided for a second unit to permit alternate operation.

Table 2-10 Breakdown of Estimated Power Requirements

Name of Facility	Estimated Power Requirements (kw)
Ice maker	7.5
Ice storage	4.4
Refrigerator	4.4
Water pump	5.5
Lighting and misc.	4.2
TOTAL	26.0

6) Working and Storage Space

We have provided an office area to serve both the fishing equipment sales operation and as a management office for the Fisheries Complex. With provision for a reception area, sales counter, and desks, we have set the area for this office space at about 32 m^2.

We have also established a workshop area of some 64 m^2 for repair work on the various types of fishing equipment. This area will be provided with supply shelves and working tables.

For storage of fishing equipment and everyday necessities, we have provided for a warehouse equipped with supply shelves. To allow ample working space, we have allocated some 96 m^2 to this facility.

In front of the entrance to the ice storage area and refrigerator, it was necessary to leave ample working space for receiving, dispatch and handling of cargo. From a security standpoint, this space can also be considered as being protected by an outer wall.

We have provided some 160 m^2 for the working area.

③ Construction and Layout Plan

The bulk of the construction materials can be sourced locally but, considering the uncertainties with respect to stability of supply and the relatively short construction period, we have tried to reduce local operations to the minimum. We have, therefore, deemed it best to have components and materials brought in from Japan for local assembly. Accordingly, we have selected a construction method for the Fisheries Complex buildings providing for a single-store, steel frame structure.

The facilities then are to comprise an ice-maker, ice-storage, refrigerator, water mains, generators, officers, warehouse, work and loading area.

The entrance for loading and transport vehicles, ice delivery, and the bringing in and taking out of catch has been positioned on the river side in the interest of easy access to the quay.

An outline of facility specifications is given below:

Outline of Principal Specifications

1) Buildings:

Total Floor Space	306 m^2
Ice-making equipment, ice storage, refrigerator	66
Machine room	30
Office	32
Storage area	96
Workshop area	64
Other	18

Main structure	:	steel frame prefabricated, single story
Roofing	:	polyvinyl chloride coated metal sheet, roll roofing and corrugated
Wall	:	block masonry, mortar coated, paint finish
Interior flooring	:	mortar finish

2) Ice-making Equipment:

Ice-maker	:	plate type, 2 tons/24 hrs., sea water use
Ice storage (-5°C)	:	capacity about 25 m^3, prefabricated, with unit coolers

3) Refrigeration Unit:

Refrigerator (-5°C)	:	capacity about 25 m^3, prefabricated, with unit coolers

4) Water Supply Facilities:

Water tank	:	1 m^3 capacity (approx.), salt-resistant type
Pump and piping	:	salt-resistant

5) Generator:

Continuous type	:	40 KVA x 2 units

6) Other:

Sundries for office, warehouse, and workshop

Insulated fish boxes 50 pcs.

Auxiliary equipment

2-2-3 Fishing Gear and Equipment

(1) Items to be Disbursed

To expedite operations at the Sopinho Fisheries Complex, we have made provisions for the following initial supplies of fishing gear and equipment to accompany the basic facilities.

Table 2-11 Fishing Gear and Equipment in Relation to Project Activity

Area of Operations	Target Group	Main Uses	Items Required
Technical Training	Artisanal Fishermen	Diffusion of fishing gear Improvement of fishing technology	1) gill net materials 2) materials for small scale beach seines 3) materials for hand lines
		Communication at sea	4) SSB and VHF/FM transceivers
		Receiving weather information	5) radio receivers
		Repair of fishing vessels	6) marine engines
Fishery Production	Complex Vessels	Development of fishing ground Pilot operations	7) materials for gill nets 8) materials for line fishing 9) fish finders
		Communication at sea	10) radios

To permit the production of fishing gear to fit operating conditions in the various areas, the items will not be provided in finished form. Moreover, composition of the materials has been developed with a view toward giving priority to those items that are most difficult to obtain locally.

(2) Quantities and Specifications

① Gill Nets for Artisanal Fishermen

After taking into account the specifications of the gill nets generally being used locally, we have specified multi-filament nylon netting material of 210 D/3-6, with a mesh of about 50-75 mm, a mesh depth of 100 and a netting length of 100 m per roll. Both float and sinker ropes will use synthetic rope of about 6 mm diameter, with each to be composed respectively of one right and one left twist.

There are 160 fishing vessels in the planned target area, but almost all are of canoe type. We feel it would appropriate to confine the initial distribution of gill net materials to some 40 of these vessels.

In view of the loading capacity of the canoes, the probable operating constraint would be 2 rolls per vessel. In addition, there is frequent netting breakage in the gill net fishing, with a high rate of wear and tear. We have therefore added 3 rolls per vessel as spare supplies.

Accordingly, the planned total of netting material comes to 200 rolls. With 2 rolls per operating unit and a hunging ratio of some 60%, the required quantity of both float and sinker ropes, including also buoy-anchor ropes and a 30% reserve factor, comes to 135 coils at 200 m per coil. In addition, among the floats, sinkers, anchors, buoys and sewing and mending yarn needed in the gill net fishery, we have added appropriate quantities of floats, sewing and repair yarn that are difficult to procure locally.

② Materials for Small-Size Beach Seines

With Mozambique, including the Sopinho area, characterized by many coastal areas of extended shallow waters, as well as extensive sandy bottoms, the catch efficiency of beach seines

will be high. Even with non-powered vessels, this method occupies an important niche as a feasible traditional fishing method.

The side length of the wing net exceeds 100 m for the large size and runs about 25 m in the small size, with the size of the beach seines and composition of the netting material and mesh varying by area. Allowing for a size sufficient to permit a wide arc sweep by the canoe, we have decided upon about 30 m for a side length of the finished wing net, a 5 m finished length for the bag net, and 6 m for the circumference of the bag opening.

Netting materials will use 360 D - 400 D polyethylene. The wing nets will be 12-ply, with a mesh of 40 mm. Bag nets will be 9-ply with a mesh of 20 mm. The float and sinker ropes will use synthetic rope of 10 mm diameter, with each to be composed respectively of one left and one right twist. Towing rope for beach seines will have a diameter of 24 mm.

As in the case of gill net materials, some 40 vessels will be targeted to receive the materials for the small beach seines but, given the fact that this fishing method has already been established in the area, we have added a considerable quantity of extra materials, centering on netting and floats, to allow for the repair of existing beach seines and an immediate increase in their size.

Figuring a mesh depth of 50 and a netting length of 100 m per roll of netting, the required amount of netting for each small-size beach seine, after allowing for losses in finishing, will come to 1 roll each for wing and bag nets. Added to the 40 rolls each to service a total of 40 seines, the surplus quantity is set at 4 times the basic volume--- for a total of 200 rolls respectively in all.

The required quantity of float and sinker rope per seine, including boltch line, comes to 1.5 coils at 200 m per coil.

Adding a contingency allowance to the basic 60 coils for the 40 seines, we arrive at a total of 70 coils in all. The towing rope, with a single side length of 300 m, requires 3 coils per seine, with a total of 130 coils, including spares. To these quantities, we have added a necessary allowance for sewing and repair yarn and floats.

③ Hand Line Materials for Artisanal Fishermen

We look upon the entire fleet of 160 vessels in the planned area as targets for hand line distribution. Principal weight will be placed on hand line fishing, but we are allowing a reserve amount to permit the construction of gear for simple bottom longline operations. The lead and gut will be in three types of nylon monofilament, from No.10 to No.30. Fish hooks will also be in three types, "Mutsu" No.10-20. The swivels will be box-type or two-way swivel, and will be provided in 2 appropriate sizes (large and small).

The required amount of nylon monofilament will be 1 roll of 100 m of each type per fishing vessel, with fish hooks in one box of 50 pieces per type and swivels also in one box of 50 pieces per type.

④ VHF/FM Transceiver

This equipment will be used for communication at sea relating to the training program. In addition, after the fishermen's cooperatives have been organized, the equipment can be used for communication for collection of cargoes, and ice supply.

Power output will be 25 W, with 10 units to be furnished.

⑤ Radio Receivers

To guard against accidents at sea, these receivers will permit the receipt of weather information and both regular and emergency communications from the Fisheries Complex. 20 all-wave receivers will be provided.

⑥ Marine Engines

These will be used as replacement engines in constructing the 7.6 m wooden powered fishing vessels, NP-II. Thus, it will be necessary to furnish both the engine, propelar and shafting. Horse power will be about 30 PS. 10 units will be provided.

⑦ Gill Net Materials for Complex Vessels

Composition and specifications for this material will be identical to those for the artisanal fishermen. Eight rolls will be provided for operating use per vessel, with a reserve supply of double this amount. Thus, the total netting requirements for the five vessels will be 120 rolls. The rope will be similarly provided in 65 coils, including a 30% spare allowance.

⑧ Hand Line Materials for Complex Vessels

Composition and specifications will be the same as for the artisanal fishermen. The required quantity per vessel is set at four times the quantity for artisanal use. In addition, we will add a reserve of 20 rolls of each of the 3 sizes of nylon monofilament, 80-90 boxes of the various types of fish hooks, and 20 boxes of the various types of swivels for use in long line and trolling operations.

⑨ Fish Finder

Fish finders will be used to develop fishing grounds for stock assessment during pilot operations. They will also play an important role in the fishery training program.

We will provide for 10 units capable of measuring depths of up to 200 m, including spare units for use by fishermen's cooperatives and other groups.

⑩ SSB Radio Equipment

These will be used for communications between Complex vessels and shore facilities for scheduled and emergency transmissions of artisanal fishermen. Power will be 10 W, with 10 units to be provided, including spare units for use by fishermen's cooperatives and other bodies.

(3) Distribution Plan

Considering the vital role the above fishing material and supplies will play during the initial stages of operation at the Sopinho Fisheries Complex, it is all the more important to pay very careful attention to their distribution.

Based on the plan of the Government of Mozambique, inland transport to the Sopinho area will be the responsibility of EQUIPESCA, with distribution from Sopinho to the local fishermen the responsibility of the Sopinho Fisheries Complex.

It would be desirable to be able to distribute these materials without charge to the artisanal fishermen and the fishermen's cooperatives. But, even if charges must be levied, for administrative purposes, the principle must be established that fishermen will be able to obtain these materials under the most favorable conditions-- such as via payments deducted from catch proceeds upon landing at the Fisheries Complex (i.e. stipulating a repayment period and a fixed number of payments keyed to the

average volume of each landed catch).

We have outlined below the specifications for the various types of fishery materials and equipment.

Specifications for Fishing Materials and Equipment

1) Net Materials:

Nylon multi-filament netting	:	210 D/3-6; 50-75 mm mesh size; 100 mesh depth x 100 m/roll; 320 rolls
Polyethylene multi-filament netting	:	360-400 D/9-12; mesh size 20-40 mm; 50 mesh depth x 100 m/roll; 400 rolls
Repair and finishing yarn	:	one lot
Floats	:	for use in gill nets and small scale beach seines; one lot
Synthetic rope	:	diameters of 6-24 mm (200 m/coil); 400 coils

2) Hand Lines:

Nylon mono-filament	:	No.10-30 (100 m/roll); 600 rolls
Fish hooks	:	"Mutsu" No.10-20 (50 per box); 800 boxes
Swivels	:	(50 pcs/box); 400 boxes

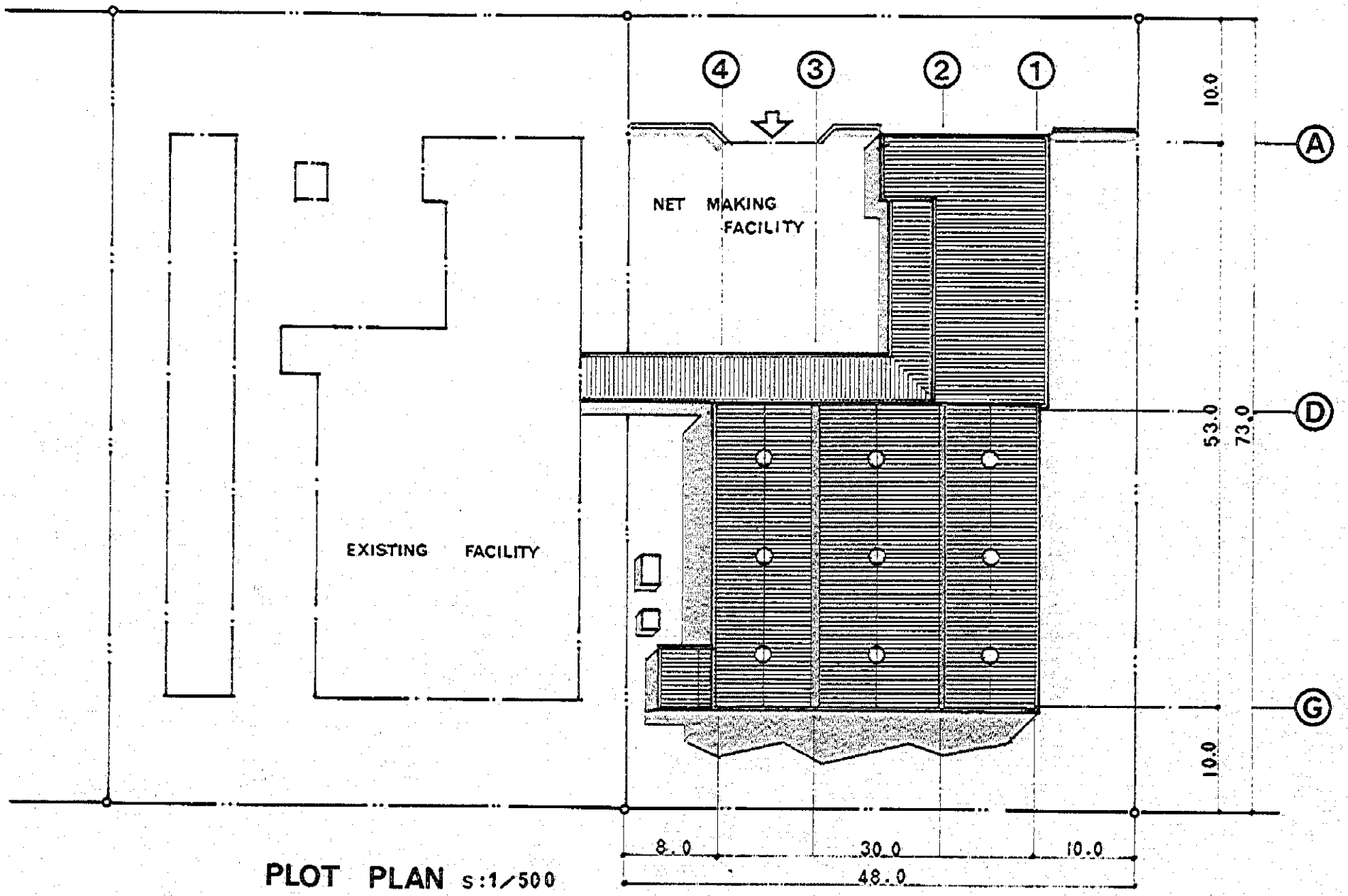
3) Equipment:

Marine engines, about 30 PS, with shafting;	10 units
Fish finders -- up to depths of 200 m;	10 "
SSB Radio (about 10 W output);	10 "

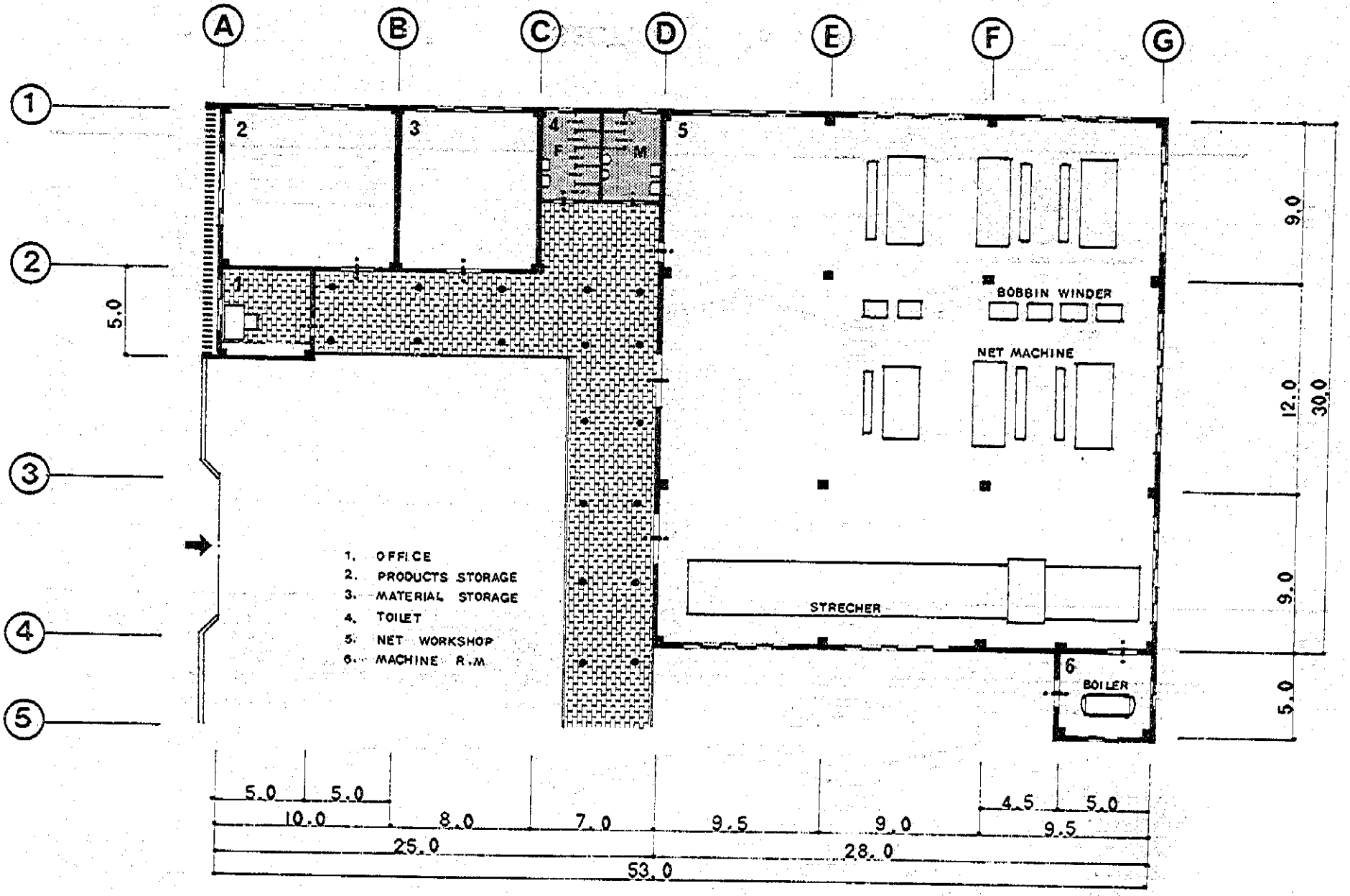
VHF/FM transceiver (about 25 W output);	10 units
Radio receivers;	20 "

4) Other necessary materials: one lot

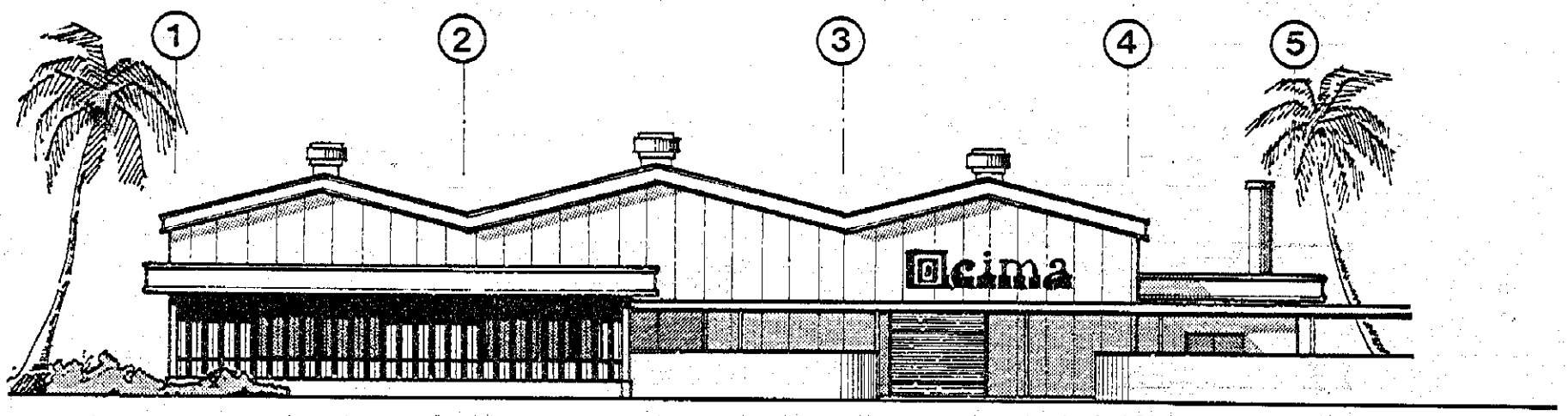
2-3 DRAWINGS



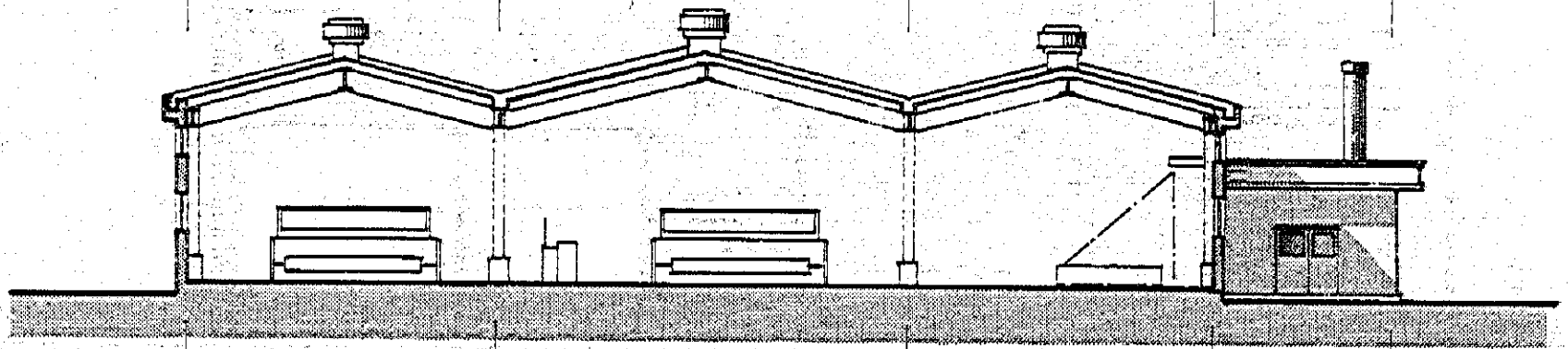
PLOT PLAN S:1/500



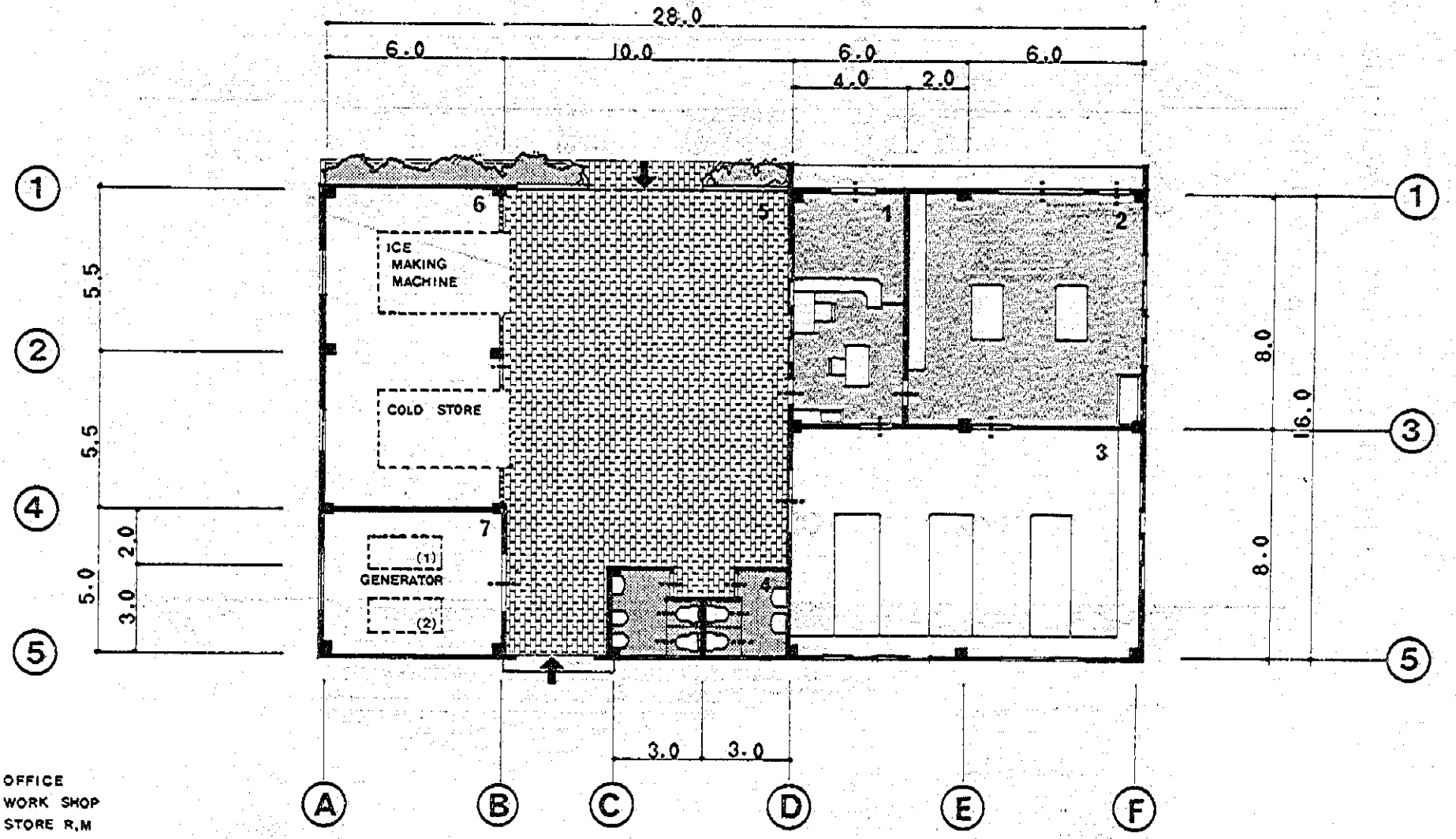
NET MAKING FACILITY FLOOR PLAN S:1/300M



ELEVATION S : 1 / 200

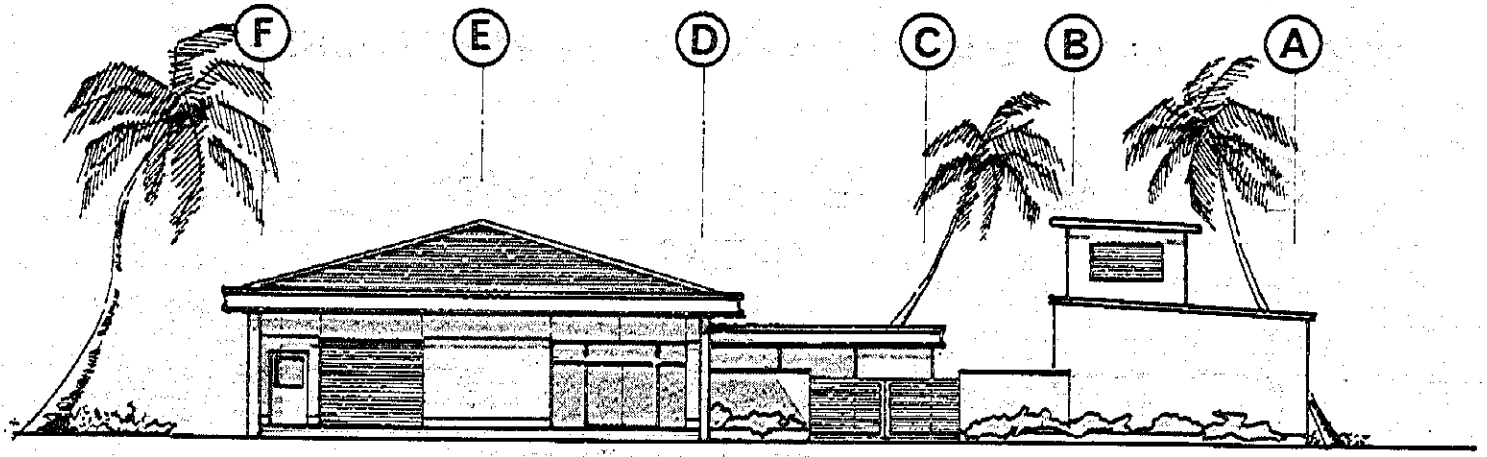


SECTION S : 1 / 200

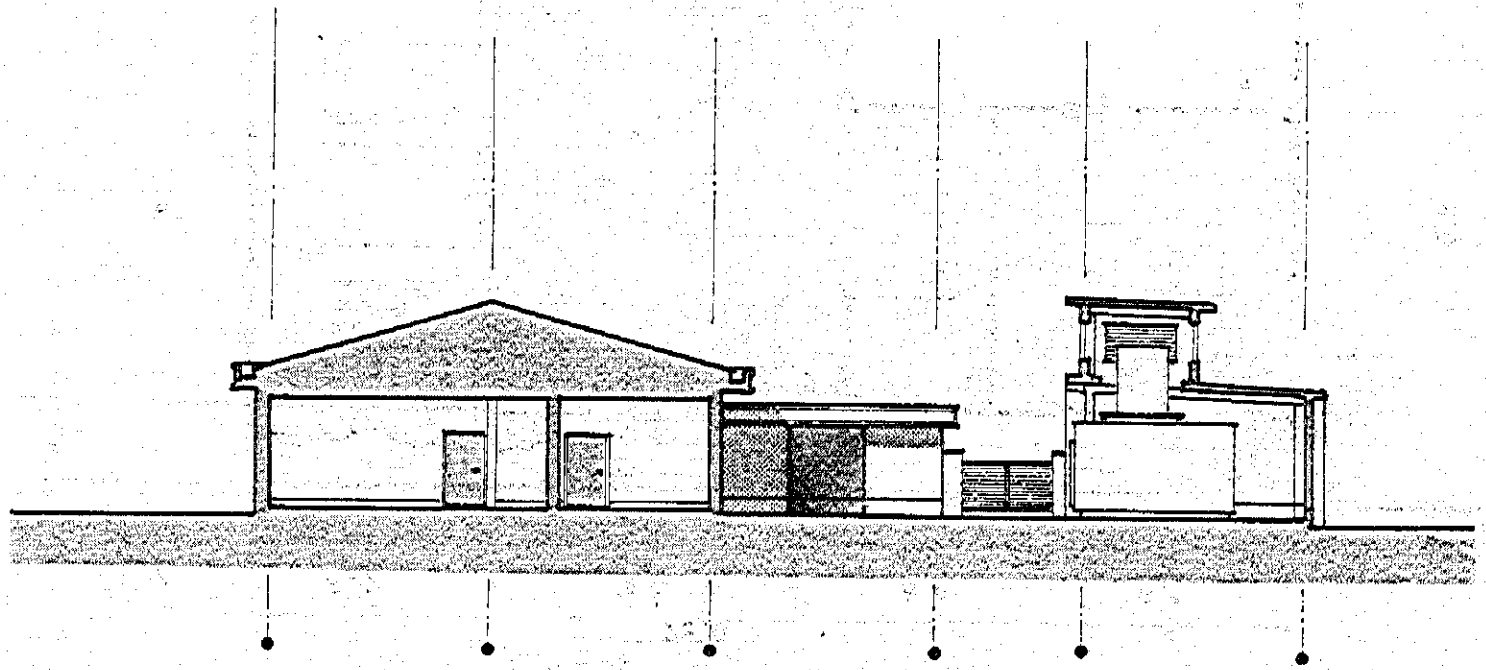


1. OFFICE
2. WORK SHOP
3. STORE R.M
4. TOILET
5. WORKING SPACE
6. MACHINE R.M
7. GENERATOR R.M

SOPINHO FISHERIES COMPLEX FLOOR PLAN S: 1/200



ELEVATION s : 1 / 200



SECTION s : 1 / 200

SECTION 3 MANAGEMENT PLAN

3-1 Net Making Facility

3-1-1 Administration

The main items of equipment presently owned by CIMA, the net making corporation, are as shown in the table on the following.

Table 3-1 Equipment Presently Owned by CIMA

(CIMA, 1982)

Pitch (m/m)	Shuttles	Applicable Twine	Mesh Range (knot-to-knot, m/m)	Manufacturer	Model	No. of Units
6.0	455	110D/2~210D/9	5.3 ~ 95	Amita Co., Ltd.	KGA6-45	1
6.75	405	210D/2~210D/12	5.6 ~ 95	"	KGC7-40	1
7.0	412	110D/2~210D/9	5.5 ~ 110	"	SET7-40	1
8.0	341	210D/4~210D/24	5.6 ~ 95	"	KGA8-30	3
8.75	311	210D/4~210D/18	8 ~ 95	"	KE9-30	1
9.0	511	210D/3~210D/18	7 ~ 250	"	ANT9-50K	2
9.0	312	210D/2~210D/18	7 ~ 110	"	SET9-30	1
10.5	311	210D/6~210D/36	8.9 ~ 95	"	KGA11-30	2
12.6	216	210D/6~210D/45	9.5 ~ 95	"	KGA14-20	1
12.7	416	210D/9~210D/18	14 ~ 100	Tanimura Mfg. Co., Ltd.	DS-400	2
17.5	156	210D/12~210D/75	16 ~ 95	Amita Co., Ltd.	KGA18-15	1
24.0	153	210D/30~210D/120	22 ~ 230	"	KGA24-15	2
25.0	109	210D/15~210D/120	22 ~ 95	"	KGC25-10	1

Total Number of Shuttles 6,181

Total Number of Weaving Unit ..... 19 units

Spool Winder ..... No. of Spindle 8 ..... 3 units

Bobbin Winder ..... No. of Spindle 8 ..... 1 unit

Depth Stretching Machine .... Stretch Capacity 4 tons ..... 1 unit

Length Stretching Machine ..... 1 unit

The volume of production through September, 1982 is given in Table 3-2 on the following page.

Table 3-2 CIMA Production History(in tons)

(CIMA, 1982)

Year	Breakdown by Type of Material		Total Production
1975	–		44
1976	–		68
1977	Nylon Multifilament	50	
	Nylon Monofilament	4	
	Polyethylene	7	
	Kuralon	3	64
1978	Nylon Multifilament	49	
	Nylon Monofilament	2	
	Polyethylene	7	
	Kuralon	2	61
1979	Nylon Multifilament	40	
	Nylon Monofilament	1	
	Polyethylene	10	
	Kuralon	5	56
1980	Nylon Multifilament	24	
	Nylon Monofilament	-	
	Polyethylene	44	
	Kuralon	8	76
1981	Nylon Multifilament	29	
	Nylon Monofilament	3	
	Polyethylene	31	
	Kuralon	9	72
1982 (Projected)	Nylon Multifilament	102	
	Nylon Monofilament	6	
	Polyester	42	150 (Actual production Jan.-Sep. totaled 102 tons)

According to CIMA, the reason for the sharp fluctuations in production from prior years reflects the fact that, owing to shortages in foreign exchange, there was a slow-down in the procurement of raw materials as well as a decline in machine utilization arising from difficulties in obtaining spare parts.

Also, four weaving units newly installed in November, 1981 were placed into operation without benefit of either installation or operating guidance from the manufacturer. As may be presumed from this, the problems relating to management and operation of the net making facilities have been less of a technological nature than those reflecting raw material procurement which antedated the technical difficulties. Thus, if these problems can be solved, CIMA, in our judgment, should be able to operate on its own without difficulty. However, from the standpoint of productivity, there is still much room for improvement.

From January - September, 1982, the total production came to 102 tons. Dividing this by the total number of spindles multiplied by operating hours, production per unit and shuttle becomes:

102,000 kg (6,181 shuttles x 16 hours/day x 5 days
x 39 weeks) = 0.005289 kg/hr/spindle

In this connection, we may note that, when the planned installations of net weaving machines goes on stream, the above figure should rise to:

0.005289 kg / 2,310 shuttles x 16 hrs. x 5 days
x 52 weeks = 50,825 kg.

But even so this would not even meet half of the production target. A prodigious effort to raise productivity is thus hoped for.

3-1-2 Personnel Plan

As of November, 1982, CIMA had a total of 115 employees, of

which 105 were workers and 10 managers or technicians. There were 2 shifts a day of 9 hours each. Personnel requirements for the planned new net making facilities, weaving machines, depth stretching machines and bobbin winder are as follows:

Petty manager	1 person x 2 shifts	2 persons
Net-making section	10 persons x 2 shifts	20 persons
Heat treating, inspection, finishing section	5 persons x 2 shifts	10 persons
Warehouse operation	1 person x 2 shifts	2 persons
Total	17 persons x 2 shifts	34 persons

Existing personnel should be ample for overall managerial and technical direction. Through strategic placement of skilled workers and proper training programs, operations become quite viable.

With respect to machinists, the Japan International Cooperation Agency (JICA) has a facility in Japan for training engineers. Active use should be made of such foreign training programs, in Japan and elsewhere, in an effort to improve technical levels. In this way, we may expect a further rise in equipment operating rates.

3-1-3 Operating Costs

(1) Power

69 kw x 0.7 x 16 hours = 77.28 kwh/day
772.8 kwh x 240 days = 185,472 kwh
At 1.81 MT per kwh,
185,472 kwh x 1.81 = 335,704 MT,
rounded out to 336,000 MT/year

(2) Water

To be furnished from a captive well. Thus, no charge is necessary.

(3) Fuel

Based on boiler operation 2 days on/2 days off, for 8 hours a day .....

58 lit./hour x 8 hours/day x 80 days = 37,120 liters

At 10 MT per liter .....

37,120 lit. x 10 = 371,000 MT,

rounded to 371,000 MT/year

(4) Labor

Management personnel:	2 persons @	10,000 MT/m.	20,000 MT
Workers:	32 persons @	3,500 MT/m.	112,000 MT
Total			132,000 MT

132,000 MT x 12 months = 1,584,000 MT/year

(5) General Administrative

at 10% of above total (1, 3, 4)

2,290,000 MT x 0.1 = 229,000 MT

(6) Depreciation

Since this program is based on grants-in-aid, no provision for depreciation is required. However, for the purpose of judging possibility of generating funds for continuing reinvestment, it should be calculated in accordance with the standard of useful life in the Japanese Income Tax Law.

Useful life: 35 years for the building
15 years for facilities attached to the building
10 years for machinery

Based on constant sum depreciation, the rate of annual depreciation works out to:

2,491,000 MT/year

(7) Annual Operating Costs for the Net Making Facility

Power	336,000 MT
Fuel	371,000
Labor	1,584,000
General & administrative	229,000
Sub-total	2,520,000
Depreciation	2,491,000
Total	5,011,000 MT

3-2 The Sopinho Fisheries Complex

3-2-1 Managment

In Japan, economic activities of a fishery cooperative include the following:

Member operations
- fishery operations
- financial services
- savings and other credit operations

Purchase and supply operations
- supply of every day essentials

Marketing operations
- transport, processing, storage or sale of members' catches and other products
- the establishment of joint-use facilities necessary to the operation or livelihood of the members; arranging for members to use these facilities

In addition, some cooperatives also give technical guidance to their members.

According to the plan for the Fisheries Complexes in Mozambique, most of these activities are to be carried out by the Fisheries Complexes.

One point that must be carefully borne in mind is the fact that the Fisheries Complexes are to engage in their own fish production activity.

Fishermen's cooperatives are as yet unorganized but, even after they are organized, their foundation will remain weak. Thus, given the present small scale of Mozambique's fisheries which gave rise to the subject plan to organize and firmly establish fishermen's cooperatives, this situation is unavoidable.

However, the operation of a Fisheries Complex is no more than a government service; it should play only a supplementary role in the smooth development of fishery cooperatives and should not replace or compete with the functions of these associations. In particular, the Sopinho Fishereies Complex, as a state entity (Empresa Estatal), should avoid a situation where in an effort to make its fishery operations profitable, it introduces powered vessels and modern gear and method which may serve to put pressure on the species and livelihood of local artisanal fishermen who still use antiquated gear.

To avoid this danger, the fishing operations of the Fisheries Complex should not extend beyond pilot operations and operational guidance to artisanal fishermen for purposes of developing undeveloped species and new fishing methods. The Fisheries Complex should strictly refrain from such activities as fishing in the same grounds for species competing with artisanal fishermen.

With regard to the management and operation of the facilities, particularly the servicing and repair of the icemaker and refrigerator, this can be handled by mechanics and electricians of the engineering corporation, TECHNIPESCA, which is under the aegis of the Secretariat of State for Fisheries. And graduates of the Fisheries Training Center can be expected to operate vessels and provide guidance to artisanal fishermen.

3-2-2 Personnel Plan

For the initial stage, the Sopinho Fisheries Complex would require the following staff:

Manager	1 person
Mechanic	1 person
Wharehouse manager	1 person
Worker	1 person
Total	4 persons

Engineers from TECHNIPESCA can take care of servicing and checking the ice-maker and refrigeration facilities through periodic visits. When the number of powered vessels starts to be assigned, consideration can be given to adding engineering staff. For the time being, however, the above personnel requirements should be adequate.

3-2-3 Operating Budget

(1) Power

Self-generated; no charge.

(2) Water

To be obtained from the Complex' own well; no charge.

(3) Fuel

50 PS x 0.9 x 185 g/hours/PS x 24 hours x 365 days
= 72,927,000 g
= 72,927 kg
= 85,762 lit.

85,762 lit. x 10 MT = 857,620 MT,
rounded to 858,000 MT/year

(4) Labor

Manager	10,000 MT/month
Mechanic	8,000
Warehouse manager	6,000
Worker	5,000
Total	29,000 MT/month

29,000/month x 12 months = 348,000 MT/year

(5) General and Administrative

Set at the total of (3) and (4) x 10%,
1,206,000 MT x 0.1 = 121,000 MT/year

(6) Depreciation

Since these facilities are expected to be covered by a grant-in-aid, this section is not applicable. However, for the purpose of judging reinvestment possibility, we may calculate depreciation, on a constant sum basis keyed to useful life pursuant to the Japanese standard, as follows:

Useful life of building	22 years
Useful life of machinery and equipment	13 years

860,000 MT/year

(7) Annual Operating Budget for the Sopinho Fisheries Complex

Fuel	858,000 MT
Labor	348,000
General & administrative	121,000
Sub-total	1,327,000
Depreciation	860,000
Total	2,187,000 MT

(8) Annual Operating Budget for Fishing Vessels Attached to the Fisheries Complex

The fishing vessels themselves will not be provided under the grant-in-aid, but we have tentatively estimated annual budget requirements as follows:

Based on the conditions set forth in the preceding Section;

No. of Complex fishing vessels	5 No.
Days of operation per year	180 Days
Engine Horse Power	30 PS

With a crew of 5 men per vessel and 8 hours of operations per day, the budget works out as follows:

Labor Cost:

5 persons x 5 vessels x 3,000 MT/day x 12 months = 900,000 MT/year

Fuel Cost:

5 vessels x 30 PS x 0.185 kg/ PS/hour x 8 hrs. x 0.8 x 180 days
= 31.968 kg/year

31.968 kg ÷ specific gravity 0.85 = 37,609 lit.

37,609 lit. x 10 MT = 376,090 MT/year

Lubricating Oil:

At 10% of fuel cost = 37,609 MT/year

Total Costs: 1,313,699 MT/year

SECTION 4 IMPLEMENTATION PLAN

4 – 1 Implementation Schedule

Prior to the start of construction on the net-making facility and the Fisheries Complex, the Government of Mozambique should assume responsibility for the following related activities;

(1) Final determination of the facility sites; obtaining agreement among responsible government departments; procedures for obtaining approvals.

(2) Relocation or removal of homes and related facilities in the projected site areas.

(3) Site preparation and leveling, as necessary.

(4) Supply of electricity in sufficient amounts into the sites and preparations to permit construction to process smoothly after arrival of construction materials.

(5) Procedures for obtaining construction approvals.

(6) Arranging for the duty-free clearance of construction materials, equipment, vehicles, and other materials and supplies necessary to the implementation of this project.

(7) Arranging for the smooth clearance of materials and supplies through customs; storage of equipment in a suitable warehouse for securing against exposure to the elements; and measures to guard against damage to or theft of the materials and supplies.

Under the contemplated project schedule, it is expected that, following the Exchange of Notes and assuming the smooth execution of a consultant agreement, biddings based on tender specifications, drawings, and tender documents to be prepared by the consultants, the delivery of net making facility, the Sopinho Fisheries Complex,

and the fishing gear and materials can be completed within about 10 months from the conclusion of a construction and supply contract.

The work-flow chart for this project is as follows.

The Work-flow Chart