

#### 4-3-7 Personnel Plan

The personnel at this center consists of director, assistant director (in charge of training), engineers engaged in seed production, investigation & research of aquaculture, engineers for maintenance and management of facilities, and general office workers. Seed production, Investigation and Research of aquaculture Division is divided into 2 sections. These are the Prawn Section and Fish/Cuttle fish section. Each section has one person in charge of general research, two persons for breeding management and feeding, and 2 persons for pond management.

Usually 2 alternating system are in operation, with a total of 9 staff members in each section:  $(2 \times 2) + (2 \times 2) + 1$  chief of research = 9 persons. The manager is expected to be a man of talent who has a wide knowledge of oceanography, and experience in administrative management. The vice manager is expected to be a person with initiative who has a high-level knowledge about aquacultural techniques and is good at the personnel management.

Position	Charge	Number
Director	General management	1
Assistant Director	Assistant to Director and general management of training section	1
General affairs department Department Manager	Management of finance, account and general affairs	1
	Clerk	2
	Secretary	2
	Worker	4
	Driver	3
	Watchman	3
	Cook	1
Prawn department Department Manager	Management of prawn seed production, culture, and research	1
	Researcher	1
	Technician	2
	Worker	5
Fish and cuttle fish department, Department Manager	Management of fish and cuttle fish seed production, culture and research	1
	Researcher	1
	Technician	2
	Worker	3
Maintenance	Mechanician	3
Total		37

#### 4-4 Construction Plan

##### 4-4-1 Results of site survey

###### (1) Infrastructural conditions

###### ① Roads

To reach the planned construction site, there is an unpaved road which goes from the PDRY Oil Refinery Hospital towards the seashore. Where the road becomes asphalted, approach to the facilities is through the admission passage to the site which is at a short distance from the road. The distance between the hospital and the planned site is about 500m.

###### ② Electric power

The supply of electric power is in the hands of the Public Corporation for Electric Power. Power supply is 240V, 415V, 1.1KV, 3.3KV. The electricity is supplied in the frequency of 50hertz(Hz). For electric power installation, three-phase 415V is applied. The standards for the electrical installations are being set at the moment and this construction work will be carried according to either JIS or BSCP.

Electric power is transmitted to the planned construction site from a 3.3KV substation in the PDRY Oil Refinery Hospital which is located at a point some 500m from the construction site. The person in charge of this company understands the conditions. The PDRY Government will lay electricity under the ground and supply it to the planned facilities by using three-phase 415V and a single phase 240V.

###### ③ Water supply

Water can be supplied from no other source than the PDRY Oil Refinery Hospital. The person in charge of water supplies at the company comprehends this situation. Under the present conditions, suspension of water supply are possible. So, as for water supply to the planned facilities, the PDRY Government will convey water into the elevated water tank on the rooftop of the administration building. And water is gravitationally supplied to the facilities.

④ Sewerage

Since sewerage facilities are not installed in this district, sewerage shall be disposed of within the site. Drainage and contaminated water must be disposed of by the purificatory cistern and biological affluent, and wooden containers are provided for human waste. Sewerage must be carried out by vacuum pump car. Drainage of cultivation pond is disposed of at the seaside.

⑤ Gas

In the site, there is no installation for supplying city gas. So gas is supplied into the planned facilities by propane gas.

(2) Results of survey and sounding

The fig. 4 exactly shows the results of the site survey, as well as sounding. The site faces the inlet enclosed by the peninsula projecting outwards on the east side and the island connected by Tomboro on the west side. At the shore which is located in south side of the site, base rocks are exposed. And the part at about 70m in depth is almost flat sandy beach is DL + 2.7 - 3.0 meters deep. the north side of the site gradually rises with an incline of about 1/10.

Sounding reveal that the sea bottom dips toward the center of bay, with an extremely shallow incline of about 1/80. During the monsoon period, the sand of sea bottom in the whole bay is churned up.

(3) Boring

Organization which conducted survey: People's Democratic Republic of Yemen  
The Institute for material inspection,  
the Minister of Construction

Date of survey: 1985 August 8 - August 12

Place for survey: The planned construction site for Little Aden Aquaculture  
Research Center

① Conditions of site

The scheduled building site of this project is situated to the east of the Little Aden bathing area. The north side consists of two sections. One section is the trapezoid section marked at the access and branch roads. The other is the section of a rectangle whose one side is about 170 meters length on coastline. The construction site covers an area of about 3 hectares. On the coastline, base rocks are exposed. However, except for this, the area is mainly flat sandy beach covered with fine particle sands stretching for about 70 meters towards the north. The transformed part of the site is the land with an incline of about 1/10. And this part contains almost white-coloured granular sand with some shell fragments. As a main feature of the project, culturing ponds will be built on the flat part which is near the seashore, and the building of administration and research is constructed on inclined land. If this center is situated in almost the middle section, cutting and filling are estimated as about 2.0m respectively over and under the average ground level.

② Outline of survey

In order to get ground data for planning, we investigated ground composition by conducting rotary boring of caliber 150mm, at three points, A, B and C shown in the diagram of the survey point location. Along with this, we conducted the standard penetration test regulated at B.S., at points each of 75 centimeters in depth. And we found N, the number of strikes required in order for the sampler to penetrate to a depth of 30 centimeters. By these means, we investigated ground consistency. These samples show cross-sections of soil and have been arranged for the convenience of observers.

③ Geological Outline

Point A ( Surroundings of the planned construction site for the administration and research building).

The section from ground level to G.L. -3.00m is composed of loose white slightly yellow sand with crushed shells. The section from G.L. -3.00m to

-7.30m in depth is composed of grey dense gravel with crushed shells and pebble stones. From G.L. -7.30m to G.L. -8m is composed of very dense dark brownigs grey silt matted gravel, from G.L. -8m to G.L. -9m is composed of dense dark brownish grey coarse gravel with pebble stones. N value at G.L. -3.00m shows high number as 38 as it is underground water level, and the site can be used for spread foundations if the lower layer is of RC construction. The underground water level is at a minimum of F.L. -5.50m, maximum of G.L. -3.60m.

Point B (Surroundings of the planned construction site for large sized cultivation pond)

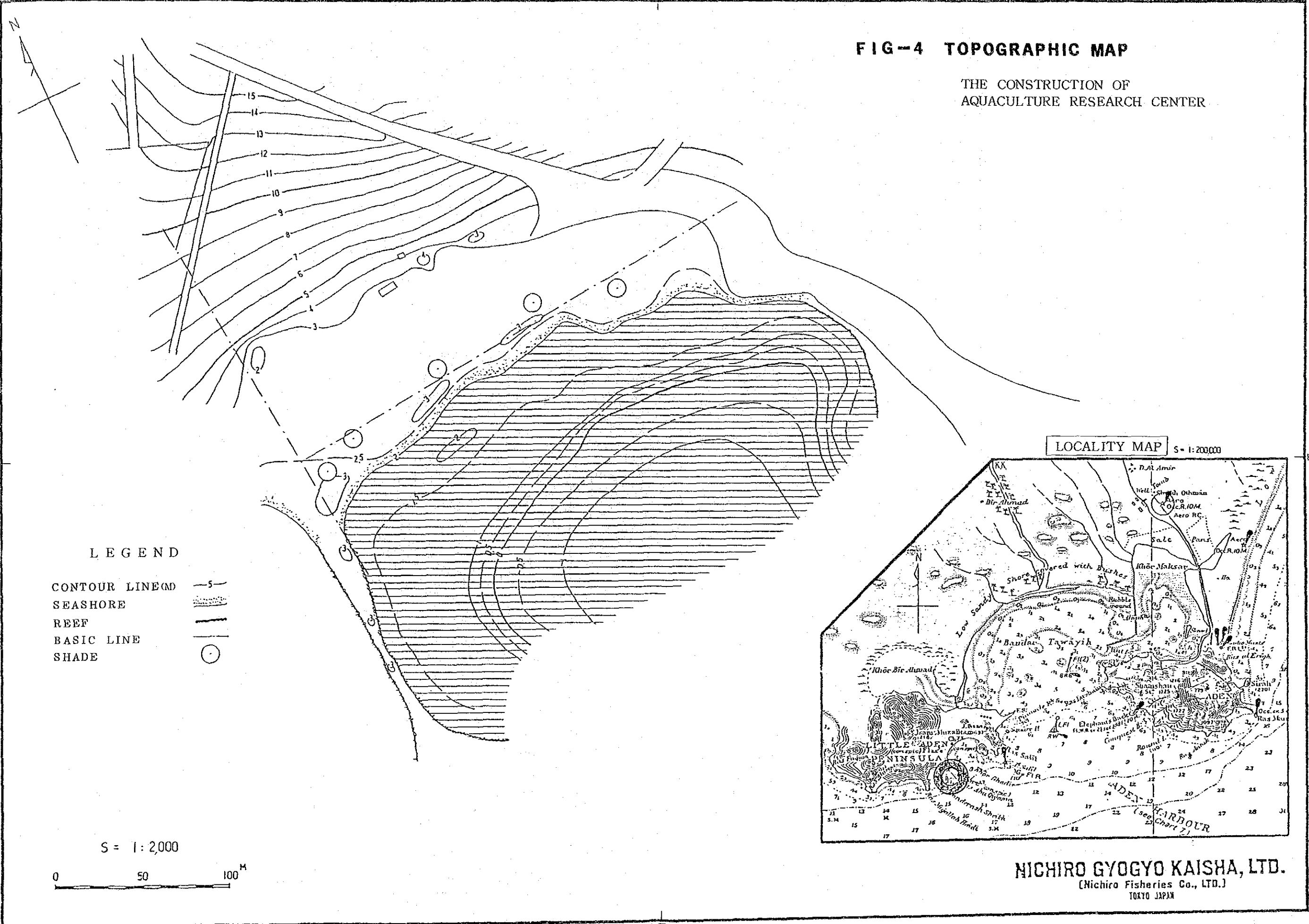
the section from ground level to G.L. -2.25m is composed of grey coarse sand of medium density with pebbles. From G.L. -2.25 to G.L. -2.50m consists of grey yellow white medium dense sand with pebbles. From that level to G.L. -6m, consists of shells fragments, medium density grey sand with pebbles. N value at G.L. -2.25m shows 35 and is high. Underground water level is at its minimum G.L. -2.50m, at the maximum G.L. -1.40m.

Point C (Vicinity of the planned construction site for water receiving pit)

From the ground level to G.L. -1.90m consists of loose light grey coarse sand with crushed shells and pebbles. To G.L. -2.80m consists of medium dense dark grey silty sand with gravel and shell. Around G.L. -3.90m, consists of very dense dark gray coarse sand and shell with crushed aggregate and it is not possible to excavate. N value is high on the whole and it shows 39 at G.L. -1.50m, 30 at G.L. -2.25m, 50 at G.L. -3.00m.

**FIG-4 TOPOGRAPHIC MAP**

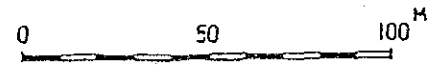
THE CONSTRUCTION OF  
AQUACULTURE RESEARCH CENTER



**LEGEND**

- CONTOUR LINE (M) — 5 —
- SEASHORE ———
- REEF ———
- BASIC LINE - - - - -
- SHADE ○

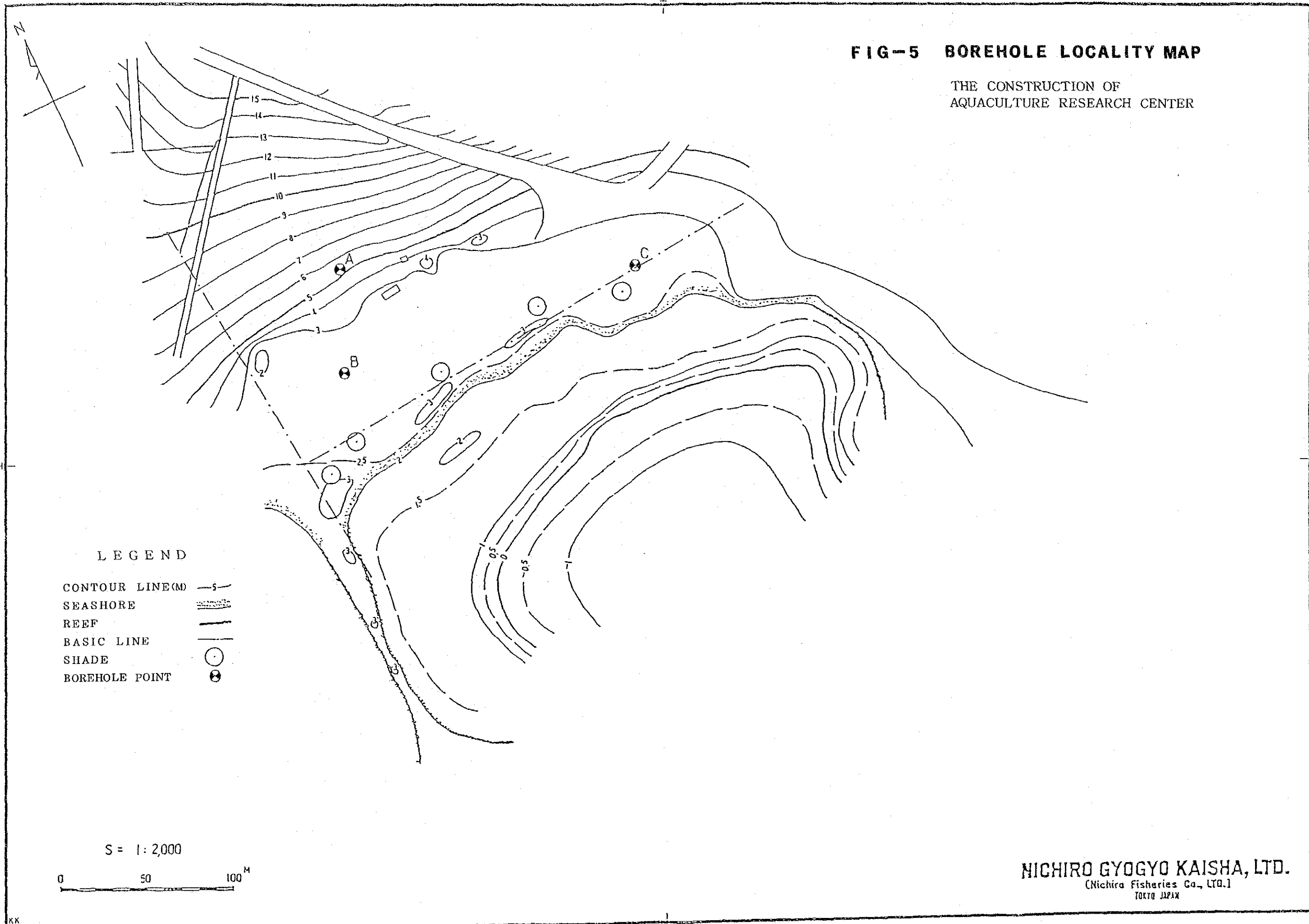
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




**NICHIRO GYOGYO KAISHA, LTD.**  
[Nichiro Fisheries Co., LTD.]  
TOKYO JAPAN

**FIG-5 BOREHOLE LOCALITY MAP**

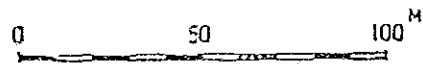
THE CONSTRUCTION OF  
AQUACULTURE RESEARCH CENTER



**LEGEND**

- CONTOUR LINE(M) — 5 —
- SEASHORE 
- REEF 
- BASIC LINE 
- SHADE 
- BOREHOLE POINT 

S = 1:2,000



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TOKYO JAPAN



BOREHOLE POINT: A  
DATE (STARTED):

**BOREHOLE LOG**

DEPTH (M)	LOG AND THICKNESS	CLASSIFICATION	STANDARD PENETRATION TEST		
			DEPTH (M)	NO. OF BLOWS AT EACH 30 CM	N. VALUE
			0.0		
		Loose white slightly yellow fine uniform sand slightly fine shell slightly moist.	0.75		
		dense red brown ground slightly sand.	1.50	9 9 7	
		med dense gray white yellow big and crushed shell with compacted coarse sand slightly silt more moist. water sand.	2.25	15 13 7	
3.00		Very dense white yellow gray black compacted shell sand slightly gravel more moist.	3.00	20 10 8	
3.50		Dense dark to gray slightly silty med gravel sandy silt slightly cement sand more moist.	3.75	3 5 6	
4.00		Dense brown dark gray silty sand mottled crushed med gravel med moist.	4.00	9 13 15	
5.00		very dense brown dark gray fine sand slightly silt med moist.	5.25	21 19 10	
5.50			6.00	11 12 21	
6.00		med dense dark gray slightly brown to red black coarse sand slightly shells gravel more moist.	6.75	5 4 9	
7.00			7.50	19 17 17	
8.00		Dense brown red dark to gray slightly white coarse sand silt mottled gravel more size same med moist.	8.25	6 5 6	
8.50			9.00	6 9 28	
9.00			9.75		
			10.50		
			11.25		

STUDIES AND RESEARCH DEPARTMENT  
SOILS AND MATERIALS LABORATORY  
KHORMAKSAR

BOREHOLE POINT = B  
DATE (STARTED) :

**BOREHOLE LOG**

DEPTH (M)	LOG AND THICKNESS	CLASSIFICATION	DEPTH (M)	STANDARD PENETRATION TEST	
				NO. OF BLOWS AT EACH 10 CM	N. VALUE
0.0		Med dense light brown coarse sand shell slightly moist	0.0		
0.75		Med dense light gray uniform silty sand Med dense light gray coarse sand with crushed shell slightly moist Silt 15mm more moist Dense whitish gray brown coarse sand mottled shell hard more moist	0.75	18	8 5 5
1.50		Med dense light gray uniform silty sand	1.50	11	5 4 3
2.25		Med dense light gray coarse sand with crushed shell and gravel slightly mottled brown gray silt of sand and sand more moist	2.25	35	11 13 11
3.00		Med dense gray fine grained sand with sand shell med gravel more moist	3.00	6	3 2 1
3.75		Med dense gray silty sand more moist	3.75	13	1 1 11
4.50		Med dense gray silty sand more moist	4.50	13	3 4 6
5.25		Med dense gray white sand slightly gravel with big size shell from to common more moist	5.25	23	7 9 7
6.00			6.00	22	5 8 9
6.75			6.75		
7.50			7.50		
8.25			8.25		
9.00			9.00		
9.75			9.75		
10.50			10.50		
11.25			11.25		

BOREHOLE POINT = C  
DATE (STARTED) :

**BOREHOLE LOG**

DEPTH (M)	LOG AND THICKNESS	CLASSIFICATION	STANDARD PENETRATION TEST		
			DEPTH (M)	NO. OF BLOWS AT EACH 10 CM	N. VALUE
0.0			0.0		0
0.75		Loose light gray coarse sand with crushed shell mottled with med gravel slightly moist. water level 0.9M.	0.75		
1.50		med dense dark to gray silty sand with gravel and shell.	1.50	18	12
2.25		very dense brown to red, dark gray coarse sand and shell with crushed aggregate. max size 60 mm more moist.	2.25	9	11
3.00			3.00	50	--
3.75			3.75		
4.50			4.50		
5.25			5.25		
6.00			6.00		
6.75			6.75		
7.50			7.50		
8.25			8.25		
9.00			9.00		
9.75			9.75		
10.50			10.50		
11.25			11.25		

#### 4-4-2 Site and arrangement plan

##### (1) Conditions of site

The planned site of this project are situated in the Little Aden district which is located west-southwest of Aden. And the site is part of bathing area which is about 500 m down a gently sloping unpaved road from the Hospital owned by the PDRY Oil Refinery. The site faces the inlet enclosed by the peninsular jutting out on the east side and island on the west side. At the building site, there are five shades for bathers, shower rooms and a purification cistern. But the part involved in the planned building site will be removed.

The coastline on the south side consists of craggy cliffs. The part of about 70 m in depth is mostly flat sandy beach. On the north side of the site, the land with an inclination of about 1/10 extends to the boundary line of the site. The west side of the site is sandy beach, facing shark bay, which is crowded with sea bathers on holiday. In the adjacent area jutting out on the east side, steep slope is very close and the flat part is small. But in this area, the Maritime Research Center is aided by funds from UNESCO and the Islam Bank.

The planned site of this project ranges over an area of about 170 meters wide on coastline and about 170 meters length on the direct crossing line. On the north side, the point of intersection between roads is transformed. So the site is about 30,000 square meters (3ha) in area.

##### (2) Fundamental principle on arrangement plan

The planned site for the project are divided into a south side section adjacent to seashore and a north side section on the side of access. The ground level in the plan on the north side is set up on the level of 3.5 m higher than flat south side. Since the frequency of contact with the outside is high in the administration and research section, this building will be stationed close to the entrance to the site, linked with the access road on

the north side. As water supply installations are set up on the seaside, the building for seed production and cultivation will be stationed there. As for those facilities which comprise each field stated above, the nature of each field and the line of work flow should be taken into full consideration. And the plot plan should be arranged so as to facilitate the efficient running of the center as a whole.

In establishing the ground level in each facility, it should be taken into consideration that filling and cutting must be kept to a minimum.

### (3) Arrangement plan

At the entrance to the site the road is forked. One road is the approach to the division of administration and research. The other is the road to the division of seed production. The entrance to the site will be extended to reach the culture pond area and seed production building because this road is necessary for not only the shipment of seeds and the sending in of production materials but also the maintenance and management of facilities.

As for outdoor facilities, in the division of seed production there will be two large-sized culture ponds in low levelled area close to the coast. On a 1.5 meter higher level, there will be five small sized cultivation ponds and an FRP-made ponds. On the south east edge of the site, facilities for water supply are to be built. On the west side, of small sized culture ponds the machine room will be installed. Near the building of administration and research, there is parking space for about 10 cars.

### 4-4-3 Building plan

#### (1) Ground plan

##### ① Administration and research building

This building has both the administrative function and the researching function. Parts common to both are the library, conference room and archive. The building is functionally divided into the north side's

two-storey block for the administration division close to the entrance to the site, and the south side's one-storey block for the research division close to aquaculture facility. The two blocks are linked by a covered walk. The space between the two buildings has the character of a courtyard. According to the ground plan, the facilities are open to the outside, and built taking the climate and living customs of the PDRY into consideration. The facilities play an effective role in supervision of aquaculture and general administration. On the east side of the research block, there will be a dining room and kitchen along with sleeping accommodation for researchers. These installations are totally separated from the research division. Also, the part of the upper floor on the east side is allocated as the space for cars for this center's exclusive use.

## ② Seed production building

This facility is for the purpose of seed production with a water tank for hatching and culture and covers a large area. The water tanks are made of reinforced concrete. The movable FRP tank is also situated with due regard to the line of work flow operation and management. As other necessities for seeds production offices, night watchman's room, cold storage and the culture room for pure strains and feed rooms are planned. A part of construction framework is the upper floor. Here, as water tanks of FRP are scheduled to be installed. Also part of this space will be used for a warehouse and workshop, both of which will be used for the work of the whole seed production division.

## (2) Sectional plan

### ① Administration and research building

The result of the survey shows that ceiling height in buildings of the PDRY is legally stipulated at more than 3.00 meters, in order to lessen the radiation impact due to direct sunlight transmitted through the roof surface. To ensure good ventilation, windows and ceiling fans are employed. In the build-

ing of administration and research, regional character should be respected and the storey height of the construction should be set at about 3.30 meters. Floor height in the living area is sufficient to resist moisture absorption from the ground. We consider 30 centimeters to be enough for the floor height. The floors of the administration division and research division are set up in such a way to minimize the gap between the floor and the existing ground surface. To conduct rational ground design structurally, the floors are planned for a gap between the floor and ground surface of about 1 meter.

## ② Seed production building

The seed production building is steel-framed. And the seed production division which is the main facility is situated in the middle of the construction framework. The seed production building whose ceilings are not boarded reveal the bare structure. The height of the building is set at 3.0 meters which is the minimum requirement limit. And the maximum height of the roof with an inclination of 9 centimeters is about 6.3 meters. Since rainfall is very low in the PDRY, there is less necessity to determine roof inclination from the perspectives of rain disposal. In this case, we chose billowy asbestos slate, considering the arrangement of roof materials.

## (3) Plan for location of buildings

The following points are taken into account in the plan for location of buildings.

- \* The period of high temperature lasts for a long time throughout the year.
- \* Rainfall is very low throughout the year.
- \* Sandstorms are frequent.
- \* The key materials which can be procured in the PDRY, are in short supply. And the term of construction work is restricted.
- \* There are some reinforced concrete buildings mainly functioning as frameworks. But on the actual construction level, there are less reinforced concrete buildings, in general.
- \* The traditional method of construction, masonry, is widespread. Concrete blocks produced in the PDRY are used in the bond building.

## ① Roofing

In the PDRY, rainfall is little. Among old public buildings, walls are built of bond and roofs are built of simple wooden-made tie beam and corrugated iron plate with slight inclination. The inside of buildings is like hut. Except for this, most of roofs are built of reinforced concrete slab including the buildings which are being constructed at present. It is usual for rooms not to be ceiled and cinder concrete, waterproof layer and compressed concrete or gravel are put on top of the slab.

The building of administration and research of this project is built of reinforced concrete. As for its roof, the general method of construction in the PDRY is adopted. The same method also goes to machine rooms built of blocks. The seed production building is built of reinforced concrete. Its roof is inclined. Because of the proximity of the building to the seashore and the insulation ability, corrugated slate is used as roof material.

## ② Walls

In the PDRY, walls are mainly built by the bonding of concrete blocks. Materials are relatively accessible. And this is widespread as a traditional method of construction. To reduce that heat escapes from wall surface, the air portion of the block is effective. Heat insulation materials as such are not used. The inside and outside of walls are completed through construction work by mortar or plaster.

In this project, the building of administration and research is built of reinforced concrete. The seed production building is steel-framed. In principle, for external wall, 20 centimeters thick concrete blocks are used and for the partition wall between rooms, 15 centimeters thick concrete blocks are used on all parts. And the walls are finished with plaster. For the external walls of the seed production building, corrugated slate is used except for the bottom part, considering the arrangement on actual building.



### ③ Openings

In the PDRY, wooden frames and wooden tools are used in general. Public buildings which are under construction, mostly have wooden window frames. However, in terms of the degree of finishing and precision, they are not satisfactory. And the cost is high. So in this project, aluminium sash is used exclusively for both external and internal walls.

### ④ Floor

In the PDRY, floors are mostly finished in mortar. In living rooms of public buildings, Terrazzo blocks are mainly used. Tiles built of vinyl chloride are little seen. Also in this project, we planned to complete floors by using mainly domestically obtainable materials for finishing as much as possible.

### ⑤ Interior

In the PDRY, ceilings are high. Direct plaster work is common. Boarded ceilings are rare. In this project, ceilings are in the building of administration and research to conceal water pipes. Also, ceilings are boarded in the office of the seed production building. However, most of the ceilings are plastered. Walls are mainly finished in mortar as mentioned above. After that, walls are painted.

Administration and research building

Reinforced-concrete building

Total floor area of the two-storied house 700.00m<sup>2</sup>  
(ground floor 590.5m<sup>2</sup>, first floor 232.5m<sup>2</sup>)

Corridor and others 123.00m<sup>2</sup>

Execution Area 823.00m<sup>2</sup>

Walls

External Wall.....Concrete block Thickness 200m/m

Partition Wall.....Concrete block Thickness 150m/m

Windows and doors..Aluminium sash

Finish

Facing

Roof :Two layers of waterproof asphalt sheet protective  
mortar finish

External wall :Mortar Finish, Lithing spraying

Baseboard :Mortar Finish, steel trowel finish

Porch floor:Clinker tile

Interior

Name of the room	Floor	Baseboard	Lower side wall	Wall	Ceiling
corridor	clinker tile	Terrazzo block	Mortar finish V.P. finish	as left	Light weight steel frame base
Lavatory	Mosaic tile	100x100 tile	as left	as left	Decorated board application
All other rooms	Terrazzo block	Terrazzo block width 10cm	Mortar finish V.P. finish	as left	plaster finish

Lodgings	Punch carpet	as above	as above	as above	as above
Dining hall	Linoleum	as above	as above	as above	as above
Kitchen	Mortar finish	Mortar finish V.P. finish	as left	Decora- ted board	as above
Lavatory	Mosaic tile	100x100 tile	as left	as above	as above

Seed production building

Steel framed building

One-story

total floor area 896.00m<sup>2</sup>

Covered Area 224.00m<sup>2</sup>

Execution area 1,120.00m<sup>2</sup>

Walls

External wall.....The lower part, concrete block,  
thickness 150m/m, H=1.00m  
Others, covering with short pitch  
corrugated Slates

Partition wall.....Concrete block  
thickness 150m/m

Windows and doors..Aluminium sash

Finish

Facing

Roof :Covering with long pitch corrugated slates

External wall:Covering with short pitch corrugated slates

Lower part (To FL up to 1.00m above)

Mortar finish, Lithing spraying

Baseboard : Mortar finish, steel trowel finish

Open space floor:Concrete slab on grade, steel trowel

finish

Interior

	Floor	Baseboard	Wainscot	Wall	Ceiling	Note
Seed produc- tion rm.	Earth floor of concrete steel trowel	Mortar finish	Mortar finish			steel o.p. finish
Office rooms	Terrazzo block	Terrazzo block width= 100mm	Mortar V.P. finish	as left	Board o.p. finish	

Culture room of original seed	Mortar finish	as left	as above	as above	as above
Lavatory	Mosaic tile	100sq. tile	as left width=1.0m	as above	as above
Store house	Earth floor of concrete steel trowel	Mortar finish	as left width=1.0m		
Cold storage		Prefabricated			

Machine Room

Concrete block building

One story 100.00m<sup>2</sup>

Walls

External wall.....Concrete blocks, thickness 200m/m

Windows and doors...Aluminium Sash

Finish

Facing

Roof :Reinforced-concrete slab

Mortar finish for waterproofing

External wall:Mortar finish, Acryl lithing spraying

Baseboard :Mortar finish, steel trowel finish

Interior

Room	Floor	Baseboard	Basewall	Wall	Ceiling	Note
Pump rm	Earth floor	Mortar finish with steel trowel		No	No	with tank

## (4) Area plan table of each room

Unit: m2

Section	Name of room	Calculation base	Floor area
Admini- stration section	Director Room	Desk, Chair, Reception set Bookshelf	25
	Assistant Di- rector Room	Desk, Chair, Chair for visitor, Bookshelf	25
	Administra- tion office room	Office desks for office worker (4 persons), Chair, Bookshelf	25
Study and training Section	Conference room	Council room is used for both administration and study section	70
	Trainees' room	10 persons lodging (4 persons room x 2 1 person room x 1 Total 3 rooms )	50
	Dining room	Table for 5 persons x 2, Chair	20
Research and Develop- ment Section	Archives		25
	Study staff room (1)	For 2 persons of chief study officer	25
	Study staff room (2)		25
	Dry labora- tory	System of large room and cal- culation from the condition of use of lab	50
	Laboratory	as above	25
	Dark room		5
	Library	Glass tank for display, reading desk, chair, Bookshelf	70
	Worker	System of large room	18

Production Section	Indoor seeds production room		640
	Covered space		224
	Feed preparation		40
	Feed production	Constant temperature room (20 - 30°C)	18
	Cold storage room		30
	Office room	System of large room	38
	Workshop		46
	Storage		50
Others	Hall, entrance, Lavatory		276
	Porch, Garage etc,		123
Total			1,943
Other House	Pump and Machine room		123
Total			2,067



#### 4-4-4 Structure plan

##### (1) Method of framework

###### ① Administration and research building

It is built of ferro-concrete. And it adopts economic span division of 5.0m : 7.0m. Its structure is rigid frame which fixes columns, beam girder and underground beam girder.

###### ② Seed production building

It is steel-framed. In the surroundings of the building, the columns are set up at an optimum distance apart. In the inside of the building, its structure is middle framework and rigid frame which allows greater span.

##### (2) Design of structure

###### ① Standard

In the PDRY, the standards for structural design are not especially established. Generally, designs conform to the British standards. But this is not obligatory. So the standard to conform to depends on the organization in charge of the project. Also as the result of tapping the opinion of the official in charge of structure in the Ministry of Construction, we got the acknowledgement that the Japanese standards are good. Accordingly, as a guideline for design, we decided to conform to the Japan standards, taking economics into account while comparing with the British standards.

###### ② Foundations

As a result of the boring survey in the PDRY, it is recognized that the sand layer whose relative density is medium exists in the area which is above GL 10 meters in depth. In the planned ground soil, (GL -1.5 to 1.0m, N value is about 20) long term load, 10 - 15 ton/m<sup>2</sup> as well as short term load, 20 - 30 ton/m<sup>2</sup> are expected. The direct ground construction method in which loads are directly supported by ground is adopted.

③ Earthquake shock

There are no instances of earthquakes. Seismic intensity is 0.1, in accordance with the standard of Architectural Institute of Japan.

④ Wind pressure

The maximum wind speed is recorded as 30 meters per second from the results of past measurements. So the wind speed is calculated as shown below.

$$P \text{ (wind pressure)} = c \cdot q \text{ Kg/m}^2$$

$$q \text{ (speed pressure)} = 30 h$$

C = coefficient of wind force

h = height (m)

⑤ Used materials and allowable stress intensity

Cement: Ordinary Portland cement and acid resistant cement

Rough aggregate: Gravel or Crushed stone

Small aggregate: Sand

Concrete: Designed standard strength:  $f_c = 180 \text{ Kg/cm}^2, 240 \text{ Kg/cm}^2$

Designed shearing strength  $f_s = 6.0 (9.0) \text{ Kg/cm}^2$

Designed compressive strength  $f_c = 60 (120) \text{ Kg/cm}^2$

Reinforced concrete: Deformed bar SD30

Yield point  $3,000 \text{ Kg/cm}^2$

Tensile and

compressive stress  $2,000 (3,000) \text{ Kg/cm}^2$

Steel frame: Mild steel SS41

Yield point  $2,400 \text{ Kg/cm}^2$

Tensile and

compressive stress  $1,600 (2,400) \text{ Kg/cm}^2$

(note) Figures in parentheses show short term stress intensity.

⑥ Sectional area calculation

On the basis of the calculation formula and figures and tables determined by the Architectural Institute of Japan, the calculation will be made taking into consideration the site situation.

#### 4-4-5 Water works and public works plan

##### 1) Conditions of sea area

###### ① The height of waves:

In this sea area, there is no record of wave height. According to the questionnaire at the harbour bureau, the maximum height of waves in Aden bay is about 3 meters. In this connection, we conducted the wave height estimation (average wind velocity 18kt = 9.3 m/sec, blowing distance: SW wind on opposite coast 260 km, blowing time: consecutive 24 hrs), based on the wind direction and the data on wind speed from the predicted wave of wind and waves. The results show that offshore waves are 3.0 meters high. Therefore, even if this project site faces the seashore, the buildings are not open to the effect of high waves, taking into account that waves' height is 3 meters and the topography of sea bottom is a shoal.

###### ② Tide: Ebb and flow of tides proceed at a rate of about 20 centimeters per second

③ Tide level: H.W.L           +2.58m  
                  L.W.I.(D.L)-0.24m

###### ④ Quality of sea bottom:

Near the shore, base rocks are exposed. In the middle part of the sea, there is granular sand with an average depth of 30 centimeters.

###### ⑤ Others:

In this sea area, at the stormy weather in the period of monsoon, the whole area of the bay happens to become muddy due to the churning up of the sea bottom sand. Judging from the topography near the shore in the future, the erosion of the sandy beach is predicted due to high waves. As mentioned in the paragraph of high waves, it is considered that the high waves do not attack directly the structure.

(2) Plan for aquaculture ponds

The scale of the water tank is decided on seed production and cultivation plans. And the structure is determined taking into consideration the purpose of use and topographical conditions. The following diagram shows the scale and structure dependent on the type of fish and the purpose of use.

Fig. 11 Outdoor Culturing Pond

Species	Form (m)			no.	Construction
	width	x length	x depth		
Prawn Culturing Pond	50	x 50	x 1.5	2	embankment
Prawn middle culturing pond	16	x 25	x 1.5	2	RC
Mullet culturing pond	10	x 25	x 1.5	2	RC
Mullet culturing pond	20	x 25	x 1.5	1	RC
Cuttlefish culturing, Mullet middle breeding, adult fish, etc.	Ø7.0	x	1.2	3	FRP
Cuttlefish culturing pond	Ø5.0	x	1.2	5	FRP

Fig. 12 Seed production tank

Species	Forms (m)			no.	Construction
	width	x length	x depth		
Prawn seed	3.2	x 2.4	x 1.5	20	RC
Cuttlefish seed	Ø2.5	x	1.0	10	Prefabrication
Cuttlefish seed	Ø2.0	x	1.0	24	Prefabrication
Multipurpose seed	0.71	x 1.51	x 0.545	10	FRP tank
Multipurpose seed	1.1	x 2.0	x 0.81	10	FRP prefabrication
Seed culturing	Ø1.154	x	0.82	10	Polycarbonate
Seed culturing	Ø1.09	x	1.25	10	Artemia incubation tank

### (3) Plan for water supply

#### ① The method of water intaking

3 methods can be considered. They are the direct pumping method, the natural introduction method through pipe conducts, and the open waterway method. In the PDRY, considering the construction needs, maintenance and inspection, the natural introducing method through pipe conducts is adopted.

#### ② Water intaking point

On intaking water, it is desirable to avoid floatage on outer layer and mud. It is also desirable to avoid the areas where floating sand from the sea bottom is highly dense and waves are broken. Since this sea area is a shoal beach, we set up the point of water intaking at a level of 3 meters in depth. However, during the monsoon period, the maximum height of waves is 3 meters. And muddy sea water cannot be avoided. So sand should be precipitated from the muddy sea water by preparing the pit for water intaking.

#### ③ Pipe for water intaking

For determining the diameter of the pipe for water intaking we consider the amount of water intaking in, the flow speed in the pipe, and the attached materials in the pipe line. The pipe is layed toward the center of the bay. It is layed completely under ground in order to maintain stability.

As for the materials of the pipe, concrete, FRP, steel can be considered. But the pipe is of steel and the point of water inlet is built of steel materials (SS41). And it is resistant to corrosion by sea water. The materials for the pipe are decided in this way, taking into account economy, actual construction, geographical conditions and maintenance, inspection and past records of installations for water intaking.

#### ④ Measures against attachment of living organisms in the water intaking pipe

Since it is predicted that the inside of pipe will be blocked by the attachment of living organisms, 2 jet pumps for cleaning the inside of the pipe by pig, as well as polypig (500 A) are provided.

#### ⑤ Water receiving pit

The water receiving pit also functions as the pond in which sand is precipitated. The pit is designed so that sand can easily be removed by sand pump (flow volume  $0.25 \text{ m}^3/\text{min}$ ).

A net screen is installed to avoid the damage caused by inflow of floating materials.

#### ⑥ Pump room

In pump rooms, 3 pumps (one for reserve) of horizontal axis ( $2920 \text{ L/min} \times 15\text{m}$ ), 2 vacuum pumps (one for reserve) ( $1.7 \text{ m}^3/\text{min} \times 400\text{mmhg}$ ) and 2 (one for reserve) underwater pumps for sending sea water ( $333\text{L/min} \times 20\text{m}$ ), the disc for the distribution board of electricity are installed, considering the maximum amount of water supply ( $370\text{t/h}$ ) and the operation of the facilities. Also in the pump room, the floor level is determined taking into account the performance of the pumps.

#### (4) Plan for sea water filtration

Judging from availability of filtering material, filtering effect and maintenance and management, two pressures fed, high speed filters ( $20\text{t/h}$ ) are scheduled to be installed. Filtered sea-water will be stored in a water tank. The filtered sea water will be sent from the tank to the elevated tank by pump ( $333\text{L/min} \times 20\text{m}$ ). Water can be supplied by the gravitational water supply system. The method of reverse flow cleaning can be performed by reverse flow cleaning pump ( $1,833\text{L/min} \times 10\text{m}$ ) which conducts water from receiving tank. This is a manual operation to ease the maintenance and inspection. The flow sheet of seawater supply is shown on the next page.

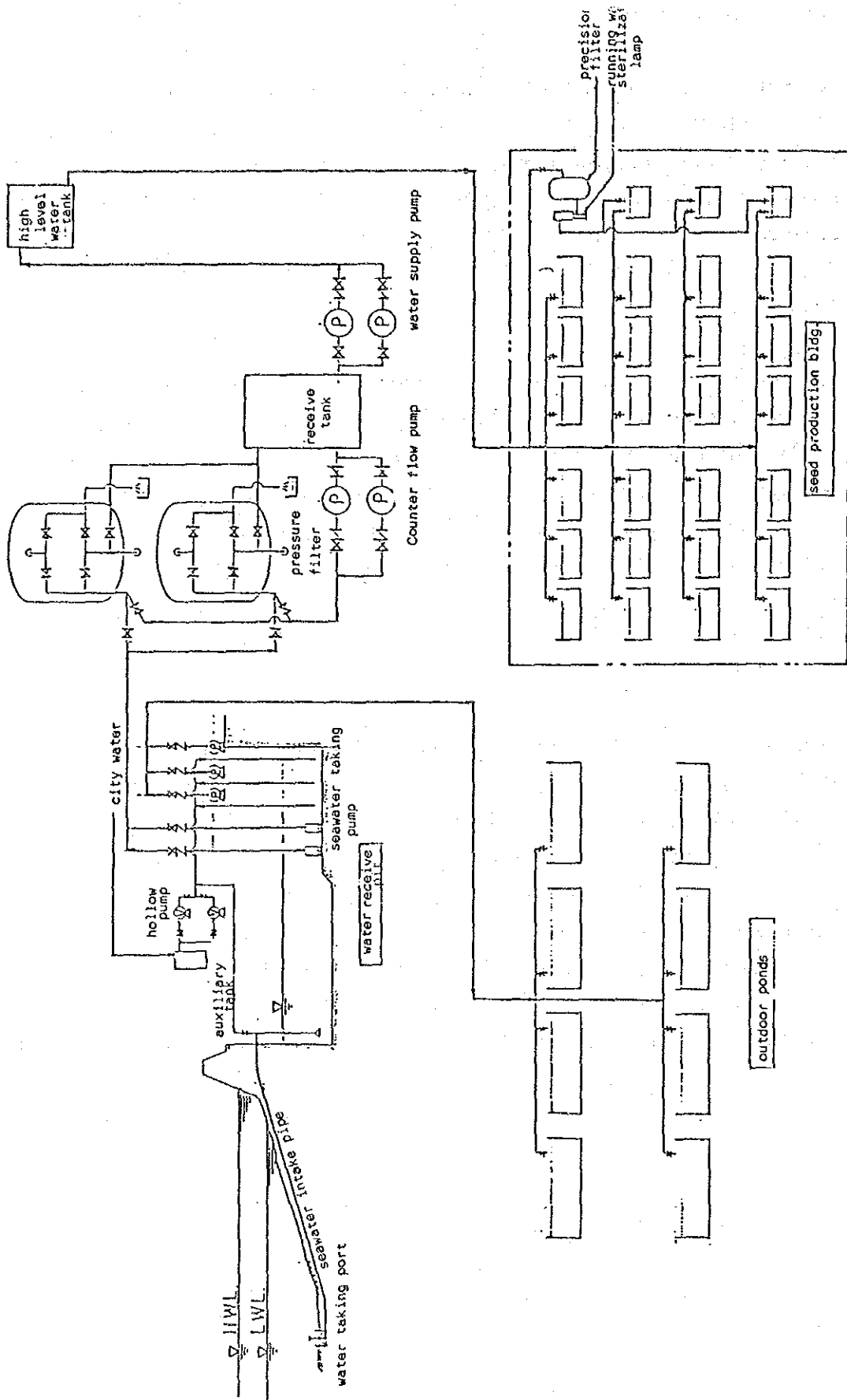


Fig. 6 Flow sheet of sea water supply system

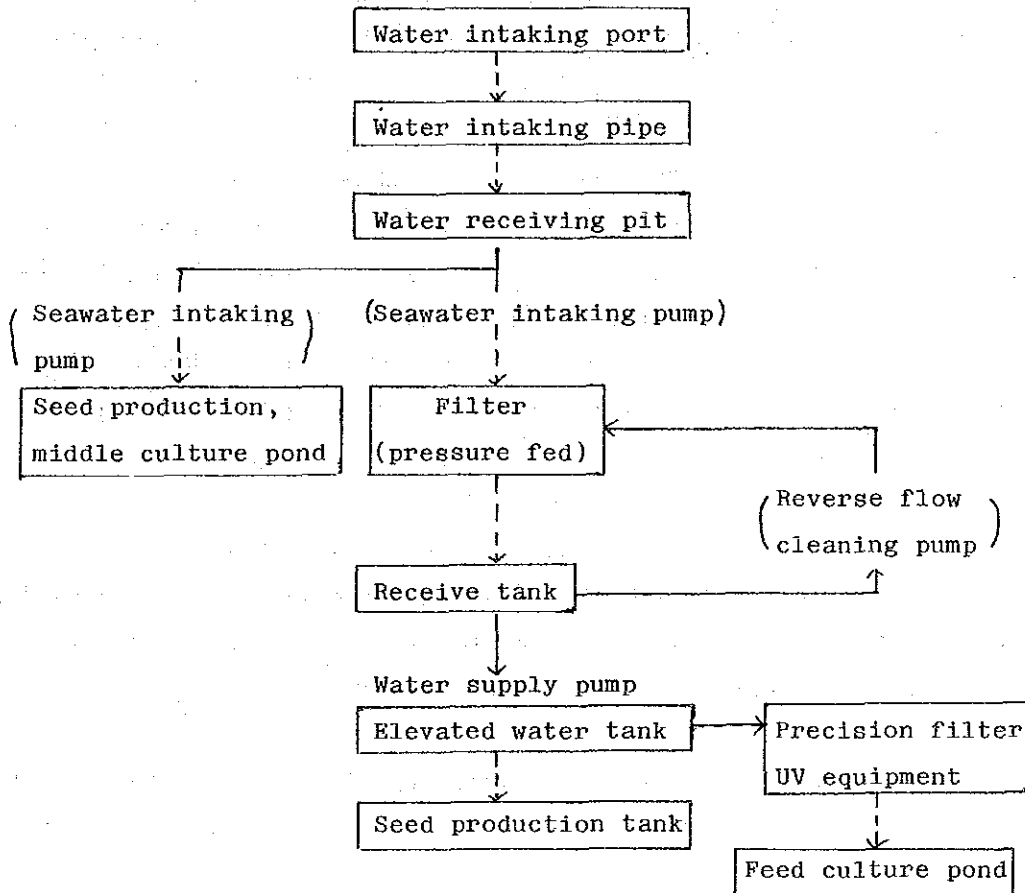


4-4-6 Facility plan

(1) Seawater and water intaking plan

Intaken seawater will be supplied to required places through filtered and fresh seawater systems as shown in the figure.

Figure 7 Summary plan on the water intaking and distributing system







(5) Sanitary equipments

Sanitary equipments will be brought in from Japan.

(6) Propane gas equipment

Propane gas will be used, and the gas cylinders will be prepared by the Yemen side. The propane gas equipment will be installed only in the following places:

- ① Laboratories and hot water service room in administration & research building
- ② Kitchen in lodging part

(7) Plan for air-conditioning and ventilating equipments

1 Air-conditioning

There will be two types of air-coolers: window-type and separate type set on the floor (floor type). Ceiling fans will be used in the rooms without air-conditioners. Drainage from air-conditioners will be taken off on the ground. (Air-coolers installing places)

A. Administration and research building

Director's room	window type	5,000 kcal/hr	1
Administration office	window type	5,000 kcal/hr	1
Assistant Director's room	window type	5,000 kcal/hr	1
Library	window type	5,000 kcal/hr	2
Researchers' and instructors' room	window type	5,000 kcal/hr	2
Conference room	floor type	7,000 kcal/hr	2

B. Seed production building

Office	floor type	7,000 kcal/hr	1
--------	------------	---------------	---

C. Lodging part

Bed room	window type	3,000 kcal/hr	1
Dining room	window type	5,000 kcal/hr	2

(Ceiling fan installing places)

① Administration and research building

Archive 1  
Workshop 3  
Workers' room 1  
Laboratory 2

Dry laboratory 5

② Ventilating equipments

Ventilators will be attached on wall, and they can be used anytime. 30 cm diameter pressure fans will be installed in the storage and feeding room of the seed production building, and 20 cm fans will be set on the other rooms.

(8) Electric equipment plan

① The works for the above-mentioned equipments and relative works will be achieved by the PDRY.

② Power generator for emergency

Generator for emergency will be installed because the power supply is not stable in the country. The load involving the equipment is necessary for the aquaculture facilities for cold storage installed in the culture building, and for general water supply system.

Independent generator for emergency

Three-phase 415V 50Hz 150 KVA 1500 RPM

Radiator cooling type, automatic starter mounted type

400 L oil tank (separately installed)

③ Main line and power system (common)

Wiring will be made from the receiving and transforming equipment to the intaking point of each building. The wiring will be made of three phase 415V, monophas 210V 50Hz by laying wiring pipe under ground.

④ Street light

Lights will be placed on around the culture pond and near the administration and research building. Lighting equipment will be of mercury lamp of pole type about 200W. The wiring will be made laying wiring pipe under ground.

⑤ Outlet for lamps

Supply and installation of lighting equipment, switches and outlet plugs and wiring works related.

⑥ Inside main line and power system

Piping and wiring, installation of distribution panel, and wiring works for cooler from the intaking point in the building to the distribution panel.

⑦ Piping work for telephone

Only piping works will be made for enabling the telephone installation for the office, the laboratory of the administration and research building, and the seed production building.

4-4-7 Equipment and materials plan

The selection and the number of equipment required for the center will be examined in this section. Here, the equipment and materials will be selected for seed production, experimental culture (Prawn, cuttle fish, mullet, etc.), training of culture practice, collection and sea transportation of adult fish, spawn and fry, and oceanographic environmental survey.

For the selection of equipment and materials, principles are set up for less running cost after the start and for easy maintenance considering the local capacity of operators. In accordance with the above mentioned conditions, the following conditions are set for the selection:

Production section: Seed production equipment shall be selected to fulfill the above conditions to take the basic function and production scale into consideration. For collection and sea trans-

portation of adult fish, fry and spawn, materials meeting to the local sea conditions and enabling the raising research efficiency shall be selected.

Research section: In principle, the priority must be given to practical scientific apparatus, with which aquaculture research and feed development, measures against diseases, and physiological and ecological research will be performed.

Instruction and training section:

Equipment and materials shall be limited to ones necessary for training of fishermen and trainees of the center.

Aquacultural environment survey:

Equipment and materials necessary for seed production and aquacultural environment survey shall be selected for the commercialization of aquaculture of this center.

① Seed production equipment

Feed preparing machine to produce 300 kg - 500 kg feed necessary for a day and feed sprinkler will be selected. Feed for prawns for the first one year should be secured.

② Seed culturing equipment

Various fishing nets, live fish transporting boat, and carrying vehicle necessary for the catch of seed, adult fish and spawn are selected.

③ Research equipment

Equipment for seed production, experiment with seeds, seed survey and technicians training are selected.

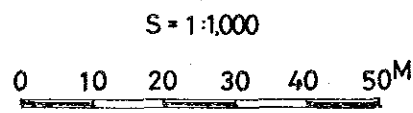
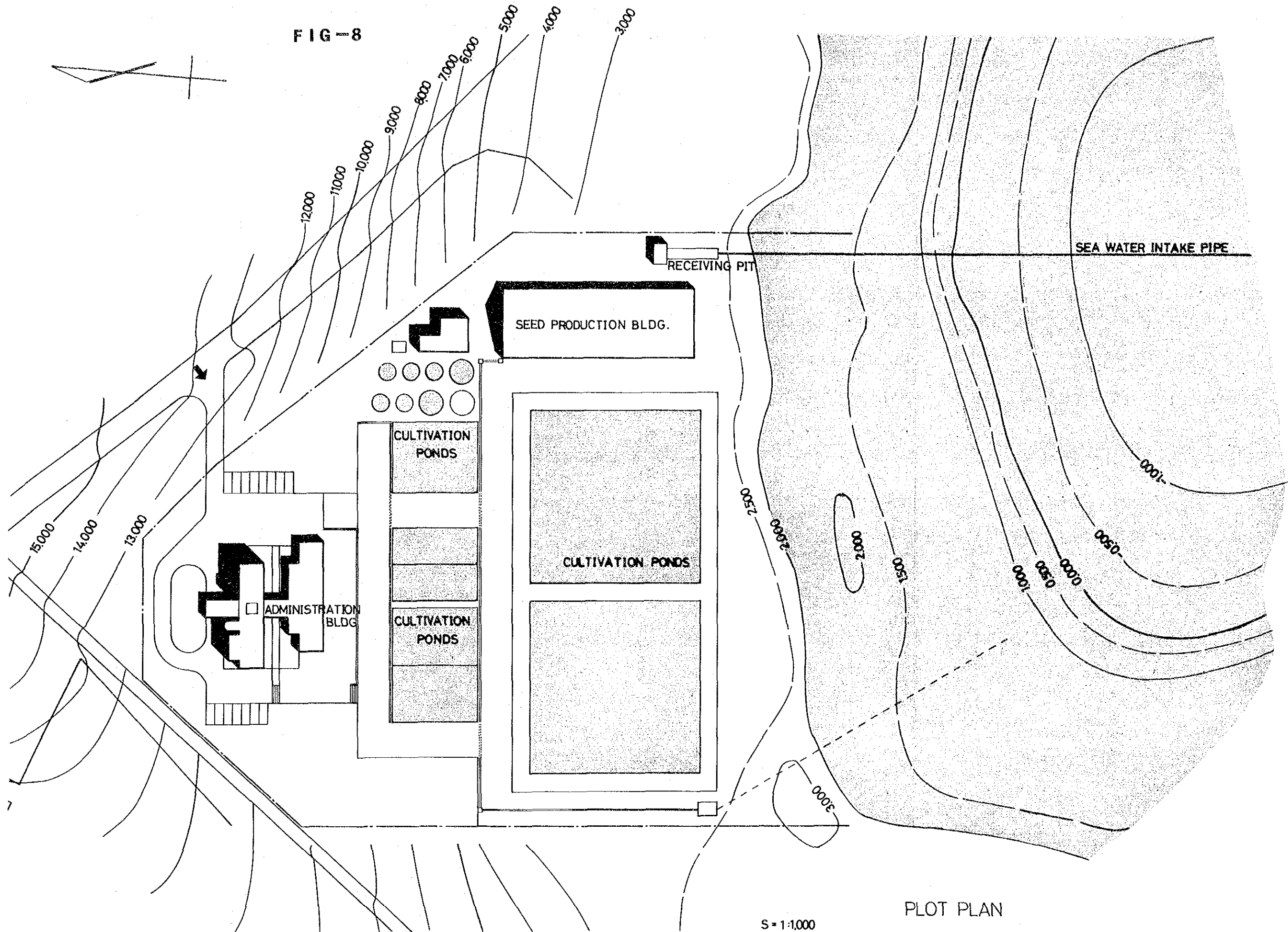
④ Other supplies

Various tools and creels are selected for miscellaneous operations at the center.

4-4-8 Basic design plan:



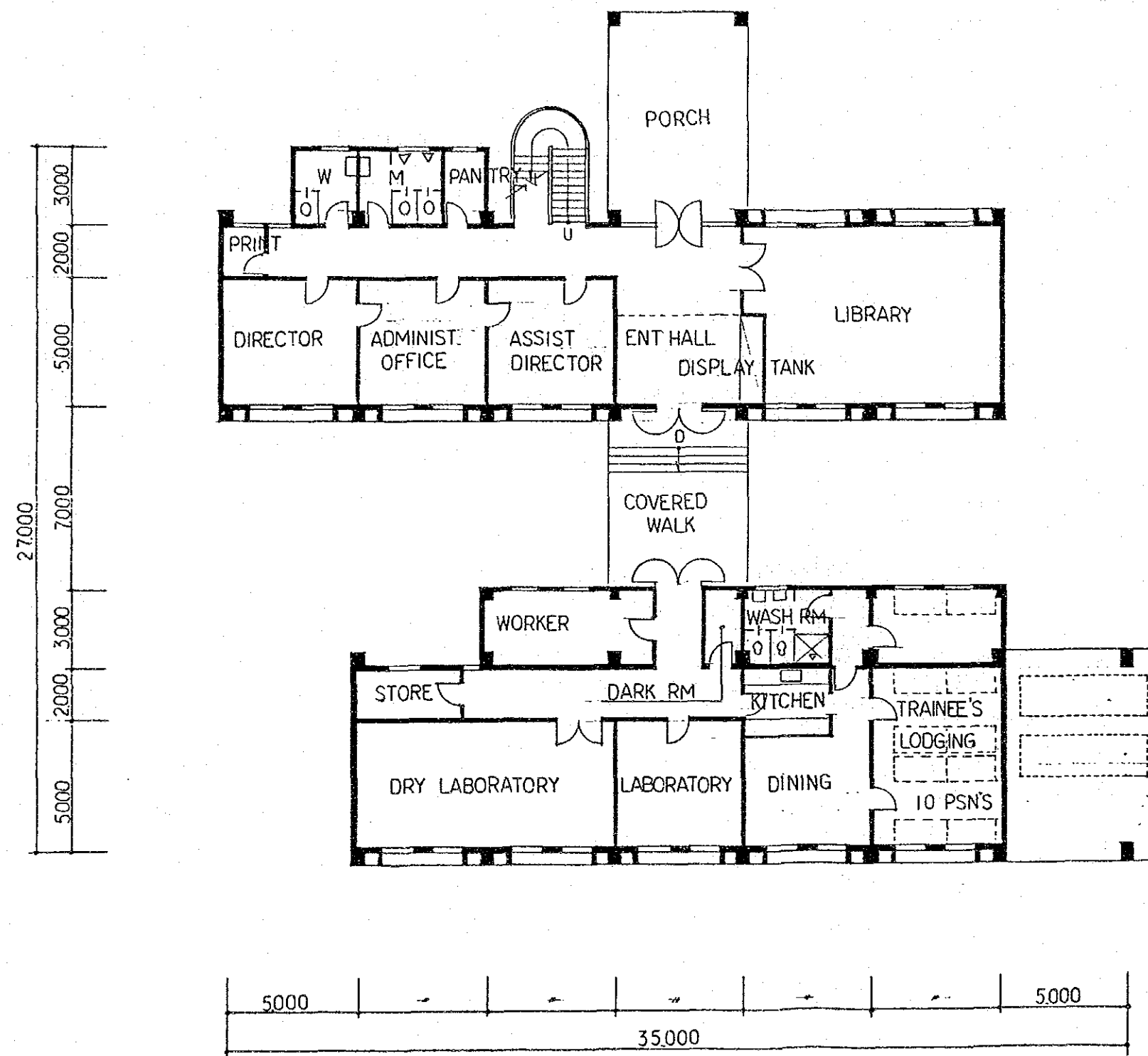
FIG-8



PLOT PLAN

AQUACULTURE RESEARCH CENTER OF P.D.R.Y.

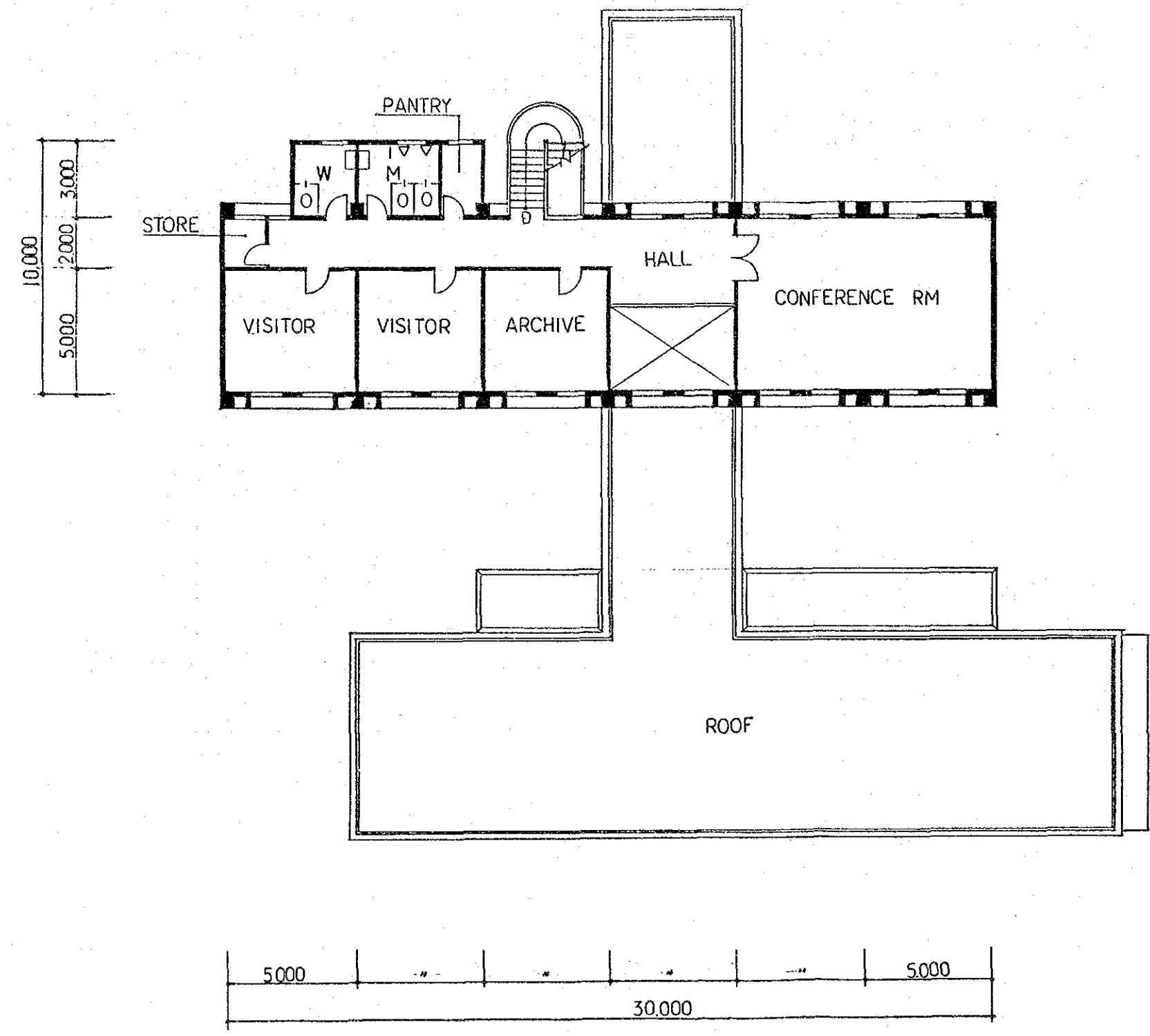
FIG-9



GROUND FLOOR PLAN S: 1/200

ADMINISTRATION AND RESEARCH BUILDING  
AQUACULTURE RESEARCH CENTER OF P.D.R.Y.

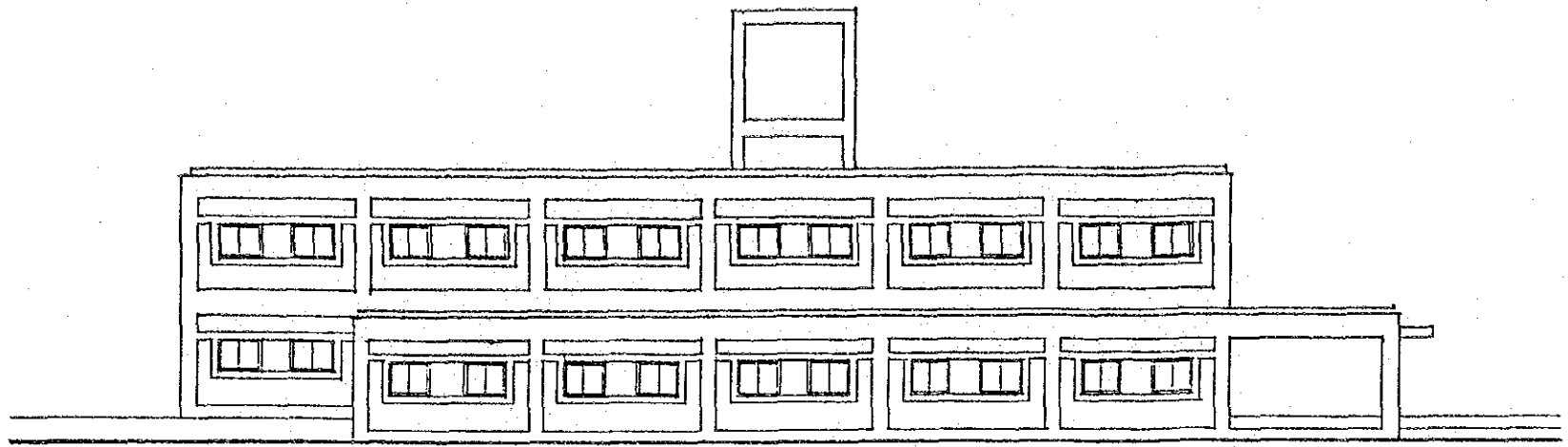
FIG 10



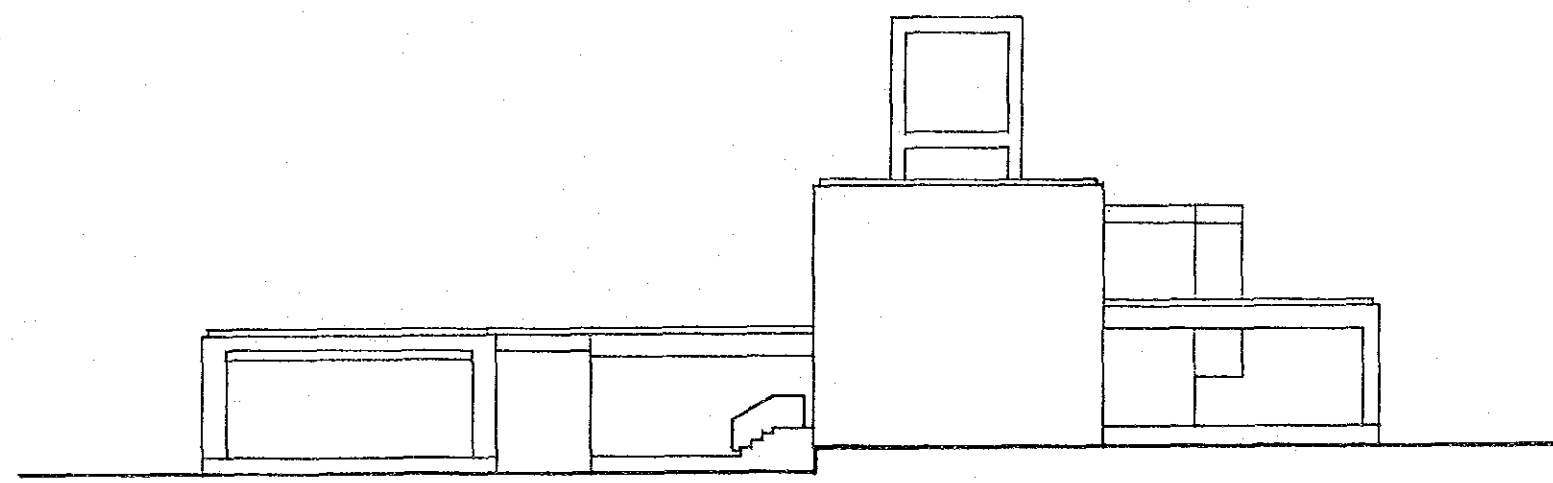
1ST FLOOR PLAN S: 1/200

ADMINISTRATION AND RESEARCH BUILDING  
AQUACULTURE RESEARCH CENTER OF P.D.R.Y.

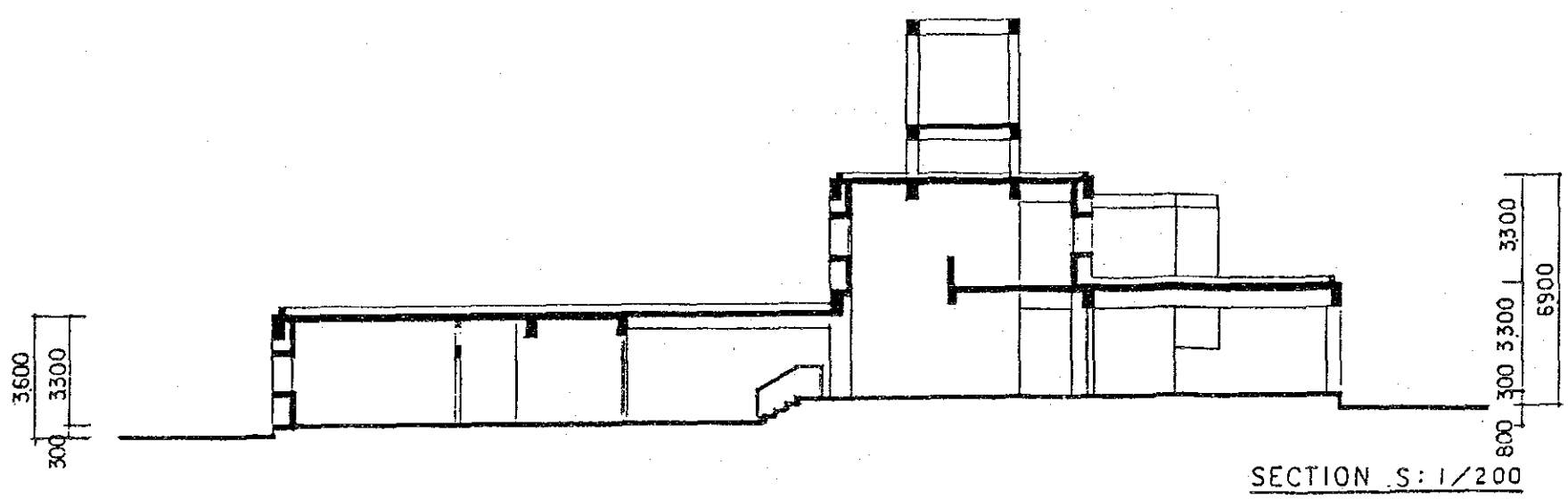
FIG-11



SOUTH ELEVATION S: 1/200



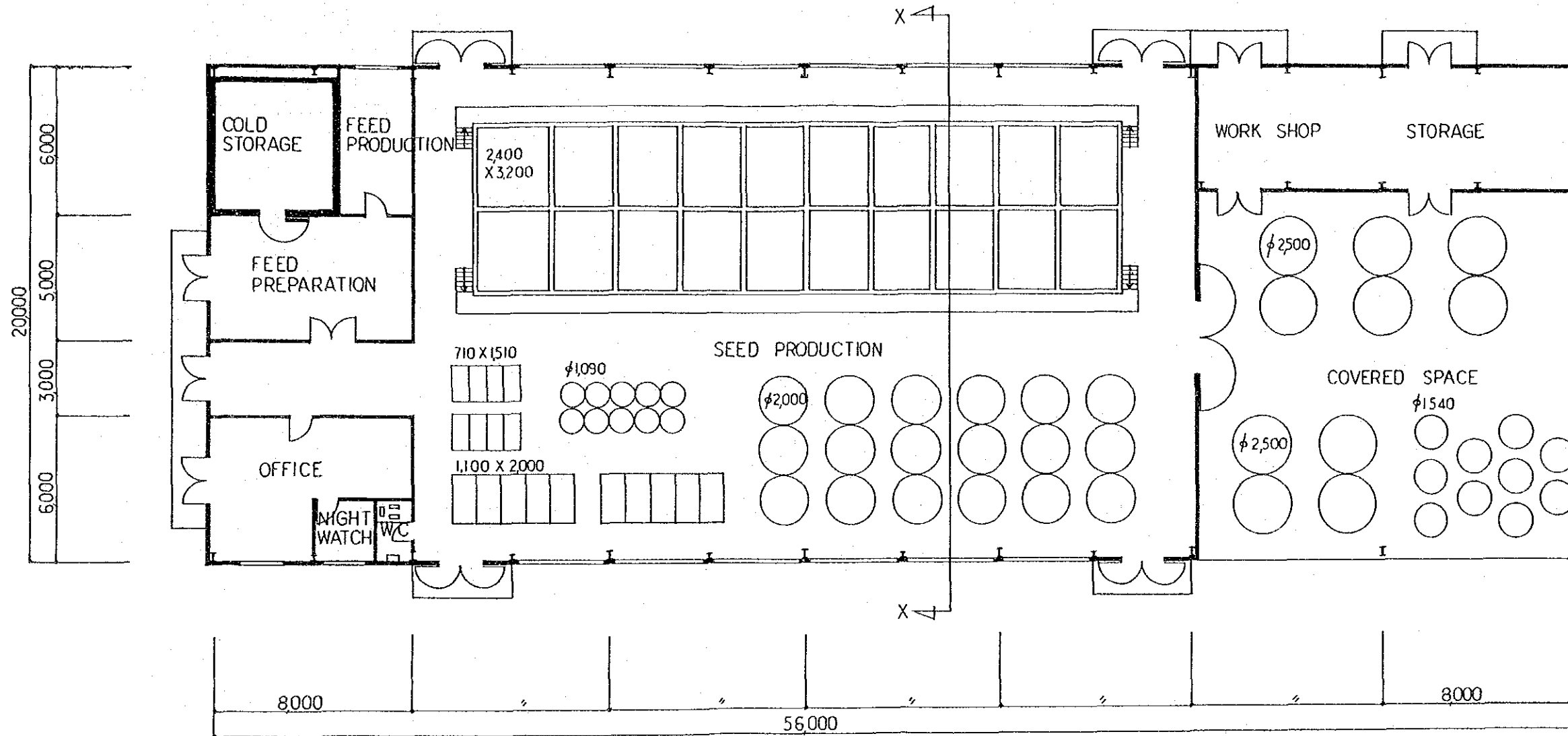
EAST ELEVATION S: 1/200



SECTION S: 1/200

ADMINISTRATION AND RESEARCH BUILDING  
AQUACULTURE RESEARCH CENTER OF P.D.R.Y.

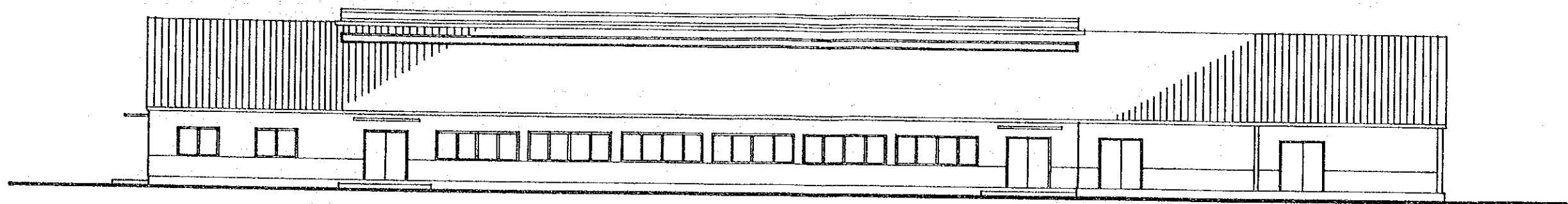
FIG-12



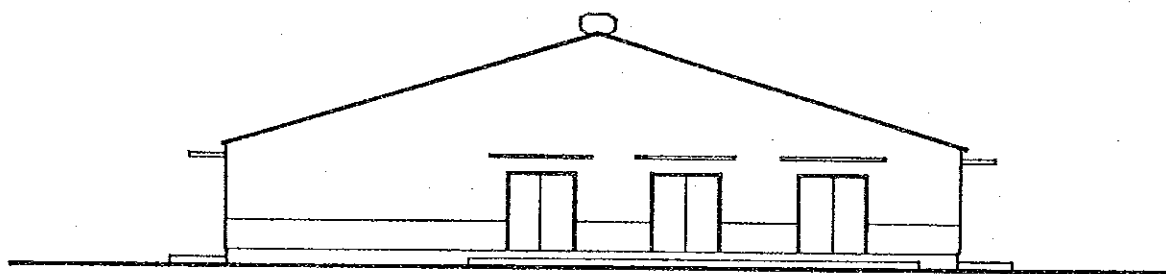
GROUND FLOOR PLAN S:1/200

SEED PRODUCTION BUILDING  
AQUACULTURE RESEARCH CENTER OF P. D. R. Y.

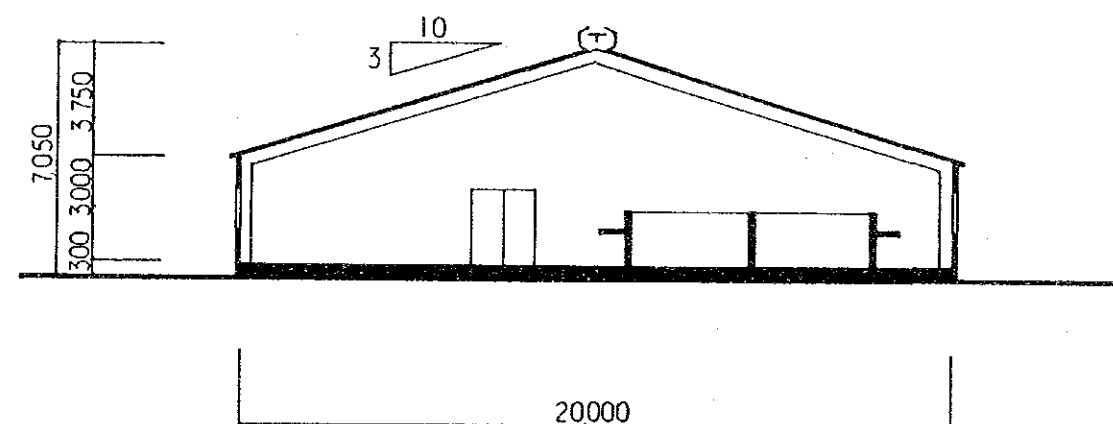
FIG-13



WEST ELEVATION S : 1 / 200



NORTH ELEVATION S : 1 / 200



X-X SECTION S : 1 / 200

SEED PRODUCTION BUILDING  
AQUACULTURE RESEARCH CENTER OF P.O.R.Y.

#### 4-5 Work plan

##### (1) Public works and construction works' conditions

Problems involved in the public works and construction works in the PDRY are as follows:

##### ① Local availability of building materials

Since only sand, gravel, and rocks are available in the PDRY, most of the other building materials must be brought in from Japan or other countries. Examination was made in the estimation on both the possibilities, and the cost and delivery term are preferable in the Japanese supply to the other country's supply. Thus, most of materials will be brought in from Japan.

##### ② Supply of materials for temporary construction and lease of construction machines

Few materials for temporary construction are available in the PDRY, and there is no other way than to rent them from Japanese companies working in the country or to bring in from Japan.

##### ③ Local constructor

Although a few private so-called constructors exist in Aden, they have no machines for plant construction. These local companies are of a small engineering shop in Japan which undertake small scale construction works such as building up blocks and stones.

##### ④ Local man power

Generally, the PDRY lacks labours. Moreover, workers having a certain skill are already assigned to the governmental organization such as the Ministry of Construction. Since hiring those workers away from the governmental organization is forbidden by the law, it is practically impossible for foreign companies to get competent workers within the country. The fact is that foreign companies carries out most of the projects by bringing in plants, building materials and construction machines from their own countries as well as the labours from other countries. Workers for this project also should be brought in from other countries.

⑤ Sea transportation between Japan and Aden Port

There are only two liner companies which run one liner per month from Japan to Aden. These liners stop over by Japanese and other Far Eastern harbors to load other goods and finally arrive at Aden. For that reason, it sometimes takes as long as 80 days for oneway trip because of the waiting and stop-overs at the ports of call. Since the liners pass through the Islamic countries, they have to be ready for another one month stay in the Islamic countries during Ramadan period.

⑥ Customs clearance and overland transportation at Aden Port

Since the port of Aden is ill-equipped, and the size of the liners are getting larger, it is impossible to bring the liner alongside the quay to unload the cargo. Although it is possible to send barges to the shore, since the National Shipping Company is in charge and running the schedule of the crane at the quay, it takes a long time for the barges to finish their work. Overland transportation, which is also taken care of by the National Public Corporation for Land Transport, is inefficient and takes a long time. The cooperation of the PDRY in the customs clearance and the land transportation of equipment and materials for this construction project is expected.

(2) Work plan

The access road to the planned site is for the present still unpaved. An entry road to the construction site is necessary to start the construction works. Accommodation for the workers should also be well considered in accordance with the conditions of the location.

Little rain and long hot period is expected at the site. The effect of monsoon and Ramadan to the work efficiency should be taken into consideration during the first half period of the construction.

The plant project is the combined work of the construction work, such as building an administration and research building and a seed production building, with the water and public works, such as making aquaculture ponds of great and small sizes and water supply and filtration equipment; especially high emphasis is put on the aquacultural equipments. Previous arrangement on the process of construction work, public work, and installation work is required to realize functional facilities.



Operation management is undertaken by the consultant who make the operation design. The organic coopertaion of the aquacultural techniques, which actually operates the facilities, and the engineering and architectural techniques are necessary.

(3) Work Classification

The work assigned to Japan and the People's Democratic Republic of Yemen to execute this project is as follows:

Column	Contents	Allotment	
		Japan	Yemen
Roads	Prepare access roads, construct entry roads		0
Land	Boring, prepare reports on geological survey,	0	
	Prepare construction site,		0
	Bring in soil into the site		0
Elect-ricity	Supply necessary electricity,		0
	Provide pipe & wire after switchboard	0	
Tele- phone	Install necessary telephone lines and supply telephone equipment		0
	Piping and wiring for telephone inside the facilities	0	
Water Supply	Supply necessary water		0
	Supply water in the high level water tank to be facilitated		0
	Construction of water provision pipes in each facility	0	
Drainage	Construct drainpipes	0	
	Set up purifying tank and dipping up tank	0	
Outside Const- ruction	Construct fences around the site		0
	Set up gates and guardrooms		0
	Construction to set up fences within the site	0	

Convey- ance expense	Transportation expense from Japan to Aden port to convey construction materials and equipments,	0	
	From Aden port to the site, maintenance fee	0	
Customs expense	Fees for customs' permission in relation to materials and equipments, necessary measures to obtain free duty and clearance of customs to convey them into the country		0
Expedi- ency	Take necessary measures to get permission for the Japanese administrators to enter, and to obtain free duty. The same applies to obtain free duty of tax law.		0
Admini- stration	Japanese consultants will administer all the constructions	0	
	As counterparts of Japanese administrators, PDRY will appoint Yemenite administrators by its own expense		0

4-6 Execution schedule

Months	1985		1986												1987			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Period	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
Conference	15																	
E/N	31																	
Operation Plan	31		20															
Approval			20															
Exchange de Notes				31	28													
Contracts					28	31												
Preparation of site & paving									10									31
Water									1									28
Temporary Construction									1									28
Administration & Research									1									31
Seed Production									20									20
Machine Room													10		30	1		10
Construction Facilities													1		30	1	31	
Common Temporary Bldg.																		31
Equipments																1		31
Water pipes															10			28
Tanks										20								10
Subsidiary facilities																1		31

4-7 Administration and operation plan

The Administration and management of the Center will be carried out by the Ministry of Fish Wealth of the PDRY. The expenses will be put on the budget of the Ministry. The Ministry of Fish Wealth promised to keep the budget according to the sum up in August and September and the decision in October (fiscal year begins in January).

Fig. 14 Year Budget for the Center's maintenance and management

Unit: S.Y. Dinars

Columns	Administrative budget	Activity budget	Total
Personnel	15,440	7,560	23,000
Electricity & water	11,600	30,000	41,600
Feed	-	1,400	1,400
Repairment	1,890	1,910	3,800
Communication	900	-	900
Transportation	5,000	5,000	10,000
Business trips	8,000	-	8,000
Training	10,000	-	10,000
Consumption	3,800	8,000	11,800
Others	1,000	-	1,000
Total	57,630	53,870	111,5000

Note: 1 S.Y. Dinars = ¥700 approx.

Fig. 15-1 Personnel Expenses Statement

Unit:YD

Status	no.	Salary	Total
Director	1	1,500	1,500
Assistant Director	1	1,400	1,400
Chief Researcher	2	1,100	2,200
Researcher	2	1,000	2,000
Asst. Researcher	4	600	2,400
chief Engineer	3	700	2,100
Chief of Gen. Affairs	1	1,100	1,100
Clerical	2	600	1,200
Secretaries	2	420	840
Site Worker	12	420	5,040
Drivers	3	420	1,260
Maintenance Worker	3	420	1,260
Cooks	1	700	700
Totql	37		23,000

Power expenses statement

Fig. 15-2 Electricity expense

machines	power (KW)	NO.	driving period hrs/day	driving days per year	total KWA	cost YD/kWA	expense YD
water taking pump	15.0	2	24	365 x 1	131,400		
water taking pump				90 x 1	32,400		
underwater pump	3.7	1	12	365	16,206		
Filter supply pump	5.5	1	12	365	24,090		
counter flow pump	7.5	1	0.5	365	1,369		
blower	7.5	1	24	180	32,400		
blower	2.2	1	24	90	4,752		
Water mill	1.5	10	24	90	32,400		
Total					275,017	0.1	27,502

Expense of FRP boat

150days x 4 hours x 19.5L/h x TD0.21/L= YD 2,457

Power budget Total YD 29,957 ≈ YD 30,000 approx.

Feed Expense Statement

Fig. 15-3 Feed expense statement

Type	necessary amount per year	unit price YD	price YD
For seed production			
Altemia	10kg	25/kg	250
Particle feed	20kg	20/kh	400
grand total	30kg		650
For adult prawns			
Small fish	3,514	50/ton	176
Fish meal	1,381	110/ton	152
Wheat	1,699	70/ton	119
Bran	3,548	30/ton	106
Soybean	896	70/ton	63
Others	542	140/ton	76
Grand Total	11,580		692
Total	11,610		1,342

Fig. 15-4 Facility Repairment expense statement

Facilities	repairment expense	note
buildings	YD 1,890	¥265,000,000(construction fee) x 0.5%/year + ¥701
Water facilities	YD 1,910	¥134,000,000 (water facilities) x 1%/year + ¥701
Total	Yd 3,800	



4-8 Rough estimation of working costs

Work Expense on the PDRY Side	(Unit 1,000 yens)
Access road Maintenance Construction	20,000
Levelling ground in the site (including breakdown of former bldgs)	20,000
Fences around the site	4,000
Electricity, water supply and Telephone construction	33,000
<hr/>	
Total	77,000



## CHAPTER 5 APPRAISAL OF THE PROJECT



The main objective of the Fishery Development Project in the PDRY is to increase the acquisition of foreign currencies from export of marine products and the supply of animal protein to the citizens of the country. The exportable fish species for acquiring foreign currencies are mainly the demersal fish such as cuttle fish, lobsters, prawns and breams which has shown 90% of gross export amount of marine products in 1984.

To expand the export on a short term basis, they can increase the number of fishing vessels and make an effort of the quantity they gather. But there is a possibility of resource exhaustion if they increase the quantity of fishing effort for demersal fish.

On the other hand, the people of the PDRY take in 20 kg of fish per year and per person. Thus it can be estimated that they can increase the amount of marine products supply by organizing the fishing effort, storage, processing and circulation. But by the year 2000, the population could grow up to 3 million which is 1.5 times as much as now so that it means it will be difficult to keep up the supply rate of marine products per person.

Concerning sardines which is the main resource in the PDRY, the fishermen are negative towards catching them as the preference is low. The sardines caught tend to be fertilizer or feedstuff and rarely used to supply animal protein for the people. As a result, it is difficult to bring up the consumption of marine products per person from the current ratio to 26kg per year, which is the aim of the Government.

On the basis of the above mentioned situation, it is considered that the country made a request for the construction of the Aquaculture Research Center as a first step which would finally lead to increased aquaculture of superior grade seafood such as prawns, cuttle fish, mullet, tilapia, rabbit fish and grouper, with a purpose of supplying protein and acquiring foreign currencies in the PDRY.

In this study, the team tried to analyze the following six elements to see whether the aquaculture could be set up as an industry in the PDRY : seed, culture site, feed, culture techniques, the Ministry of Fish Wealth, market

① Seed

Production of cultured seed of marketable prawns is possible as adult prawns are easily obtainable. Also, the fry of superior grade species such as cuttle fish, mullet, rabbit fish, and grouper can be caught in the coastal area.

② Site

At the present, there are salt farms in two districts in the Aden Province, but most of them have not been used. Even only the remains of salt farm near the shrimp station of MSRRC has about 4,000 ha of site and it can easily be converted to an aquacultural site with little work.

③ Feed

It is said that the catchable amount of pelagic fish is 200,000 tons a year, but in the current situation only 40,000 tons, 20% of the above, is caught. Therefore, there is wide room in resource. Moreover, if the residue of tinning works (7,000 tons/year at the present) and of flour factory (30 tons/day) and the odd fish of trawler are effectively used, there will be no problem about the feed supply.

④ Aquacultural techniques

Although the basic research of prawn aquaculture has been undergone at the shrimp station of MSRRC, the techniques are still primary stage and it cannot be led to a commercial aquaculture. The aquaculture techniques for mullet, tilapia, rabbit fish and cuttle fish have not been established yet, and there is a large sphere for experiment, research, technical development, education and training to be carried out by the Center.

⑤ The Ministry of Fish Wealth

Mr. Sharaf, the First Deputy Minister for Fish Wealth and the other officials of the same Ministry have showed a great zeal for the promotion

of aquaculture and the training of engineers. They send many students abroad for the study. Since there is no financial problem in relation to the operation of the shrimp station, it is considered that no problem shall be expected for the running budget of the Center.

#### ⑥ Market

Constitution of marine products price in the country is:  
Selling price at fishing cooperative to distribution corporation, when 1 for fish of class 3, super class is 8 times and 3 times at fishing cooperative directly to consumer. In spite of such difference in the price, there are much people who buy superior fish in the fish market in Aden. As the people have a liking for certain kinds of fish, the market is suitable for the aquaculture.

As a result of the analysis of the six elements above, if technical problems are solved, the possibility of commercialized aquaculture will be much increased.

The facilities which are realizing research of fisheries, personnel training in the PDRY are MSRRC and the Fisheries Training Center built in 1970 with a help of the USSR. In the future, there are plans to set up the Marine Laboratory as the second phase of MSRRC and to build the Manpower Development Center in the framework of the Fisheries 3. Both of them are not for seed production or experimental aquaculture research for commercialization nor for personnel training to acquire techniques and research for the purpose of commercialization of aquaculture. Furthermore, the shrimp station belonging to MSRRC will be abolished after completion of the present Aquaculture Research Center.

If the aquaculture techniques suitable to the country is developed, the manpower necessary for the aquaculture is trained, and the techniques and knowledges are propagated widely in the country by the construction of the Center. Otherwise, the following effects can be expected:  
Commercialization of aquaculture, acquisition of more foreign currencies, increased supply of animal protein to citizens, and more opportunities for employment.

From the purpose of the center, the expected function could be not "basic research intended" , but "production intended". So from that point of view, the team has broadly outlined the concept of prawn aquaculture industry development centering around the Aquaculture Research Center, overlooking the scope of the center as a three-phased step-by-step improvement.

The following development concept is the guideline for step-by-step improvement assuming the effort of the PDRY itself. And the team expects that the project of construction of the Center attains the goal.

(1) Phase one (period of three years)

To produce one million prawn seeds as the goal of the Center, and to reach to grow 40,000 commercial sized prawns. At the same time, to develop the most suitable way of commercial aquaculture for the PDRY and personnel training. Yearly plan for this goal is as follows:

Unit: 10 thousand pieces

Year	Goal	Seed Culture	Remarks
1st year	13	1	Concentrate on producing seeds, to culture 40,000 pieces.
2nd year	50	2	2 - 4 times more than the 1st year
3rd year	100	4	Achieve the goal of this plan

(2) Phase two (period of two years)

With the purpose of developing and utilizing the appropriate site along the coast of Aden, a pilot farm for prawn aquaculture, which is the most suitable facility for the country will be built in the remains of Little Aden salt farm close to the Center for the start toward the commercial aquaculture of prawn in the PDRY. The target production of pilot farm is 5 tons per 10 ha.



(Pilot Farm)

Size & goal of production in Pilot Farm					
Year	Total	Pond area	Production	Required seeds	Remarks
1st year	4 years	5 ha	2.5 tons (100,000)	330,000	Density of culture (final) 2/m <sup>2</sup> Commercial size 25g/piece
2nd year	5 years	10 ha	5 tons (200,000)	660,000	Yield (P20-25g) 30%

The above pilot farms will be ten times as big as the experiment pond at the Center, and all the necessary seeds will be supplied from the Center.

The prawn aquaculture experiment at the Center in Phase two aims at the following product plans with a view to improve seed production and technical training as the main force of prawn aquaculture in the PDRY.

(Center)

Year	Total	Goal		Remarks
		Seed	Culture	
1st year	4 years	2 million	60,000	Seed production 1.5 cycles per year, culturing density 1.5 times per year as final goal
2nd year	5 years	4 million	80,000	Seed production 2 cycles per year, culturing density twice per year as a goal

(3) Phase three (period of seven years)

Based on the result of the pilot farm, prawn aquaculture on a commercial scale in the PDRY is aimed. As concrete means, the remains of salt farm of 4,000 ha in Little Aden will be used. The first goal in the Phase three is the commercialization of prawn aquaculture. To reach this objective, 2,000 ha site will be developed to produce 1,000 tons of commercial sized prawns. The final goal of the Phase three is to produce 2,000 tons in 4,000 ha site.

Moreover, the products per unit area can be increased to two or three times of the initial value by advancing from rough leaving culture to semi-intensive culture, and further from semi-intensive to intensive one. In other words, it is to make the cycle of culture from once per year to twice per year, from half feeding to full feeding culture, and to make culturing density twice as much.

(The Scale of Phase 3)

Year	Total	Scale of Production			Remarks
		Amount	Pond area	Seeds	
1st year	6 years	100 tons (4 million)	200 ha	13 million	
2nd-3rd	8 years	500 tons (20 million)	1,000 ha	66 million	
4th-5th	10 years	1,000 tons (40 million)	2,000 ha	130 million	first goal
6th-7th	12 years	2,000 tons (80 million)	4,000 ha	260 million	final goal

The seed producing facilities to achieve the above plan can be realized relatively easily and at low cost by converting the Center's culturing pond area to the pond for seed production.

(Estimate of phase 3)

This estimate is done by supposing that whole products are sold to the Corporation in order to calculate the income and expense of the culturing enterprise.

Item	Unit: YD			
	1st year (100 tons)	2nd-3rd year (500 tons)	4th-5th year (1,000 tons)	6th-7th year (2,000 tons)
<b>Income</b>				
Sales	76,000	380,000	760,000	1,520,000
<b>Expense</b>				
Personnel	19,200	96,000	192,000	384,000
Feed	30,000	150,000	300,000	600,000
Seed	9,100	46,200	91,000	182,000
Miscellaneous	760	3,800	7,600	15,200
<b>Total expense</b>	<b>59,060</b>	<b>296,000</b>	<b>590,600</b>	<b>1,181,200</b>
<b>Net profit</b>	<b>16,940</b>	<b>84,000</b>	<b>169,400</b>	<b>338,800</b>

Basis of calculation

Sales: through the Distribution Corporation Fresh Fish 760 YD/ton  
Personnel: 40 persons to produce 100 tons 480 YD/person, year  
Feed: 6 tons of adult fish/1 ton of prawns Price 50 YD/ton  
Seed: 700YD/1 million pieces

Supposing that the unused salt farm is converted to the aquaculture pond, and a Japanese style intensive prawn aquaculture with 4,000 ha per area is carried out, about 20,000 tons production can be expected. Even if the aquaculture is made at 1/10 density compared to the Japanese one by rough leaving, 2,000 tons production may be assured. When the Distribution Corporation exports them at a price of 4,000\$/ton, 8 million dollars in foreign currency, which exceeds the Gross Export Amount of the year 1983, 6,600,000 dollars, is estimated.

(However, the purpose of such presentation of the development concept is to give a view that this center is not an organization for the sake of only research but also is tightly bound to production. Nevertheless, the foundation of this center is not automatically giving improvement on the increase of aquaculture industry.)



## CHAPTER 6 CONCLUSION AND SUGGESTIONS



## CHAPTER 6

## CONCLUSION AND SUGGESTIONS

### 6 - 1 Conclusion

The Aquaculture Research Center will be the basic institution for the promotion of aquaculture industry in the country, and its objectives are researches aiming the production. Therefore, the working purposes of the center are "Research and development", "Personnel training", and "Propagation of aquaculture knowledge".

According to the initial request, the aquaculture of cuttle fish and prawn which would be the main foreign currencies earning items on a full scale had been aimed by this project, however, following the field survey carried out and the discussion held with the authorities of the PDRY like the Ministry of Fish Wealth, although the active position of the country for promoting the breeding and culture was understood, the actual level of aquaculture techniques and engineers is just on the laboratory step, and it was found that now the time is not yet suitable to the commercialized aquaculture on a full scale.

Therefore, for the time being, it is necessary to build the base for the development of fisheries in the country from "catching fisheries" to "producing fisheries" through the construction of the Aquaculture Research Center being provided with the administration, research and training building, the seed production building, the seed breeding and culture pool, other various facilities and equipment and materials with the main themes of "Basic aquaculture experiment and research", "Aquaculture personnel training", and "Propaganda of aquaculture enterprise".

It is more promising for successful commercialization through establishing the semi-intensive and intensive large scale production techniques, developing the optimal feed and assuring the production, and making the personal training for the promotion of aquaculture.

There is also a possibility to achieve the target of obtaining foreign currency and increasing the supply of animal protein to domestic customers by

the commercialization of aquaculture. As mentioned above, it is evident that the contribution of the present project is not limited to the country's fisheries but also to the country's economy. Therefore, the significance of the grant aid from the Japanese Government is important and it is expected that the present project will be quickly transferred to realization.

6 - 2

(1) Suggestions for Japanese Government

① Dispatch of aquaculture engineer

Although some basic technology transfer has already been made in the researchers of the country, the level is just at the experiment level. It is desirable to send aquaculture experts for a few years from the start of the center in order to make the researches for commercialization of the center more smooth and effective. The experts to be sent are considered to be suitable two persons, one for prawn and the other for fin fish.

② Receiving of counterparts

It can almost be said that the country's fishermen have no knowledge about the aquaculture. Moreover, there is no full-scale experiment and research institution for the aquaculture in the PDRY, nor the aquaculture as enterprise. Therefore, it is preferable to invite persons who shall be in charge of the administration and operation of the center to Japan before the completion of the center so that they will learn the history and actualities of aquaculture, the organization, operation and administration of similar institution, and the education on aquaculture. Equally after the start of the center, parallelly to the technical assistance of the above-mentioned Japanese experts, it is desirable that the training course for leading researchers and engineers will be held in Japan.

(2) Suggestions for the PDRY government

① Fisheries products distribution

It seems that the fishing is developed in the PDRY, but there is room for improvement in the domestic fisheries products distribution. In the market



in Aden city, fresh or thawed fishes are sold at ordinary temperature without use of ice, and their freshness is lost by the time. As the construction of 3,000 tons scale cold storage and fisheries product processing shop were included in the fisheries development project, the loss due to the distribution is considered to diminish after the arrangement of cold chain on the receiving points. It is required that the cold chain for fisheries products will be arranged in future in order to enable the supply of cultured fish with good freshness to consumers and the use of fresh small fish or residue of processed fish as feed for aquaculture.

② Transfer of old breeding pool and unused salt farm to aquaculture pool

It is expected that old breeding pool and unused salt farm will be transferred to aquaculture pool as the receiving facilities of the aquacultured prawn seeds or developed aquaculture techniques for fishes in the center and the basis for the promotion of aquaculture industry will be established.

③ Use of breeding engineers and trainees

The present center is not to develop the manpower for the official world or the academic circle, but to train the persons for promoting the aquaculture industry. For this purpose, it will be required that aquaculture enterprise, public corporation, etc. are established as receiving institution of trained manpower for realizing the commercialized aquaculture in the places mentioned in the paragraph 2.

④ Drainage of aquaculture water

The problem of restriction on the drainage of aquaculture water shall be taken into consideration because the surroundings of the center is reserved for sea bathing. It is commonly accepted that as the drainage of aquaculture is just consuming oxygen, except for chemical bathing, there is no problem for returning it to sea. In regard of this problem, the Ministry of Fish Wealth must communicate with other authorities concerned for obtaining their comprehension and cooperation for no restriction.



## DOCUMENT APPENDIX



APPENDIX 1

MINUTES OF DISCUSSIONS

Minutes of Discussions

On

Basic Design Study

For

Aquaculture Research Center Project

In

The People's Democratic Republic of Yemen

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Japan International Cooperation Agency (JICA), the Governmental Agency responsible for implementation of economic and technical cooperation programme of the Government of Japan, despatched the Basic Design Study Team, succeeding to the Preliminary Study Team, on the Project for the construction of Aquaculture Research Center (the Center) in the People's Democratic Republic of Yemen (P.D.R.Y.)

The Team headed by Dr. Yoshinori OGAWA, Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries, has conducted a field survey and held a series of discussions, with PDRY Government Officials concerned from June 29 to July 18, 1985.

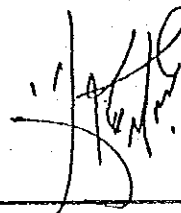
Both Parties confirmed the results of the discussions attached herewith.

June 6, 1985

Aden.

小川 良徳

Dr. Yoshinori OGAWA  
Leader  
JICA Study Team



Mr. Abdul Wahab Sharaf  
First Deputy Minister  
for Fish Wealth.

A T T A C H M E N T

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1. The Project description is as follows:

(1) Title of the Project.

Project for the construction of Aquaculture Research Center

(2) Objectives of the Project.

The objectives of the Project is to construct the Aquaculture Research Center in order to carry out research works on seed production and growing-out and to conduct training of aquaculture techniques.

(3) Activities of the Center.

The following activities will be carried out in the Center.

- (a) Research and Production of artificial seeds of shrimps and Experimentation of growing-out of the seeds in pilot scale ponds.
- (b) Research on the life cycle, artificial seeds production and growing-out of cuttlefish.
- (c) Research and Production of the artificial seeds of fin-fish such as mullet, tilapia, and rabbit-fish.
- (d) Training aquaculture researchers and technicians.

(4) Location of the Project Site.


The Project site is located at the beach of Al-Marsa as shown in ANNEX 1. The site covers an area of approximately 3 hectares.

(5) Institutional Framework.

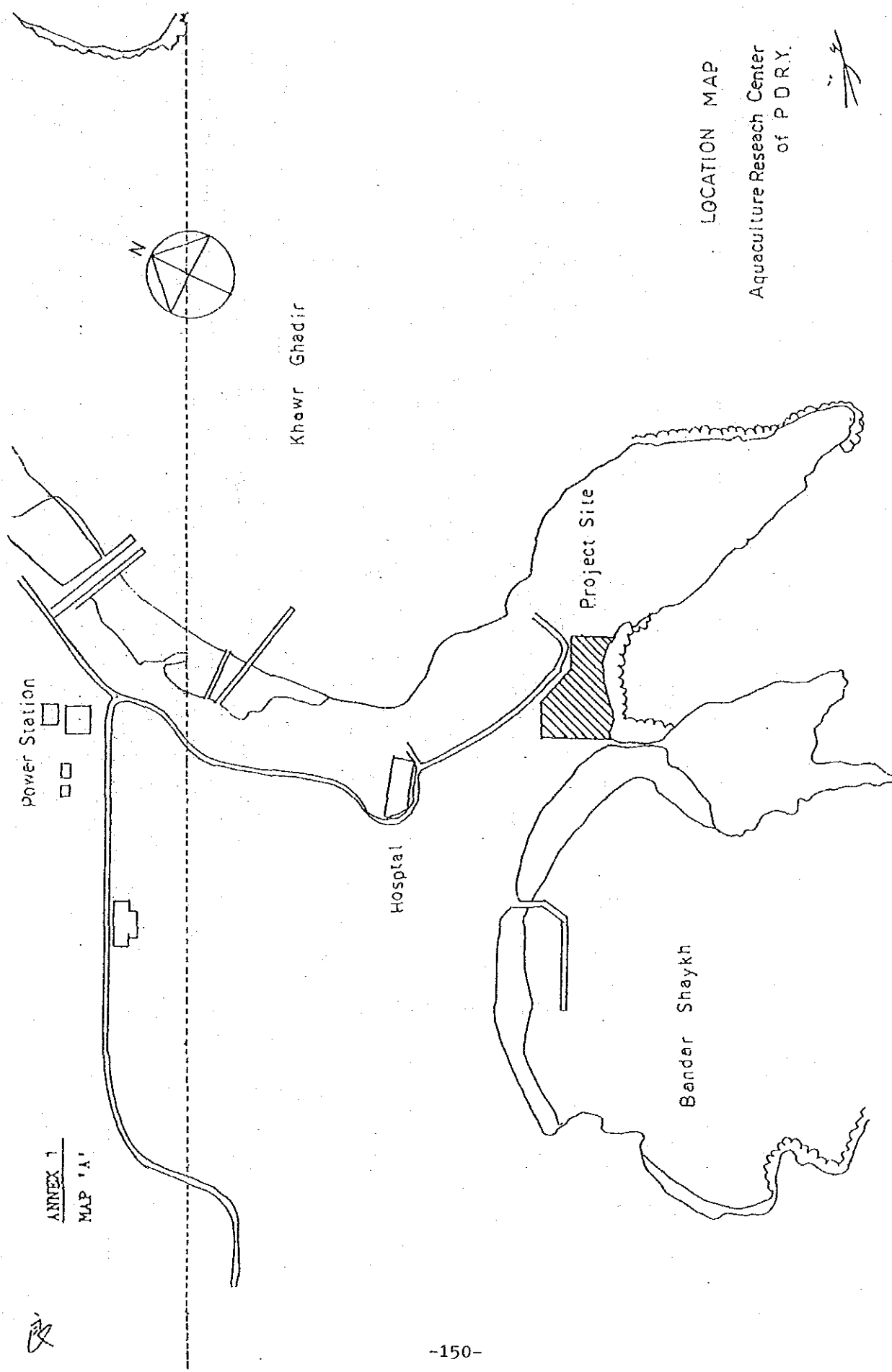
Ministry of Fish Wealth of PDRY is responsible for the execution of the project.

Aquaculture Research Center shall be the independent organization under the direct supervision of the Deputy Minister for Fish Wealth.

The organization chart of the Center is shown in ANNEX 2.

2. The PDRY side has understood Japan's Grant Aid System explained by the Team which includes a principle of using a Japanese Consultant Firm and a Japanese General Contractor for the construction of the Center.
3. Major Facilities and Equipments requested to be provided by the Government of Japan are listed in ANNEX 3.
4. The Government of PDRY will take necessary measures listed in ANNEX 1 on condition that the Grant Aid by the Government of Japan would be extended to the Project.
5. The result of the Basic Design Study shall be compiled in the Basic Design Study Report, which shall be submitted to the Government of PDRY by the middle of October, 1985. 





ANNEX 1  
MAP 'A'

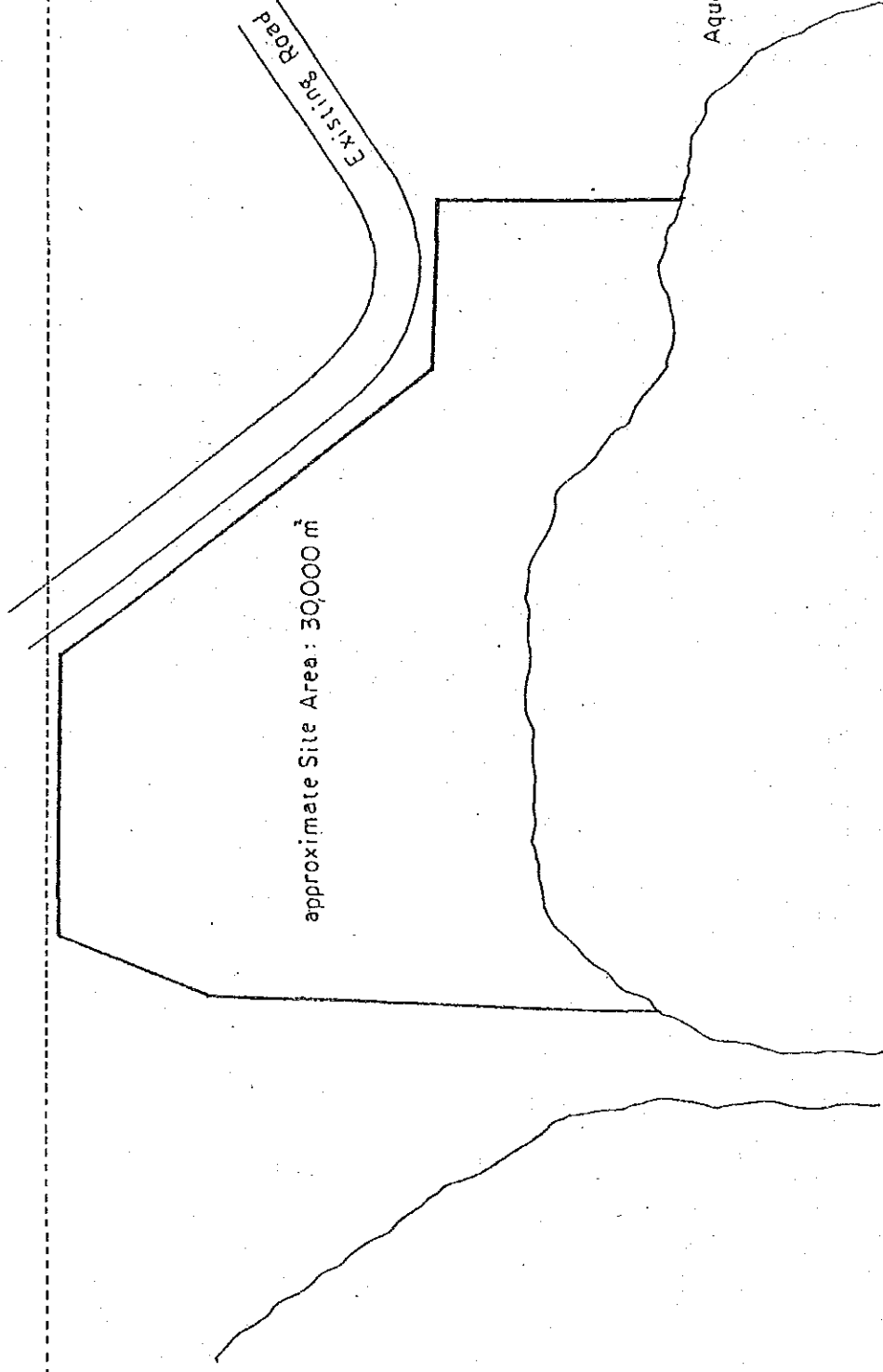
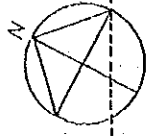
LOCATION MAP  
Aquaculture Research Center  
of P.D.R.Y.

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MAP 'B'



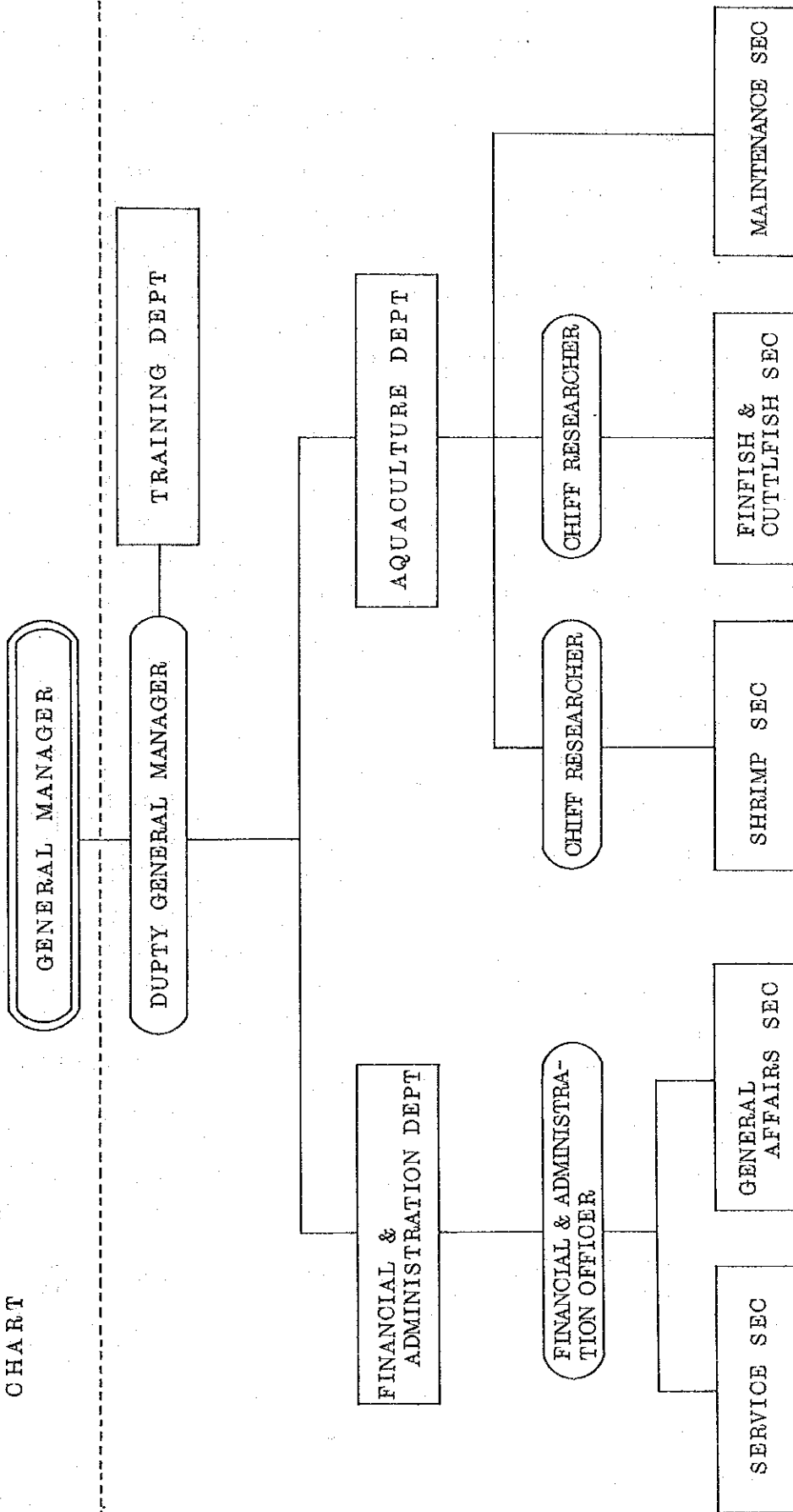
SITE PLAN  
S=1:2,000

Aquaculture Research Center  
of P.D.R.Y.



ANNEX 2

ORGANIZATION CHART



*Handwritten initials*

ANNEX 3

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(1) LIST OF FACILITIES.

Administration and Research Bldg. 1

- General Manager Rm.
- Deputy General Manager Rm.
- Meeting Rm.
- Financial and Administration Office
- Visitors Rm.
- Library
- Conference Rm.
- Lecture Rm.
- Storages
- Laboratory for Shrimp
- Laboratory for Fin-fish and Cuttlefish
- Mechanician Rm.
- Dark Rm.
- Dry Laboratory
- Wet Laboratory
- Feed Preparation Rm.
- Work-shop
- Cafeteria
- Stock Rm. for Phytoplankton
- Pre. Cultivation Rm. for bait production
- Miscellaneous.

Seed Production Bldg. 1

Coldstorage 1

- Coldstorage with chill Rm.
- Feed Preparation Rm.

Dormitory for Trainees 1

Machine Rm. 1

Pond

- Shrimp Rearing Pond 8
- Fish Rearing Pond 14

Seawater intake and discharge system 1

- Intake Pipe
- Intake Basin
- Pump
- Filter
- Elevation Tank
- Reservoir Tank
- Miscellaneous

(2) LIST OF MAJOR EQUIPMENTS AND MATERIALS.

Equipments for Seedling.

- Tanks for seed production
- Tanks for plankton culture
- Equipments for feed preparation
- Pump
- Refrigerator - Freezer
- Miscellaneous.

Equipments for Rearing.

- Feed cooking equipments
- Water Wheels for water agitation
- Fishing gears
- Diving equipments with air-compressor
- Live fish transportation unit
- Miscellaneous.

Equipments for Research.

- Analytical equipments
- Laboratory equipments
- Field survey equipments
- Dark room apparatus
- Miscellaneous.

Equipments for Training.

Boat and Vehicle

- FRP Boat
- 2tons Truck
- 4WD Vehicle

Note : In addition, PDRY side requested to include followings:

- Midget Bus
- Commercial Diet
- Brine Shrimp Eggs
- Chemicals.

## APPENDIX 2

## LIST OF COUNTERPARTS

Authority	Status	Name
Ministry of Fish Wealth	First Deputy Minister	Mr. Abdul W. Sharaf
	Deputy Minister	Mr. Hisham H. Ahmed
	Assistant Deputy Minister	Dr. Abdul Bari Fakhri
	Assistant Deputy Minister	Mr. F. Bahso
	Adviser to the Minister	Dr. Kaled I. Hariri
Marine Science & Resources Research Center (MSRRC)	Director	Mr. Abdulla M. Hamadi
	Deputy Director	Mr. Abdulla Ghaddaf
	Senior Project Officer	Mr. Anwer Ahmed Khan
Coastal Fishing cor- poration	Director	Mr. Ali Abdul Hameed
National Corporation of Fish Marketing		Mr. Ahmed M. Al-Mender
Ministry of Construction	Material Engineer. Chief of Central Laboratory & Resear- ch Dept.	Mr. Ahmed Ali Murshed
	Chief Quantity Surveyor Dept.	Mr. Taher Mohamed Ali
	Head of Town Planning Dept.	Mr. Baharoon Abdul Kader
	General Manager Engineering Affairs	Mr. Fawzi Moughed Abdol Gader

Authority	Status	Name
Ministry of Construction (cont.)	Head of Supervision Dept.	Mr.Saeed Mahroos Banaemah
	Head of Structural Dept.	Mr. Mohamed Mola
Aden Governorate	Governor	Mr.Mohamoud Abdulla Arasi
	Director of Environmental Health Dept.	Mr.Badr Mohamed Nagi
	Director Fire Brigade	Mr.Ali Salem Ali
Public Corporation Electric Power	Director Transaission & Distribution	Mr.Ahmed Hason As-Safi
	Director Inspection & Consumers	Mr. Ahmed Saif Abdulmageed
Ministry of Communication	Deputy Director of Telephone Dept.	Mr. Ali Yousouf Asaad
Yemen Port Authority	A.C Assist Chief Engineer Surveyor & Mooving Master	Mr.Hamza Hussein Ali
	Port of Aden Marine Dept.	Capt. A. Ali Noor H.M.
Public Water Corporation	Director of Maintenance & Operation Dept.	Mr.Abulla Abdul Fattah
Ministry of Energy & Minerals	Director of Geology & Mineral Dept.	Mr.Othman Noman
Petroleum and Minerals Board Aden Refinery CO.Ltd.	Deputy Director Electrical Dept.	Mr.Abdulla Mohsin





## APPENDIX 3

## STUDY SCHEDULE

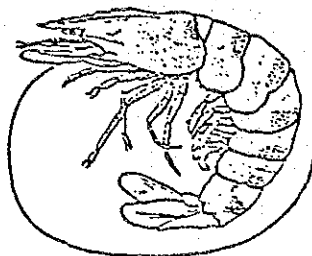
Dates (1985)		Schedule
1	26 Jun. (Wed)	Depart from Narita at 21.00 (AF273).
2	27 Jun. (Thu)	Arrive at paris at 06.45.
3	28 Jun. (Fri)	Depart from Paris at 10.55 (KU184).
4	29 Jun. (Sat)	Arrive at Aden at 02.50, acknowledgement to the Ministry of Fish Wealth, site inspection.
5	30 Jun. (Sun)	Inspect Little Aden Prawn Aquaculture Center, visit Mr. Sharaf, First Deputy Minister of MPW.
6	1 Jul. (Mon)	Meeting at MSRRC, prime measurement of site, team meeting, conference with the Material test center of the Ministry of Construction, and Ministry of Energy and Minerals.
7	2 Jul. (Tue)	Meeting at MSRRC, inspect facilities, conference and data collection at the Ministry of Construction.
8	3 Jul. (Wed)	Conference with MPW, investigation and measurement of site, team meeting, rough plan of site and layout investigation.
9	4 Jul. (Thu)	Conference with Poultry Development Corporation, re-investigation of site facility layout, conference with Yemen Port Authority, Ministry of Construction, and Public Water Corporation.
10	5 Jul. (Fri)	Team meeting on Minutes, preparation of the lists of facilities, data and equipment, plans of organization of administration and Management system, and rough plan of site.
11	6 Jul. (Sat)	Signing the Minutes, Conference with MSRRC, Aden Governorate, and the Ministry of Welfare and Environment, and with the Ministry of Const- ruction.
12	7 Jul. (Sun)	Mr. Ogawa and Mr. Yoshitake depart from Aden. Investigation of PDC Farm, measurement of site, conference with Yemen Port Authority.
13	8 Jul. (Mon)	Conference with National Brewing Corporation (Research of possibility of using beer grains as feeding), measurement of site, conference with the Ministry of Communication.
14	9 Jul. (Tue)	Measurement of site and sounding.
15	10 Jul. (Wed)	Conference with MSRRC, measurement of site and sounding, conference with the Ministry of Construction and the Public Corporation of Electric power.
16	11 Jul. (Thu)	Measurement of Farisi Salt Farm remains, Conference with MSRRC, the Ministry of Construction, preparation of measurement and sounding plan.
17	12 Jul. (Fri)	preparation of Measurement and sounding plan.
18	13 Jul. (Sat)	Investigation of Aden fishing port, team meeting on the report of the research, investigation of the fish market, conference with the Second Deputy Minister of MPW, Mr. Bari, completion of the measurement and sounding plan.

Dates (1985)		Schedule
19	14 Jul. (Sun)	Conference with MSRRC and Coastal Fishing Corporation, investigation by Kubota Construction Co..
20	15 Jul. (Mon)	Investigation of Prawn Aquaculture Center in Little Aden, Conference with National Corporation of Fish Marketing, and with MFW.
21	16 Jul. (Tue)	Conference with the First Deputy Minister, and with Aden Governorate Environment and Health Dept.
22	17 Jul. (Wed)	Acknowledgement to the related places.
23	18 Jul. (Thu)	Depart from Aden at 06.40, arrive at Copenhagen at 18.00 (ME365).
24	19 Jul. (Fri)	Depart from Copenhagen at 15.30 (SK989).
25	20 Jul. (Sat)	Arrive at Narita at 15.30.

Note: AF: AIR FRANCE  
 KU: KUWAIT AIRWAYS  
 ME: MIDDLE EAST AIRLINES  
 SK: SCANDINAVIAN AIRLINES

*Panaeus semisulcatus* DE HAAN

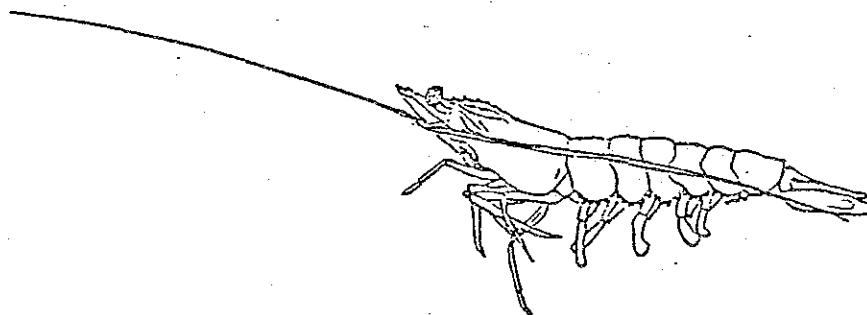
English: Green tiger prawn



Found widely in the coast of the Western Pacific Ocean to the Indian Ocean, and lives under the muddy seabed less than 20m deep. Body length goes up to 22cm, weight up to 110g. When alive, the body colours is purple reddish brown. When shipped fresh, it is less fresh than the *P. japonicus*. This prawn is popular in the Middle Eastern countries such as Kuwait, for an aquaculture specie.

*Panaeus Indicus* H. Milne Edwards

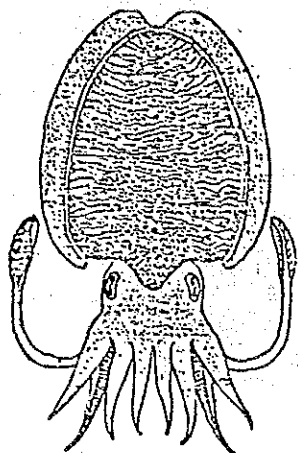
English: White shrimp, Indian Prawn



Found widely in the coast of the Western Pacific Ocean to the Indian Ocean. Body length goes up to 25cm. Characteristic points are the smooth skin and the transparent white body colour. Depending on the birthplace, the body colours vary from transparent blue or yellow. The shape is almost flat and wide with big tail.

*Sepia pharaonis* Ehrenberg

English Cuttlefish

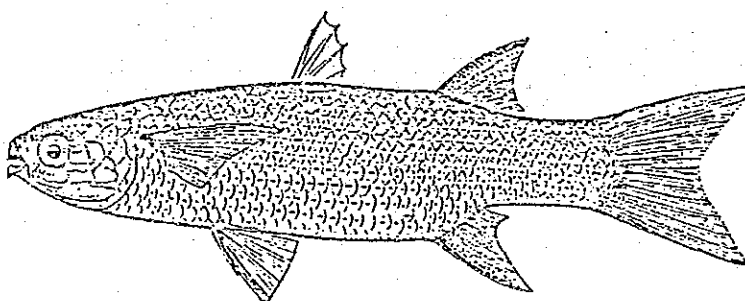


Found along the coast of the Indian Ocean to the Western Pacific, eastern limit being on the red sea. had once been gathered numerously in PDRY. Body length goes up to 36cm, weight up to 4.2kg, and are quite big a specie, but the average size is 15-20cm long. The tiger pattern on the body back surface is apparent. Meat is thick, soft and good. The following two species live on the same areas and are objects for aquaculture.

*Sepia sarmgnyi* English: Cuttle fish

*Sepia Prashadi* English: Cuttle fish

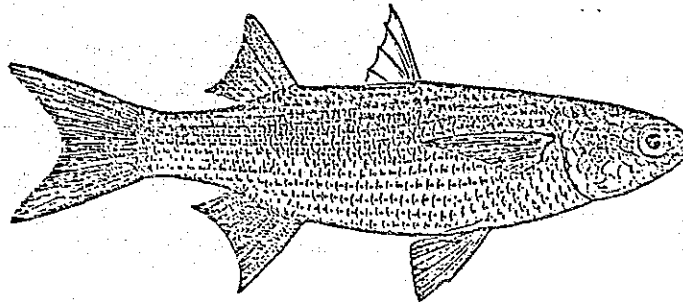
*Crenimugil crenilabis* (Forsk.) English: Mullet



Found widely in the Indian Ocean and the Pacific Ocean, with not so high haul rate. Body length goes up to 25cm. Appearance resembles that of *Mugil Cephalus*, but the characteristic is the rows of projecting flesh on the lips. No eyelids. Mulletts are thought to be high graded in the Middle East, and also is very popular in PDRY.

Valamugil seheli (Forsk.)

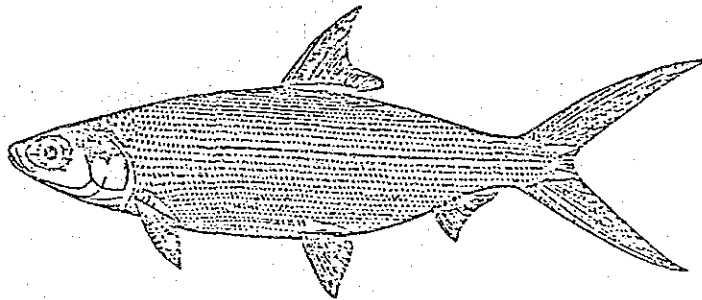
English: Mullet



Found in the tropic seas, especially in the Pacific Ocean. Body length is 18 to 23cm average. No teeth, no eyelids.

Chanos chanos (Forsk.)

English: Milk Fish



Found all over the inlets of the tropic part of the Indian ocean and the Pacific Ocean. Body length goes up to 180cm. Top part of the body is grey, sides are silver. Very strong and high jumping ability. In the South Eastern Asia, baby fish are caught at high tide and aquacultured in pools in parted inlets. Edible and distributed to homes usually 500g in weight. Rapid growth and need less than a year to become commercial size. White meat and much preference in South East Asia. Generally vegetable feeding but animal feeding also capable.

Mainly in seaweed areas and inlets. Body length up to 36cm. No scale on cheeks with marble patterned body colour.

*Siganus stellatus* (Forsk.)

English: Rabbit fish, Slimy, Spiny

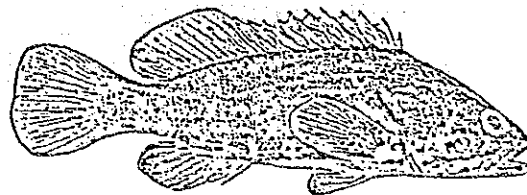
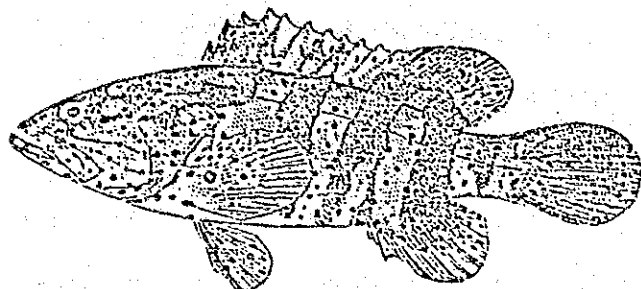
Found in shoals or seaweed areas in the tropic parts of the Indian Ocean. Body length up to 33cm. Scales on cheeks and many dark spots on the skin.

*Epinephelus taubina* (Forsk.)

English: Garrupa, Rock-cod, Black seabass

adult fish

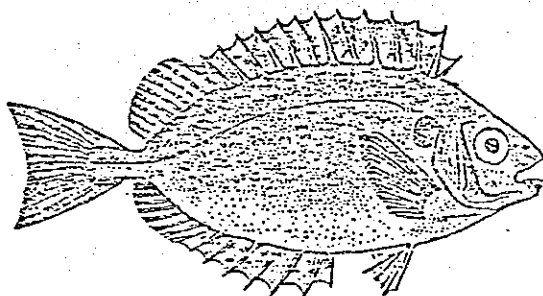
baby fish



Found widely in the red sea, the tropic parts of the Indian Ocean and the Pacific Ocean. Most abundant species of seabass and found in the coastal reefs. Body length is 40cm average, big ones goes up to 230cm, body weight up to 220kg. The body is light brown with dark brown or black spots. Baby fish resembles *E. stoliczkae* Day found in Indian Ocean. high graded in the Middle East and eaten fried at celebration. Multiplication have been tried in Kuwait.

*Siganus oramin* (Schneider)

English: Rabbit fish, Slimy, Spiny



Found in the tropic parts of the Indian Ocean and the Pacific Ocean. Mostly in calm seaweed areas or reefs. Body length goes up to 36cm. No scale on the cheeks. Olive green body colour with brown back and small round white spots. Good eaten fresh or smoked. Popular in the Middle East and palm sized ones are eaten roasted or fried. Plan of aquaculture in Kuwait and Bahrain.

*Siganus rivulatus* (Forsk.)

English: Rabbit fish, Slimy, Spiny

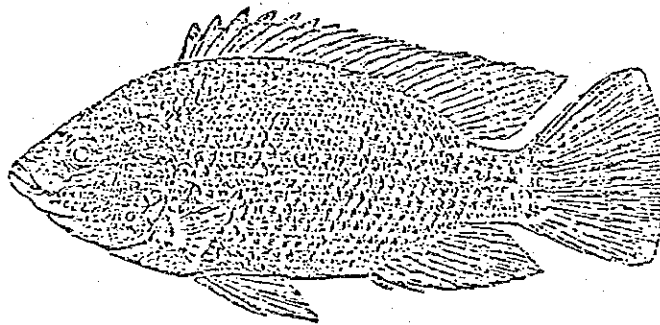
Widely found in the tropic parts of the Indian Ocean and the Pacific Ocean.

## Tilapias

Tilapias are tropical fresh water fish with African origin. Domain of active temperature is 10 - 45°C, and the suitable water temperature is 20 - 35°C. High salinity and normal breeding possible in 3‰ of salinity. Capable of spawning up to 4.8‰ of salt. Oral nursing species exist. Following three species apply to the oral nursing species. Aquacultured in the South East Asia, the Middle East and Africa. The term tilapia comes from Bushman word meaning fish. Classification is blurred and ex-Tilapia species are separated into three species as Tilapia, Sarotherodon, and Oreochromis.

*Oreochromis niloticus*

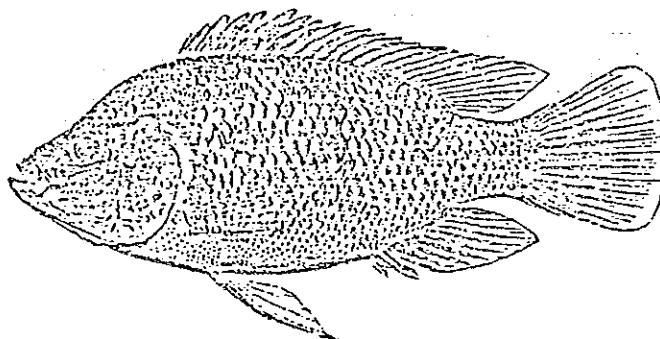
English: Tilapia (Nile tilapia)



Body length goes up to 50cm, weight up to 2.5kg. Biggest specie of Tilapia. Stronger cold resistance than *O. mossambica*. Omnivorous but prefer vegetables. Commercial size is more than 35cm long, 900g in weight. Good white meat, good feeding effect, and rapid growth which is the common characteristic of Tilapias, and is a good advantage for aquaculture.

*Oreochromis mossambica*

English: Tilapia (Java tilapia)

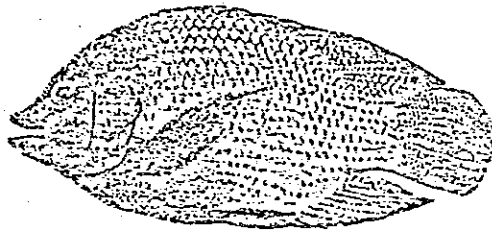




Body length goes up to 35cm, weight up to 700g. Baby fish have a habit of escaping in to adults mouth when in danger. Spawn all year round if the water temperature is more than 20°C. Omnivorous but prefer vegetables. Eat mostly seaweeds or detolitus. Species more than 20cm long, 150g in weight are distributed as commercial sizes. If an Albino and *O. niloticus* are mixed, the prime breed will be Red Tilapia which has very rapid growing ability.

*Oreochromis aureus*

English: Tilapia (Blue tilapia)



Similar character as the forementioned two. Stronger cold resistance than others. If mixed with *O. niloticus* the prime breeds are all male, therefore it is very important for aquaculture. Because the female fish do not eat during the oral nursing period, it means they grow slower compared to male.

APPENDIX 5

WEATHER STATISTICS

Monthly Weather Forecasting Khormakser Meteorological Station (Aden)

For the Month of January Prepared by: Ing. Oceanography

Year	Temperature (°C)			Humidity (%)			Pressure (mb)			W.F.*(knots)			W.D.* (force)	S.T.* (°C)	S.* (%)	
	Max	Min	H/L	Av.	Max	Min	Av.	Max	Min	Av.	Max	Min				Av.
1960-1970	28.1	22.7	29.0/18.8	25.6	75	61	61	1049.7	1038.5	1043.2	-	-	-	-	-	-
1971	28.1	22.0	29.2/19.1	24.9	73	58	67	1017.2	1013.4	1015.0	-	-	-	-	-	-
1972	28.2	22.8	29.0/20.0	25.3	73	60	68	1017.0	1013.4	1014.7	-	-	-	-	-	-
1973	28.2	23.6	29.2/20.4	25.5	73	61	68	1018.8	1015.0	1016.7	35	16.1	11.6	080	E	-
1974	27.7	23.0	28.8/20.1	25.1	73	61	69	1017.1	1013.4	1015.1	27	12.9	11.1	050	NE	-
1975	28.3	22.6	29.2/17.7	25.1	76	61	70	1018.2	1014.5	1016.1	25	11.6	10.9	070	E	-
1976	28.1	23.3	28.8/20.2	25.6	74	61	69	1017.3	1013.0	1015.2	25	10.9	9.8	110	E	-
1977	28.6	23.5	29.6/20.9	25.8	78	64	72	1016.7	1013.1	1014.7	28	11.3	9.2	090	E	-
1978	29.0	23.6	30.0/20.3	26.1	75	60	69	1018.8	1015.6	1016.7	31	10.7	9.8	070	E	-
1979	28.3	23.4	29.0/20.7	25.7	76	64	70	1017.7	1014.2	1015.8	28	11.3	7.8	080	E	-
1980	28.9	23.7	29.5/21.9	26.0	80	68	76	1017.2	1013.1	1015.1	20	7.8	7.4	090	E	-
1971-1980	28.3	23.1	29.2/20.1	25.5	75	62	70	1017.6	1013.9	1015.5	-	-	-	-	-	-
1981	28.4	22.6	29.0/18.5	25.5	81	68	71	1017.3	1013.6	1015.1	20	7.2	6.7	070	E	-
1982	28.1	23.1	29.1/21.2	25.5	80	68	74	1016.6	1013.1	1014.7	30	10.8	8.8	110	E	-
1983	28.5	23.3	29.5/20.2	25.8	74	60	68	1018.7	1016.5	1016.6	25	9.9	8.1	120	SE	-
1984	27.7	23.1	29.2/20.1	25.5	74	62	70	1017.1	1013.5	1015.1	21	8.3	7.7	110	E	-
1985	29.9	23.8	30.3/18.8	26.2	81	67	76	1016.4	1013.0	1014.5	25	10.5	-	110	E	25.97
1971-1984	28.3	23.1	29.2/20.1	25.5	-	-	-	1017.5	1013.8	1015.5	-	-	-	-	-	-
1960-1984	28.2	22.9	29.1/19.5	25.5	-	-	-	-	-	-	-	-	-	-	-	-
1948-1984	28.2	22.9	29.1/19.3	-	-	-	-	-	-	-	-	-	-	-	-	-
1948-1959	28.2	22.9	29.2/18.9	-	-	-	-	-	-	-	-	-	-	-	-	-

\* indicates: W.F. - Wind Force  
W.D. - Wind direction  
S.T. - Seawater Temperature  
S. - Salinity

Monthly Weather Forecasting Khormakser Meteorological Station (Aden)

For the Month of February Prepared by: Ing. Oceanography

Year	Temperature (°C)			Humidity (%)			Pressure (mb)			W.F.* (knots)			W.D.* (force)	S.T.* (°C)	S.* (‰)	
	Max	Min	H/L	Max	Min	Av.	Max	Min	Av.	Max	Min	Av.				
1960-1970	28.5	22.8	29.0/18.8	25.7	76	62	69	1048.8	1037.8	1042.6	-	-	-	-	-	-
1971	28.1	21.7	28.8/18.9	24.7	76	60	71	1014.3	1012.7	1013.3	-	-	-	-	-	-
1972	27.9	23.3	29.5/18.2	25.4	77	64	71	1016.2	1012.7	1014.2	-	-	-	-	-	-
1973	28.5	22.4	29.6/18.0	25.4	75	59	69	1017.3	1013.0	1015.2	29	11.6	14.5	080	E	-
1974	28.1	23.2	29.2/19.8	25.4	74	61	69	1016.3	1012.6	1014.3	34	11.1	16.8	110	E	-
1975	28.9	24.2	30.2/21.5	26.2	76	62	71	1013.0	1015.7	1014.7	31	10.9	14.0	070	E	-
1976	28.9	24.0	30.0/21.4	26.1	78	64	73	1015.3	1011.5	1013.1	26	9.8	11.5	060	NE	-
1977	28.8	21.3	30.5/16.4	25.2	71	54	63	1016.9	1014.3	1015.3	28	9.2	10.2	070	E	-
1978	28.8	24.0	30.2/21.7	26.0	77	63	71	1017.4	1013.9	1015.4	29	9.8	12.4	060	NE	-
1979	28.6	22.0	29.5/16.4	25.3	75	59	68	1016.8	1013.0	1014.5	25	7.8	9.0	080	E	-
1980	29.0	23.9	29.8/19.5	26.1	84	71	79	1015.3	1011.4	1013.2	18	6.7	7.4	090	E	-
1971-1980	28.6	23.0	29.7/19.2	25.6	76	62	70	1016.5	1012.8	1014.4	-	-	-	-	-	-
1981	28.8	23.0	29.7/19.0	25.9	79	62	72	1016.0	1012.5	1014.0	18	8.1	8.1	090	E	-
1982	29.2	24.1	30.4/21.0	26.5	85	69	79	1016.0	1011.5	1012.6	24	8.8	8.8	050	NE	-
1983	28.2	24.0	29.4/20.0	25.9	82	70	77	1016.7	1013.2	1014.7	29	8.1	8.1	050	NE	-
1984	28.3	20.9	29.9/16.5	24.7	72	54	77	1016.1	1012.9	1014.5	29	7.7	9.1	030	NE	25.28
1985	29.9	22.3	32.0/19.3	25.7	77	59	70	1014.9	1011.9	1012.9	22	6.5	-	120	SE	26.64
1971-1984	28.6	23.0	29.8/19.2	25.6	77	63	71	1014.6	1012.7	1014.3	-	-	-	-	-	-
1960-1984	28.6	22.9	29.4/19.0	25.6	-	-	-	-	-	-	-	-	-	-	-	-
1948-1984	28.6	23.0	29.5/19.2	-	-	-	-	-	-	-	-	-	-	-	-	-
1948-1959	28.6	23.0	29.8/19.8	-	-	-	-	-	-	-	-	-	-	-	-	-

\* indicates: W.F. - Wind Force  
W.D. - Wind direction  
S.T. - Seawater Temperature  
S. - Salinity

Monthly Weather Forecasting Khormakser Meteorological Station (Aden)

For the Month of March Prepared by: Ing. Oceanography

Year	Temperature (°C)			Humidity (%)			Pressure (mb)			W.F. *(knots)			W.D. * (force)	S.T. * (°C)	S. * (‰)	
	Max	Min	H/L	Av.	Max	Min	Av.	Max	Min	Av.	Max	Min				Av.
1960-1970	29.9	23.8	31.7/19.5	27.0	77	61	69	1043.3	1032.7	1036.9	-	-	-	-	-	-
1971	29.5	23.1	31.2/18.3	26.1	79	64	69	1015.2	1011.6	1013.0	-	-	-	-	-	-
1972	29.5	24.3	31.0/20.5	26.6	79	64	73	1014.8	1011.0	1012.5	-	-	-	-	-	-
1973	29.8	23.8	31.7/18.8	26.6	77	63	71	1014.6	1011.9	1013.4	30	11.6	15.1	070	E	-
1974	29.1	24.0	31.4/19.0	26.3	79	65	74	1014.8	1011.2	1012.5	31	11.1	14.7	090	E	-
1975	29.4	24.4	30.5/21.8	26.6	78	64	73	1014.9	1011.2	1012.7	28	10.9	14.4	090	E	-
1976	30.0	24.9	31.0/20.6	27.1	79	63	73	1012.8	1010.2	1011.6	30	9.8	12.1	070	E	-
1977	30.3	23.8	32.5/19.0	26.8	77	60	70	1015.9	1012.1	1013.6	29	9.2	10.9	080	E	-
1978	29.8	25.0	30.9/23.5	27.0	79	63	73	1015.0	1011.4	1012.8	26	9.8	11.9	070	E	-
1979	30.4	24.0	32.0/18.0	26.9	81	65	74	1014.6	1011.4	1012.4	26	7.8	8.8	080	E	-
1980	30.2	25.0	31.4/22.0	27.2	87	73	81	1013.9	1010.5	1011.7	23	7.4	10.7	070	E	-
1971-1980	29.8	24.2	31.4/22.0	27.2	87	73	81	1014.8	1011.2	1012.6	-	-	-	-	-	-
1981	30.0	25.1	31.2/22.9	27.3	87	71	81	1011.7	999.9	1011.4	20	6.7	7.3	070	E	-
1982	30.3	24.7	31.7/21.0	27.3	84	66	76	1014.0	1010.5	1011.9	26	8.8	10.4	050	NE	-
1983	29.8	25.6	30.8/23.3	27.3	79	67	75	1015.5	1011.9	1013.3	30	8.1	11.6	090	E	-
1984	29.9	22.6	31.4/18.5	26.1	79	61	72	1014.2	1010.7	1012.4	23	7.7	8.8	060	NE	25.92
1985	30.7	23.1	31.8/18.8	26.9	81	61	-	1014.1	1010.4	1011.9	-	-	-	-	-	26.97
1971-1984	29.9	24.3	31.4/20.5	26.8	80	65	74	1013.7	1011.1	1012.5	-	-	-	-	-	-
1960-1984	29.9	24.1	31.5/20.1	26.9	-	-	-	-	-	-	-	-	-	-	-	-
1948-1984	29.8	24.2	31.6/20.3	-	-	-	-	-	-	-	-	-	-	-	-	-
1948-1959	29.8	24.3	31.8/20.9	-	-	-	-	-	-	-	-	-	-	-	-	-

\* indicates: W.F. - Wind Force  
W.D. - Wind Direction  
S.T. - Seawater Temperature  
S. - Salinity

Monthly Weather Forecasting Khormakser Meteorological Station (Aden)

For the Month of April Prepared by: Ing. Oceanography

Year	Temperature (°C)			Humidity (%)			Pressure (mb)			W.F.* (knots)			W.D.* (force)	S.T.* (°C)	S.* (%)	
	Max	Min	H/L	Av.	Max	Min	Av.	Max	Min	Av.	Max	Min				Av.
1960-1970	31.5	25.7	33.8/21.6	28.5	78	59	-	1038.6	1028.3	1032.1	-	-	-	-	-	-
1971	31.7	24.3	36.0/19.4	27.8	78	59	71	1011.9	998.3	999.7	-	-	-	-	-	-
1972	31.0	25.8	32.3/23.0	28.2	80	67	75	1012.7	998.9	1010.4	-	-	-	-	-	-
1973	31.5	24.7	36.8/20.8	28.1	81	64	74	1012.1	1008.5	1009.9	22	11.6	11.7	080	E	-
1974	31.6	24.5	36.3/20.5	27.9	79	62	72	1012.2	1008.7	1010.7	24	10.6	11.1	080	E	-
1975	30.6	26.1	32.4/24.8	28.1	84	71	78	1012.3	1009.0	1010.7	26	10.9	13.2	070	E	-
1976	31.3	25.6	32.4/20.7	28.4	81	65	74	1013.5	1009.7	1011.2	33	9.6	9.8	250	W	-
1977	32.8	26.7	37.2/23.3	29.4	81	62	74	1011.6	1008.0	1009.5	25	9.2	10.7	120	SE	-
1978	31.9	25.1	34.5/22.5	28.5	80	61	73	1012.5	1008.9	1010.3	25	9.3	9.8	090	E	-
1979	32.2	25.0	33.3/21.6	28.3	80	62	72	1013.2	1012.3	1011.1	23	7.8	8.7	110	E	-
1980	31.8	26.0	33.8/22.3	28.7	87	71	81	1012.1	1008.3	1009.8	21	7.4	9.4	080	E	-
1971-1980	31.6	25.4	34.4/21.9	28.3	80	64	74	1012.4	1008.8	1010.2	-	-	-	-	-	-
1981	32.0	26.6	32.8/24.3	29.3	84	75	79	1012.0	1008.2	1009.8	17	6.2	6.7	110	E	-
1982	31.5	25.3	33.0/23.3	28.4	82	66	75	1012.2	1008.7	1010.1	24	8.8	9.1	070	E	-
1983	31.9	27.5	32.8/25.2	29.3	83	69	77	1011.5	1008.8	1010.2	28	8.1	9.9	030	NE	-
1984	32.4	23.5	34.0/19.0	28.1	78	62	71	1011.9	1008.3	1009.7	19	6.7	7.7	160	S	27.79
1985	32.6	26.6	33.5/23.6	29.3	81	63	-	1011.7	1008.0	1008.9	-	-	-	-	-	30.67
1971-1984	31.7	25.5	34.0/22.2	28.5	81	65	65	1011.4	1008.7	1010.2	-	-	-	-	-	-
1960-1984	31.6	25.6	33.9/21.9	28.5	-	-	-	1012.4	1008.8	1009.8	-	-	-	-	-	-
1948-1984	31.6	25.6	33.8/21.9	-	-	-	-	-	-	-	-	-	-	-	-	-
1948-1959	31.5	25.6	33.7/22.0	-	-	-	-	-	-	-	-	-	-	-	-	-

\*Indicates: W.F. - Wind Force

W.D. - Wind Direction

S.T. - Seawater Temperature

S/ - Salinity

Monthly Weather Forecasting Khormakser Meteorological Station (Aden)

Prepared by: Ing. Oceanography

For the Month of May

Year	Temperature (°C)			Humidity (%)			Pressure (mb)			W.F.*(knots)			W.D.* (force)	S.T.* (°C)	S.* (%)
	Max	Min	H/L	Av.	Max	Min	Av.	Max	Min	Av.	Max	Min			
1960-1970	34.1	27.4	38.1/23.8	30.9	78	58	67	1028.8	1019.2	1023.0	-	-	-	-	-
1971	34.3	27.5	38.1/22.7	30.6	78	60	70	1008.4	1005.5	1006.3	-	-	-	-	-
1972	32.9	26.7	34.8/23.6	29.7	77	64	72	1009.4	1008.1	1009.4	-	-	-	-	-
1973	33.6	27.0	38.5/22.5	30.7	81	69	76	1009.3	1005.6	1007.2	43	9.9	11.6	090	E
1974	33.6	27.2	37.4/24.3	30.1	80	62	73	1009.6	1007.8	1007.6	29	10.9	11.1	210	SW
1975	33.7	27.2	37.3/22.6	30.3	79	63	72	1008.4	1005.0	1006.5	25	9.5	10.9	240	SW
1976	33.6	28.1	37.5/24.4	30.7	81	63	73	1010.5	1006.8	1008.5	28	7.8	9.8	210	SW
1977	34.9	28.7	38.5/26.8	31.3	80	63	73	1015.9	1005.7	1007.3	27	8.2	9.2	300	NW
1978	35.0	27.6	38.0/24.5	31.3	82	64	70	1015.0	1005.5	1007.0	28	7.8	9.8	320	NW
1979	34.2	27.5	38.6/24.4	30.6	80	61	72	1014.6	1008.0	1009.3	28	8.3	7.8	090	E
1980	33.7	27.4	37.4/21.9	30.5	86	58	77	1013.9	1005.8	1007.3	19	7.8	7.4	140	SE
1971-1980	34.0	27.6	37.6/23.8	31.6	80	63	73	1014.8	1006.1	1007.6	-	-	-	-	-
1981	34.2	27.7	36.9/24.4	30.0	86	68	77	1011.7	1005.3	1006.8	22	5.5	6.7	220	SW
1982	33.3	27.3	39.3/23.0	30.3	83	65	75	1014.0	1007.1	1008.5	21	6.9	8.8	130	SE
1983	34.0	28.2	37.0/24.0	30.9	79	66	73	1015.5	1006.4	1007.9	28	7.4	8.1	110	E
1984	34.0	27.7	36.4/23.0	30.5	80	62	72	1014.2	1005.5	1007.2	22	7.7	7.7	230	SW
1985	35.1	26.7	38.6/23.0	30.9	80	56	69	1014.1	1005.0	1006.4	-	-	-	-	30.68
1971-1984	33.9	27.6	37.5/23.7	30.6	80	64	73	1013.7	1006.1	1007.6	-	-	-	-	30.67
1960-1984	34.0	27.5	37.8/23.8	30.7	-	-	-	-	-	-	-	-	-	-	-
1948-1984	34.0	27.4	38.0/23.8	-	-	-	-	-	-	-	-	-	-	-	-
1948-1959	27.1	27.1	38.5/24.0	-	-	-	-	-	-	-	-	-	-	-	-

\* indicates: W.F.- Wind Force

W.D. - Wind Direction

S.T. - Seawater Temperature

S. - Salinity

Monthly Weather Forecasting Khormakser Meteorological Station (Aden)

Prepared by: Ing. Oceanography

For the Month of June

Year	Temperature (°C)			Humidity (%)			Pressure (mb)			W.F. *(knots)			W.D. * (force)	S.T. * (°C)	S. * (‰)	
	Max	Min	H/L	Av.	Max	Min	Av.	Max	Min	Av.	Max	Min				Av.
1960-1970	36.9	28.9	39.8/26.6	32.6	71	49	56	1019.6	999.7	1013.4	-	-	-	-	-	-
1971	36.3	28.5	37.7/26.5	31.9	77	53	65	1005.7	1002.1	1001.6	-	-	-	-	-	-
1972	36.1	28.7	41.5/24.5	32.0	79	53	68	1005.2	1002.4	1004.1	-	-	-	-	-	-
1973	35.8	28.8	38.0/27.4	32.1	78	55	69	1005.3	1001.4	1002.9	33	8.3	11.6	210	SW	-
1974	36.5	29.3	39.4/28.0	32.6	74	49	62	1005.0	1002.4	1003.9	43	8.7	11.1	300	NW	-
1975	36.6	28.4	41.8/25.1	32.2	79	48	66	1005.1	1001.1	1002.8	33	10.2	10.9	230	SW	-
1976	36.1	29.0	38.4/26.6	32.3	75	56	66	1005.3	1001.8	1003.1	32	7.2	9.8	230	SW	-
1977	35.8	29.1	37.9/27.6	32.3	80	60	70	1005.3	1001.8	1002.8	32	8.5	9.2	060	NE	-
1978	36.3	29.0	39.0/27.0	32.5	77	53	69	1004.9	1002.6	1002.6	36	7.9	9.8	220	SW	-
1979	35.9	28.7	38.4/26.1	33.0	77	56	69	1007.1	1003.4	1005.1	26	7.2	7.8	080	E	-
1980	37.7	29.3	39.9/22.0	33.0	78	46	66	1005.0	1001.2	1002.7	23	7.4	6.3	200	S	-
1971-1980	36.3	28.9	39.2/26.6	32.3	77	52	67	1005.6	1001.8	1003.4	-	-	-	-	-	-
1981	36.1	28.8	38.5/27.3	32.3	82	59	73	1005.9	1002.4	1003.8	20	6.7	5.7	170	S	-
1982	35.9	29.4	38.0/27.6	32.5	83	63	73	1005.4	1003.1	1004.3	24	8.8	5.9	210	SW	-
1983	35.9	29.9	37.8/28.5	32.7	78	60	69	1006.7	1003.5	1004.8	31	8.1	6.7	210	SW	-
1984	36.6	29.2	38.4/27.5	32.3	80	53	68	1004.8	1001.3	1004.8	31	7.7	6.2	340	N	-
1985	35.7	28.3	37.0/27.0	31.7	81	57	70	1006.6	1002.7	1002.7	-	-	-	-	-	30.15
1971-1984	36.3	29.0	38.9/26.9	32.3	78	54	68	1005.7	1002.0	1003.5	-	-	-	-	-	-
1960-1984	36.6	29.0	39.2/26.8	32.4	-	-	-	-	-	-	-	-	-	-	-	-
1948-1984	36.6	28.9	39.1/26.9	-	-	-	-	-	-	-	-	-	-	-	-	-
1948-1959	36.6	28.9	39.1/27.0	-	-	-	-	-	-	-	-	-	-	-	-	-

\* indicates: W.F. - wind force  
W.D. - Wind Direction  
S.T. - Seawater Temperature  
S. - Salinity



Monthly Weather Forecasting Khormakser Meteorological Station (Aden)

For the Month of July Prepared by: Ing. Oceanography

Year	Temperature (°C)			Humidity (%)			Pressure (mb)			W.F. (knots)*			W.D.* (force)	S.T.* (°C)	S.* (‰)	
	Max	Min	ll/l	Av.	Max	Min	Av.	Max	Min	Av.	Max	Min				Av.
1960-1970	36.2	28.5	38.8/26.1	31.9	73	51	57	1015.1	1003.3	1008.5	-	-	-	-	-	-
1971	36.2	28.6	39.0/25.8	31.9	74	47	63	1004.0	1000.2	1001.8	-	-	-	-	-	-
1972	36.6	28.1	38.8/26.5	31.9	73	44	62	1005.1	1001.1	1002.8	-	-	-	-	-	-
1973	35.8	28.7	38.0/27.6	31.7	73	51	66	1003.9	999.7	1001.5	50	9.7	11.6	060	NE	-
1974	36.1	28.3	38.2/26.0	31.7	77	47	64	1004.2	999.7	1001.8	45	10.4	11.1	210	SW	-
1975	36.1	28.7	37.5/27.7	32.0	78	46	66	1003.9	999.5	1001.5	42	8.9	10.9	250	W	-
1976	35.3	27.6	38.0/22.5	31.5	76	48	65	1005.3	1000.8	1002.8	41	9.1	9.8	230	SW	-
1977	36.2	28.7	37.9/25.6	32.0	78	50	68	1002.7	998.2	1000.2	35	7.8	9.2	070	E	-
1978	34.8	27.6	37.1/25.6	31.1	77	53	66	1004.1	1000.5	1002.4	40	11.7	9.8	240	SW	-
1979	36.9	29.1	41.0/27.2	32.4	76	48	65	1005.6	1001.4	1003.3	29	6.9	7.8	220	SW	-
1980	36.9	28.0	39.2/37.4	32.2	79	47	66	1004.3	999.6	1001.7	31	7.0	7.4	210	SW	-
1971-1980	36.9	29.1	38.5/26.2	31.8	79	48	65	1004.3	1000.1	1002.0	-	-	-	-	-	-
1981	36.2	28.7	38.4/27.2	32.5	80	52	68	1003.8	999.7	1001.6	30	6.0	6.7	220	SW	-
1982	36.3	29.2	39.4/28.8	32.6	86	55	69	1004.9	1000.9	1002.5	38	6.9	8.8	220	SW	-
1983	36.8	29.4	38.0/27.5	32.4	76	49	65	1003.9	999.9	1001.6	35	6.3	8.1	270	W	-
1984	35.2	27.9	37.0/26.0	31.3	86	55	69	1004.1	1000.1	1001.9	25	6.6	7.7	210	SW	-
1985	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30.67	36.54
1971-1984	36.1	28.7	38.4/26.5	31.9	77	49	66	1004.3	1001.1	1002.0	-	-	-	-	-	-
1960-1984	36.2	28.6	31.9/26.3	-	-	-	-	-	-	-	-	-	-	-	-	-
1948-1984	36.1	28.5	38.6/26.1	-	-	-	-	-	-	-	-	-	-	-	-	-
1948-1959	36.0	28.3	38.7/25.7	-	-	-	-	-	-	-	-	-	-	-	-	-

\* indicates: W.F. - Wind Force  
W.D. - Wind Direction  
S.T. - Seawater Temperature  
S. - Salinity

Monthly Weather Forecasting Khormakser Meteorological Station (Aden)

Prepared by: Ing. Oceanography

For the Month of August

Year	Temperature (°C)			Humidity (%)			Pressure (mb)			W.F.* (knots)			W.D.* (force)	S.T.* (°C)	S.* (%)		
	Max	Min	H/L	Av.	Max	Min	Av.	Max	Min	Av.	Max	Min				Av.	
	1960-1970	35.6	28.0	37.9/25.8	31.4	73	54	61	1013.8	1005.0	1010.2	-				-	-
1971	35.9	28.3	39.4/26.4	31.5	76	53	64	1004.7	1000.2	1002.0	-	-	-	-	-		
1972	36.7	29.2	38.3/27.6	32.4	76	50	65	1006.3	1002.3	1003.8	-	-	-	-	-		
1973	35.1	27.0	37.2/24.9	30.6	76	49	64	1004.7	999.8	1002.1	52	12.1	11.6	010	N		
1974	35.2	28.4	37.3/26.0	31.5	76	50	64	1005.5	1000.8	1002.9	38	11.6	11.1	200	S		
1975	33.4	25.9	35.5/23.0	29.7	77	53	66	1004.8	1000.0	1002.5	45	12.5	10.9	220	SW		
1976	34.7	26.1	37.2/22.1	30.1	79	49	66	1005.5	1000.8	1002.8	35	10.2	9.8	220	SW		
1977	35.7	27.4	39.2/23.6	31.3	77	47	63	1005.5	1000.8	1002.9	42	10.0	9.2	210	SW		
1978	35.8	27.7	37.5/25.0	31.2	81	54	69	1005.3	1000.8	1002.7	31	8.4	9.8	250	W		
1979	36.1	28.8	38.0/27.0	31.9	82	57	70	1005.5	1001.6	1003.2	30	6.6	7.8	220	SW		
1980	36.7	28.1	38.6/25.5	32.1	77	48	64	1004.6	1001.4	1003.3	27	6.2	7.4	150	SE		
1971-1980	35.5	27.7	37.8/25.1	31.2	77	51	66	1005.4	1000.9	1002.8	-	-	-	-	-		
1981	35.9	27.8	37.6/24.0	31.5	81	52	68	1005.1	1000.8	1002.7	34	6.0	6.7	240	SW		
1982	35.8	28.2	37.8/27.0	31.7	82	49	68	1005.5	1001.0	1002.8	35	6.6	8.8	300	NW		
1983	36.3	28.9	39.8/26.3	32.0	78	50	66	1004.2	999.3	1001.5	45	6.2	8.1	220	SW		
1984	35.6	27.9	36.8/26.5	31.5	81	55	71	1006.1	1002.1	1003.6	22	5.8	7.7	170	S		
1985	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30.20	36.88
1971-1984	35.6	27.8	37.9/25.3	31.3	78	51	66	1005.3	1000.8	1002.7	-	-	-	-	-	-	-
1960-1984	35.6	27.9	37.9/25.5	31.3	-	-	-	-	-	-	-	-	-	-	-	-	-
1948-1984	35.6	27.7	37.8/25.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1948-1959	35.6	27.4	37.6/24.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-

\* indicates: W.F. - Wind Force

W.D. - Wind Direction

S.T. - Seawater Temperature

S. - Salinity

Monthly Weather Forecasting Khorakser Meteorological Station (Aden)

For the Month of September Prepared by : Ing. Oceanography

Year	Temperature (°C)			Humidity (%)			Pressure (mb)			W.F.*(knots)			W.D.* (force)	S.T.* (°C)	S.* (%)
	Max.	Min.	H/L	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.			
1960-1970	35.3	28.4	38.2/25.5	31.3	77	58	66	1024.5	1015.0	1017.8	33	-	-	-	-
1971	34.8	27.7	37.4/24.4	30.9	80	58	71	1008.9	1004.7	1006.4	-	-	-	-	-
1972	34.8	28.2	37.5/23.5	31.4	78	62	68	1009.6	1006.0	1007.6	-	-	-	-	-
1973	34.7	28.7	37.1/26.0	31.4	81	59	71	1008.4	1003.9	1005.7	33	9.1	11.6	230	SW
1974	35.0	28.7	37.0/25.0	31.6	78	59	70	1008.2	1004.1	1007.5	31	8.4	11.1	160	S
1975	34.9	27.9	36.8/23.8	30.9	79	63	70	1007.5	1003.2	1004.9	44	8.1	10.9	270	W
1976	34.6	27.4	37.7/25.3	30.9	81	55	68	1009.4	1005.3	1006.9	27	8.1	9.8	220	SW
1977	35.1	28.7	39.7/27.0	31.4	81	58	71	1009.3	1005.4	1006.7	28	7.0	9.2	220	SW
1978	35.4	28.5	37.6/27.0	31.5	79	56	70	1008.8	1004.5	1006.4	26	7.8	9.8	230	SW
1979	34.6	28.3	37.5/25.5	31.3	84	67	76	1008.7	1004.9	1006.3	21	6.6	7.8	190	S
1980	35.0	27.9	38.0/25.4	31.1	80	59	-	1009.1	1005.0	1006.6	23	5.5	7.4	200	S
1971-1980	34.9	28.2	37.6/25.3	31.2	80	59	71	1008.8	1005.1	1006.3	-	-	-	-	-
1981	34.8	28.2	37.0/25.2	31.3	84	63	76	1008.0	1004.1	1005.7	31	5.5	6.7	230	SW
1982	34.8	28.4	37.5/25.6	31.3	82	62	74	1009.4	1005.5	1007.0	42	6.8	8.8	330	NW
1983	35.8	29.1	38.0/27.5	32.1	79	55	69	1005.9	1003.2	1004.9	25	5.6	8.1	180	S
1984	-	-	-	-	-	-	-	1009.3	1005.5	1007.0	24	8.0	7.7	160	S
1985	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1971-1984	34.9	28.3	37.7/25.5	31.3	80	59	71	1008.7	1004.6	1006.3	-	-	-	-	-
1960-1984	35.1	28.3	37.9/25.5	31.3	-	-	-	-	-	-	-	-	-	-	-
1948-1984	35.1	28.2	37.9/25.5	-	-	-	-	-	-	-	-	-	-	-	-
1948-1959	35.3	28.0	37.9/25.4	-	-	-	-	-	-	-	-	-	-	-	-

\* indicates: W.F. - Wind Force  
W.D. - Wind Direction  
S.T. - Seawater Temperature  
S. - Salinity

Monthly Weather Forecasting Khormakser Meteorological Station (Aden)

For the Month of October Prepared by : Ing. Oceanography

Year	Temperature (°C)			Humidity (%)			Pressure (mb)			W.F.*(knots)			W.D.* (force)	S.T.* (°C)	S.* (%)	
	Max.	Min.	H/L	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.				Av.
1960-1970	32.9	24.5	35.8/20.7	28.7	74	54	64	1039.8	1028.0	1033.5	-	-	-	-	-	
1971	33.1	24.4	35.4/21.4	28.8	74	57	65	1012.0	1009.5	1011.6	-	-	-	-	-	
1972	32.1	24.3	36.6/19.9	28.3	77	68	70	1014.3	1010.2	1012.2	-	-	-	-	-	
1973	32.0	24.3	33.5/20.2	28.3	75	58	62	1013.0	1009.1	1010.9	28	10.8	11.6	060	NE	
1974	33.1	24.0	36.8/19.6	28.7	71	53	65	1011.4	1009.0	1011.1	22	8.5	11.1	150	SE	
1975	33.4	25.9	35.5/23.0	29.2	77	57	67	1012.2	1007.9	1010.1	31	8.0	10.9	100	E	
1976	31.9	25.7	33.8/22.3	28.6	79	60	71	1013.7	1009.6	1011.6	26	10.5	9.8	080	E	
1977	32.4	27.0	35.8/24.8	29.4	80	64	73	1013.7	1009.6	1011.6	25	9.2	9.2	080	E	
1978	32.6	25.7	34.5/21.0	29.2	79	60	70	1013.7	1009.9	1011.7	55	10.1	9.8	040	NE	
1979	32.2	25.2	33.6/21.8	28.8	80	62	71	1013.8	1010.2	1012.0	21	7.2	7.8	090	E	
1980	33.1	25.3	38.0/20.5	29.2	79	60	71	1012.9	1008.9	1010.8	22	5.5	7.4	150	SE	
1971-1980	32.6	25.2	35.3/21.5	28.9	77	59	69	1013.4	1009.4	1011.4	-	-	-	-	-	
1981	32.2	24.9	35.4/20.2	28.7	78	58	69	1013.5	1009.9	1011.7	21	7.7	6.7	110	E	
1982	32.4	25.2	33.7/22.2	28.7	82	62	73	1013.8	1009.9	1011.8	27	10.0	8.8	110	E	
1983	33.4	25.2	37.0/20.2	29.4	71	53	63	1013.1	1009.1	1010.8	22	6.7	8.1	160	S	
1984	32.9	21.8	35.6/18.2	27.7	75	53	65	1014.5	1010.8	1012.7	22	6.9	7.7	150	SE	
1985	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30.08	36.59
1971-1984	32.6	24.9	35.4/21.1	28.8	77	59	69	1013.4	1009.5	1011.5	-	-	-	-	-	-
1960-1984	32.7	24.7	35.6/20.9	28.8	-	-	-	-	-	-	-	-	-	-	-	-
1948-1984	32.8	24.8	35.6/20.9	-	-	-	-	-	-	-	-	-	-	-	-	-
1948-1959	33.0	24.8	35.8/20.7	-	-	-	-	-	-	-	-	-	-	-	-	-

\* indicates: W.F. - Wind Force  
W.D. - Wind Direction  
S.T. - Seawater Temperature  
S. - Salinity

Monthly Weather Forecasting Khorakser Meteorological Station (Aden)

For the Month of November Prepared by : Ing. Oceanography

Year	Temperature (°C)		Humidity (%)		Pressure (mb)		W.F. *(knots)			W.D. * (force)	S.T. * (°C)	S. * (%)
	Max.	Min.	W/L	Av.	Max.	Min.	Max.	Min.	Av.			
1960-1970	30.3	23.4	32.3/19.7	26.6	75	55	1048.6	1037.4	1042.9	-	-	-
1971	29.9	22.9	33.2/19.0	26.5	74	59	1017.1	1013.4	1015.2	-	-	-
1972	28.9	23.2	30.0/20.0	26.2	80	69	1015.7	1011.3	1013.7	-	-	-
1973	30.1	23.0	31.7/20.4	26.7	73	56	1016.6	1012.8	1014.8	29	11.3	11.6
1974	30.0	21.4	31.8/17.7	25.9	73	54	1017.2	1013.4	1015.4	24	8.6	11.1
1975	30.8	23.0	32.7/19.2	27.0	74	55	1016.3	1012.5	1014.5	28	9.2	10.9
1976	30.5	23.2	32.7/19.8	26.9	78	58	1015.1	1011.2	1013.1	25	8.8	9.8
1977	31.1	22.9	33.1/18.6	27.1	79	60	1015.8	1012.0	1013.8	22	6.4	9.2
1978	31.5	23.0	35.9/20.0	27.3	73	49	1016.4	1012.6	1014.5	27	8.5	9.8
1979	30.7	22.2	32.5/18.8	26.7	80	63	1015.2	1011.5	1013.4	18	6.4	7.8
1980	30.8	22.5	32.5/18.4	26.9	77	61	1015.4	1011.5	1013.6	18	5.2	7.4
1971-1980	30.4	22.7	32.6/19.2	26.7	76	59	1016.1	1012.3	1014.2	-	-	-
1981	30.5	22.4	32.4/19.8	26.7	76	59	1015.4	1011.8	1013.7	21	6.9	6.7
1982	30.6	24.6	31.8/30.0	27.5	82	66	1014.8	1011.0	1012.8	34	10.6	8.8
1983	29.9	22.8	32.0/19.6	26.5	75	58	1016.1	1013.8	1015.1	20	8.7	8.1
1984	30.5	23.2	32.1/16.4	26.7	74	57	1016.2	1012.5	1014.3	23	9.9	7.7
1985	-	-	-	-	-	-	-	-	-	-	-	25.60
1971-1984	30.4	22.9	32.5/19.1	26.7	76	59	-	-	-	-	-	35.81
1960-1984	30.4	23.1	32.4/19.3	26.7	-	-	-	-	-	-	-	-
1948-1984	30.3	23.0	32.4/19.3	-	-	-	-	-	-	-	-	-
1948-1959	30.3	22.8	32.5/19.2	-	-	-	-	-	-	-	-	-

\* indicates: W.F. - Wind Force  
W.D. - Wind Direction  
S.T. - Seawater Temperature  
S. - Salinity

Monthly Weather Forecasting Khormakser Meteorological Station (Aden)

For the Month of December Prepared by : Ing. Oceanography

Year	Temperature (°C) :			Humidity (%)			Pressure (mb)			W. F.* (knots)			W. D.# S. T.# (°C)	S.* (%)	
	Max.	Min.	H/L	Av.	Max.	Min.	Av.	Max.	Min.	Av.	Max.	Min.			Av.
1960-1970	28.7	22.6	29.8/18.9	25.5	73	55	64	1052.1	1040.5	1046.1	-	-	-	-	-
1971	28.7	21.6	29.6/16.0	25.1	70	59	69	1017.6	1013.5	1015.4	-	-	-	-	-
1972	28.9	23.8	29.7/21.2	26.2	81	69	75	1017.9	1014.1	1015.9	-	-	-	-	-
1973	28.2	21.9	29.4/18.5	25.1	72	56	65	1018.4	1014.7	1016.5	35	11.0	11.6	070	E
1974	28.7	22.5	29.8/18.2	25.5	74	61	69	1017.3	1013.5	1015.5	25	11.7	11.1	100	E
1975	28.9	22.7	30.6/18.2	25.8	73	56	66	1017.3	1013.7	1015.5	25	10.7	10.9	080	E
1976	28.9	23.5	30.3/20.4	25.7	76	62	71	1017.0	1013.5	1015.1	27	11.7	9.8	090	E
1977	29.6	23.8	30.6/20.5	26.5	79	64	72	1017.7	1014.0	1015.8	22	10.3	9.2	060	NE
1978	29.2	23.4	30.5/19.4	26.3	74	60	68	1017.8	1014.2	1015.8	28	11.5	9.8	110	E
1979	29.0	23.8	29.9/20.0	26.2	85	73	80	1016.8	1013.3	1014.9	20	7.1	7.8	070	E
1980	29.1	22.7	30.0/18.9	26.0	77	63	71	1016.7	1013.1	1014.8	20	6.9	7.4	080	E
1971-1980	28.9	23.0	30.0/19.1	25.1	77	63	71	1017.5	1013.8	1015.8	-	-	-	-	-
1981	28.9	23.1	30.0/20.0	25.9	74	60	67	1017.9	1014.3	1016.0	25	9.2	6.7	080	E
1982	29.1	24.1	30.0/20.8	26.4	79	65	72	1017.2	1013.5	1015.3	32	11.1	8.8	060	NE
1983	28.7	23.2	29.5/19.6	25.8	74	63	70	1017.8	1014.1	1015.8	20	8.5	8.1	070	E
1984	29.6	23.5	30.4/20.5	26.3	78	63	73	1016.2	1012.6	1014.4	25	9.5	7.7	080	E
1985	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1971-1984	29.0	23.1	30.0/19.4	25.9	77	63	71	1017.5	1013.7	1015.5	-	-	-	-	-
1960-1984	28.8	22.9	29.9/19.2	25.7	-	-	-	-	-	-	-	-	-	-	-
1948-1984	28.8	22.9	30.0/19.2	-	-	-	-	-	-	-	-	-	-	-	-
1948-1959	28.8	23.0	30.1/19.2	-	-	-	-	-	-	-	-	-	-	-	-

\* indicates; W. F. - Wind Force

W. D.- Wind Direction

S. T. - Seawater Temperature

S. - Salinity

APPENDIX 6

SOCIAL-ECONOMIC-FISHERIES STATISTICS

Table 19. P.D.R. of Yemen: Fish Catches, 1978-83  
(In thousands of tons)

	1978	1979	1980	1981	1982	Est. 1983
Cooperatives	25.6	30.7	34.8	21.6	20.4	25.4
Public sector	11.6	7.8	12.4	11.3	4.8	5.5
Joint ventures	2.0	2.6	5.4	3.6	2.7	3.0
Foreign companies	8.8	10.4	21.8	26.4	26.8	25.3
Private sector	--	--	15.0	15.0	15.0	15.0
Total	<u>48.0</u>	<u>51.6</u>	<u>89.6</u>	<u>77.9</u>	<u>69.7</u>	<u>74.2</u>

Sources: Ministry of Fish Wealth and Central Statistical Organization.



Table 31. P.D.R. of Yemen: Balance Sheet of  
Bank of Yemen, 1978-83

(In millions of Yemeni dinars)

End of Period	1978	1979	1980	1981	1982	1983
Foreign assets	65.3	73.1	81.4	88.5	99.5	98.0
Gold	0.4	0.6	0.6	0.6	0.6	0.6
Foreign exchange	60.4	66.2	71.4	79.5	87.1	83.3
Securities	3.2	4.7	5.2	6.1	6.8	6.5
SDR holdings	1.3	1.6	--	1.6	5.0	6.2
IMF reserve tranche	--	--	4.2	0.7	--	1.4
Claims on Government	99.6	124.7	142.2	165.6	235.8	304.1
Securities	0.9	0.9	0.9	--	--	--
Treasury bills	80.0	99.0	110.0	149.0	215.0	290.0
Other credit	18.7	24.8	31.3	16.6	20.8	14.1
Unclassified assets	2.0	5.8	8.9	12.1	14.2	23.5
Assets = Liabilities	166.9	203.6	232.5	266.2	349.5	425.6
Reserve money	125.6	160.3	190.8	218.1	293.6	368.3
Currency outside banks	113.2	142.5	168.6	190.8	221.7	240.9
Currency in National						
Bank of Yemen	6.3	7.7	15.7	13.8	26.4	36.0
National Bank of						
Yemen's deposits	6.1	10.1	6.5	13.5	45.5	91.4
Foreign liabilities	20.8	20.8	22.5	28.9	40.4	37.6
Capital and reserves	2.7	3.2	4.9	7.1	4.0	4.0
SDR allocations	4.4	6.4	8.1	9.1	8.7	8.2
Unclassified liabilities	13.4	12.8	6.2	3.0	2.8	7.5

Source: Bank of Yemen.

Table 32. P.D.R. of Yemen: Balance Sheet of National Bank of Yemen, 1978-83

(In millions of Yemeni dinars)

End of Period	1978	1979	1980	1981	1982	1983
Reserves	12.1	18.3	23.9	27.8	72.6	127.4
Cash <sup>1</sup>	(6.3)	(7.7)	(15.7)	(13.8)	(26.4)	(36.0)
Balance with Bank of Yemen	(5.8)	(10.6)	(8.2)	(14.0)	(46.2)	(91.4)
Foreign assets	12.6	35.0	41.5	36.9	34.2	25.5
Balance with foreign banks	(8.3)	(32.1)	(38.7)	(35.4)	(32.4)	(22.9)
Foreign investments	(0.1)	(0.2)	(0.2)	(0.2)	(0.6)	(0.7)
Bills receivable in foreign currency	(4.2)	(2.7)	(2.6)	(1.3)	(1.2)	(1.9)
Claims on Government	--	2.2	2.9	6.0	5.9	7.9
Claims on nongovernment sector	58.5	61.3	97.9	106.4	101.8	101.9
Bills receivable	(3.2)	(3.1)	(3.2)	(4.8)	(3.9)	(2.4)
Loans and advances	(55.3)	(58.2)	(94.7)	(101.6)	(97.9)	(99.5)
Unclassified	10.5	11.5	5.7	9.9	13.0	10.5
Assets = Liabilities	<u>93.7</u>	<u>128.3</u>	<u>171.9</u>	<u>187.0</u>	<u>227.5</u>	<u>273.2</u>
Demand deposits	27.0	41.4	63.5	66.5	73.2	87.3
Other nongovernment deposits	24.3	32.5	51.5	62.6	85.6	115.5
Time and savings deposits	(18.5)	(23.2)	(30.6)	(48.1)	(65.0)	(86.7)
Against letters of credit	(5.8)	(9.3)	(20.9)	(14.5)	(20.6)	(28.8)
Foreign liabilities	15.0	21.9	23.7	19.5	24.6	20.8
Balances due to foreign banks	(6.1)	(7.0)	(4.0)	(2.7)	(9.2)	(2.6)
Bills payable in foreign currency	(0.6)	(3.1)	(--)	(--)	(0.3)	(0.7)
Foreign currency deposits	(8.2)	(11.8)	(19.7)	(16.9)	(15.1)	(17.5)
Government deposits	12.5	16.7	17.7	20.6	25.5	29.6
Demand	(11.0)	(15.8)	(17.3)	(14.1)	(19.5)	(21.1)
Time and savings	(1.5)	(0.9)	(0.4)	(6.5)	(6.0)	(8.5)
Capital account	6.2	6.9	9.2	10.8	12.4	13.6
Unclassified	8.7	8.9	6.3	7.0	6.2	6.4

Source: Bank of Yemen.

<sup>1/</sup> Includes foreign currencies amounting to YD 3.4 million in 1978, YD 1.1 million in 1979, YD 2.5 million in 1980, YD 1.5 million in 1981, YD 2.1 million in 1982, and YD 3.4 million in 1983, YD 2.7 million in November 1982, and YD 2.7 million in November 1983.

APPENDIX

Table 33. P.D.R. of Yemen: Distribution of Loans and  
Advances of the National Bank of Yemen, 1978-83

(In millions of Yemeni dinars)

End of Period	1978	1979	1980	1981	1982	1983
By type of entity						
Public entities	44.3	47.3	84.1	90.2	86.5	86.7
Cooperatives	6.6	5.9	5.9	5.7	5.2	4.3
Mixed sector	0.1	0.1	0.1	--	--	--
Private entities	4.3	4.8	4.6	5.7	6.2	8.5
Total	<u>55.3</u>	<u>58.1</u>	<u>94.7</u>	<u>101.6</u>	<u>97.9</u>	<u>99.5</u>
By economic sector						
Agriculture and fisheries	3.0	2.6	3.5	5.2	7.6	9.4
Industry	5.8	4.4	2.2	3.6	3.9	4.4
Commerce and services	46.4	51.1	89.0	92.8	86.4	85.7

Source: Bank of Yemen.

Table 34. P.D.R. of Yemen: Balance of Payments, 1979-83

(In millions of U.S. dollars)

	1979	1980	1981	Prel. 1982	Prov. Est. 1983
Exports, f.o.b.	38.8	59.6	48.6	37.9	40.0 <sup>1/</sup>
Domestic exports	(20.3)	(38.5)	(28.4)	(20.6)	(22.6)
Re-exports	(18.5)	(21.1)	(20.3)	(17.4)	(17.4) <sup>1/</sup>
Imports; c.i.f.	-430.5	-669.9	-781.7	-747.3	-769.0 <sup>1/</sup>
Petroleum	(-69.8)	(-150.3)	(-156.9)	(-154.9)	(...)
Other	(-360.7)	(-519.6)	(-624.8)	(-592.4)	(...)
Trade balance	<u>-391.7</u>	<u>-610.3</u>	<u>-733.1</u>	<u>-709.4</u>	<u>-729.0</u>
Services (net)	24.1	49.5	51.2	43.1	21.7
Shipping, aviation, and insurance	(14.5)	(23.5)	(23.7)	(24.9)	(26.3)
Investment income	(15.1)	(29.8)	(44.3)	(49.5)	(26.1)
Other services	(11.9)	(20.8)	(16.8)	(16.5)	(17.1)
Government, n.i.e.	(-17.4)	(-24.6)	(-33.6)	(-47.8)	(-47.8)
Unrequited transfers (net)	342.8	426.8	528.4	593.0	521.4
Private	(313.6)	(348.6)	(409.4)	(467.3)	(468.7)
Official grants	(29.2)	(78.2)	(119.0)	(125.7)	(52.7)
Current account	<u>-24.8</u>	<u>-134.0</u>	<u>-153.5</u>	<u>-73.3</u>	<u>-185.9</u>
Loans	63.4	85.7	175.8	177.2	159.5
Drawings	(57.6)	(85.4)	(148.5)	(164.4)	(165.0)
Repayment	(-4.6)	(-9.3)	(-4.3)	(-10.4)	(-12.4)
Trust Fund loans	(10.4)	(9.6)	(--)	(-0.3)	(-0.9)
Arab Monetary Fund loans	(--)	(--)	(31.6)	(23.5)	(7.8)
Other capital	--	40.5	--	-5.8 <sup>2/</sup>	69.5 <sup>3/</sup>
Net errors and omissions	29.8	69.5	18.5	-88.3	-31.3
Overall balance	<u>68.4</u>	<u>61.7</u>	<u>40.8</u>	<u>9.8</u>	<u>11.8</u>
Allocation of SDRs	5.8	4.9	2.9	--	--
Counterpart to valuation changes	5.2	-11.3	-21.7	-16.2	-17.9
Monetary movements (increase in assets-)	-79.4	-55.3	-22.0	6.4	6.1
Deposit money banks	-37.9	-17.9	4.6	20.6	10.4
Monetary gold	-0.6	--	--	--	--
SDRs	-0.9	4.7	-4.6	-9.8	-3.5
Reserve position in the Fund	--	-12.0	10.1	2.0	-4.1
Foreign exchange reserves of the Bank of Yemen	-21.0	-16.6	-26.3	-23.7	11.9
Use of IMF credit	-17.6	-11.5	-8.1	13.3	-1.7
Subscription to IMF	-4.0	-6.9	1.4	0.6	0.6
Other	2.6	4.9	0.9	3.5	-7.5

Source: Bank of Yemen.

<sup>1/</sup> Includes estimates of re-exports and imports through the free zone at the same level as 1982, i.e., US\$15.3 million and US\$16.2 million, respectively.<sup>2/</sup> Government acquisition of shares in tourism and shipping corporations.<sup>3/</sup> A two-year supplier credit to finance petroleum purchase.

## APPENDIX

Table 35. P.D.R. of Yemen: Composition of Exports and Re-Exports, 1979-83

(In millions of U.S. dollars)

	1979	1980	1981	1982	Jan.-June	
					1982	1983
Food and live animals	16.1	22.1	11.8	12.9	4.0	5.0
Dried fish	---	---	---	---	---	---
Fresh fish	10.0	18.5	5.8	6.9	1.5	2.0
Wheat and wheat flour	---	---	0.1	---	---	---
Coffee	3.6	1.0	1.8	1.2	0.6	1.2
Other	2.5	2.6	4.1	4.8	1.8	1.8
Beverages and tobacco	1.7	2.8	2.5	2.4	1.2	0.9
Crude materials (except fuel)	5.5	12.5	3.8	4.4	1.0	3.7
Hides and skins	0.5	0.4	0.2	0.3	0.1	0.2
Cotton linters and seeds	3.0	8.9	1.3	1.7	---	2.4
Salt	0.5	0.6	0.8	0.6	---	0.7
Metal scraps	0.2	0.4	0.2	0.1	---	0.1
Other	1.3	2.2	1.3	1.7	0.9	0.2
Petroleum products	---	2.5	2.4	3.2	1.4	1.9
Animal and vegetable oils	0.1	0.1	0.2	0.1	0.1	---
Chemicals	0.1	0.1	0.1	0.2	0.1	---
Manufactured goods	0.5	1.2	0.4	0.3	0.2	0.1
Textiles	0.2	0.3	---	0.2	0.2	---
Other	0.3	0.9	0.4	0.1	0.1	0.1
Machinery and transport equipment	---	0.1	0.1	---	---	0.1
Passenger cars	---	---	---	---	---	---
Trucks	---	---	---	---	---	---
Other	---	0.1	0.1	---	---	0.1
Miscellaneous manufactured articles	0.8	0.6	0.5	0.3	0.2	0.1
Clothing	0.7	0.4	0.4	0.2	0.1	0.1
Footwear	0.1	---	---	---	---	---
Other	---	0.2	0.1	0.1	0.1	---
Unclassified items	---	---	---	---	---	---
Total	24.8	42.0	21.8	23.8	8.1	11.9

Source: Central Statistical Organization.

Table 36. P.D.R. of Yemen: Direction of Exports and Re-Exports, 1979-83 <sup>1/</sup>

(In millions of U.S. dollars)

	1979	1980	1981	1982	Jan.-June	
					1982	1983
Arab countries, of which:	3.9	5.3	6.3	6.2	2.5	2.1
Saudi Arabia	1.8	2.1	3.8	3.9	1.0	1.1
United Arab Emirates	0.1	0.2	0.1	0.2	--	0.1
Egypt	--	--	--	--	--	--
Yemen Arab Republic	1.6	2.5	2.3	1.9	1.5	0.9
Somalia	--	0.1	--	--	--	--
Socialist countries, of which:	0.5	4.5	1.0	0.2	0.2	--
China	--	3.9	0.1	--	--	--
Industrial countries, of which:	17.4	22.2	6.1	4.8	1.6	2.5
United States	0.6	--	--	0.3	0.1	0.1
United Kingdom	0.1	--	--	--	--	--
Germany, Federal Republic of	0.5	0.5	0.1	1.7	0.1	0.9
Italy	1.4	3.9	0.6	0.3	0.1	0.5
Japan	12.2	17.3	4.9	2.3	1.2	0.8
Asia, of which:	0.5	4.8	1.0	7.3	1.6	3.7
Sri Lanka	0.4	0.5	0.3	--	--	--
India	0.2	0.3	0.2	0.1	--	0.4
Singapore	0.2	3.2	3.3	7.1	1.6	3.3
Africa, of which:	0.8	1.5	1.0	1.0	0.2	1.1
Djibouti	0.4	0.5	0.3	0.4	0.1	0.4
Total	22.9	37.9	18.2	19.4	6.1	9.4

Source: Central Statistical Organization.

<sup>1/</sup> Excludes petroleum exports. Converted to U.S. dollars at the rate US\$2.8952 = YD 1.

Table 37: P.D.R. of Yemen: Composition of Imports, 1979-83

(In millions of U.S. dollars) 1/

	1979	1980	1981	1982	Jan.-June	
					1982	1983
Food and live animals	125.6	203.9	203.7	200.3	104.2	104.9
Live animals	7.7	9.3	11.8	13.0	5.6	6.3
Ghee	12.4	12.5	11.4	18.0	10.0	2.1
Wheat and wheat flour	9.3	54.7	37.3	22.9	14.0	18.7
Rice	25.3	11.7	18.6	17.0	10.5	7.0
Refined sugar	7.5	31.5	21.0	16.8	11.2	5.6
Milk powder	16.5	19.9	33.8	35.0	17.6	19.8
Coffee	3.7	0.4	1.9	1.1	0.6	1.2
Tea	4.7	6.2	4.2	4.5	3.2	4.5
Spices	2.6	1.7	2.6	2.6	1.2	1.9
Other	35.9	56.0	61.1	69.5	30.3	37.8
Beverages and tobacco	10.3	15.5	7.6	6.0	1.8	3.3
Crude materials, inedible, except fuel	15.8	27.6	10.4	13.4	4.2	9.0
Hides and skins	--	--	--	--	--	--
Sesame seeds	7.9	10.0	0.9	3.1	0.9	1.7
Wood	6.0	16.1	7.4	8.8	2.9	5.7
Other	1.9	1.5	2.1	1.5	0.4	1.6
Petroleum products	45.6	150.3	156.9	154.8	87.5	52.3
Animal and vegetable oils	4.7	3.4	2.8	5.3	2.2	2.4
Chemicals	23.0	23.5	32.2	30.7	16.0	15.0
Manufactured goods classified chiefly by materials	55.8	74.4	82.6	122.7	59.5	58.3
Textiles	12.9	14.5	8.1	12.2	5.9	6.5
Cement	5.3	2.8	9.2	11.1	6.8	7.9
Other	37.6	57.1	65.3	99.3	46.8	43.9
Machinery and transport equipment	90.5	128.1	150.5	162.1	62.4	80.4
Machinery	32.9	39.1	68.6	70.3	22.9	39.9
Passenger vehicles	11.8	8.6	16.8	16.6	8.0	7.9
Trucks	8.6	9.2	8.2	13.1	6.3	6.4
Other	37.2	71.2	56.9	62.1	25.3	26.3
Miscellaneous manufactured articles	21.9	25.5	26.7	32.6	15.4	16.7
Clothing	7.0	9.9	9.4	9.1	5.5	4.3
Footwear	1.6	0.9	1.7	1.3	0.7	0.4
Other	13.3	14.7	15.6	22.2	9.3	12.0
Total	393.2	652.2	673.4	728.0	353.3	342.4

Source: Central Statistical Organization.

1/ Converted to U.S. dollars at rate US\$2.89524 = YD 1.

Table 38. P.D.R. of Yemen: Origin of Imports, 1979-83 <sup>1/</sup>

(In millions of U.S. dollars)

	1979	1980	1981	1982	Jan.-June	
					1982	1983
Arab countries, of which:	34.7	46.3	46.3	54.1	24.6	33.3
Iraq	0.8	—	—	1.9	1.1	—
Kuwait	1.4	1.9	1.3	1.3	0.7	1.4
United Arab Emirates	1.6	0.8	1.9	5.3	1.3	2.5
Egypt	—	—	—	—	—	—
Yemen Arab Republic	13.3	18.0	20.7	20.1	9.6	11.0
Somalia	1.2	1.7	2.7	3.3	1.2	1.0
Socialist countries, of which:	68.3	70.1	77.3	84.2	38.5	43.6
China	17.4	23.0	30.0	40.6	20.4	20.1
Czechoslovakia	2.0	3.4	1.3	4.4	0.7	0.8
German Democratic Republic	8.5	7.0	5.4	6.3	1.5	3.8
U.S.S.R.	27.3	20.6	27.8	11.9	5.3	9.5
Industrial countries, of which:	156.2	261.1	294.7	321.7	151.5	146.5
United States	1.8	2.8	1.6	1.3	0.1	0.4
United Kingdom	41.2	54.2	53.6	62.0	30.6	24.8
Denmark	4.8	14.5	12.5	19.9	8.1	11.4
France	5.5	38.9	24.3	31.0	13.6	7.1
Germany, Federal Republic of	5.1	13.5	15.6	17.2	10.7	8.0
Italy	9.4	19.4	16.0	41.6	26.0	16.3
Netherlands	36.2	27.7	55.9	43.7	22.2	20.3
Japan	39.4	69.7	103.9	85.6	30.1	48.0
Other developed countries	24.2	57.3	41.6	44.1	16.0	23.0
Of which: Australia	14.2	51.1	37.4	37.2	16.0	23.0
Latin America	0.2	0.2	0.6	0.9	0.4	0.6
Asia, of which:	67.5	70.4	54.4	65.4	29.6	36.4
Sri Lanka	4.4	5.8	3.5	4.4	3.0	3.8
Hong Kong	10.3	12.5	10.5	7.6	4.3	5.7
India	17.7	17.7	10.2	13.5	6.9	7.9
Pakistan	0.3	0.3	0.7	0.1	0.1	0.1
Thailand	20.1	7.8	13.9	10.1	5.7	5.1
Singapore	11.0	9.6	9.2	17.1	6.4	8.1
Africa, of which:	6.0	9.8	10.6	12.5	5.2	6.7
Ethiopia	1.5	6.0	3.9	6.9	2.9	2.0
Kenya	3.8	3.3	6.3	5.6	2.2	3.3
Total	357.0	514.8	525.6	582.8	265.8	290.1

Source: Central Statistical Organization.

<sup>1/</sup> Excludes petroleum imports. Converted to U.S. dollars at the rate US\$2.89524 = YD 1.



Table 39. P.D.R. of Yemen: External Public Debt Outstanding, 1982-83

(In millions of U.S. dollars)

	December 31, 1982		June 30, 1983		Provisional December 31, 1983	
	Disbursed	Total including undisbursed	Disbursed	Total including undisbursed	Disbursed	Total including undisbursed
Multilateral sources	212.0	422.8	268.7	442.7	...	...
IDA	55.1	125.9	69.5	132.9	...	...
Kuwait Fund	55.1	69.3	59.1	69.2	...	...
AFESD	51.3	106.1	67.7	109.4	...	...
Abu Dhabi Fund	35.4	52.8	44.3	52.7	...	...
Islamic Dev. Bank	0.3	13.1	6.7	13.0	...	...
OPEC Special Fund	14.2	30.5	16.2	30.4	...	...
EEC	--	2.9	2.3	6.4	...	...
IFAD	0.6	22.3	2.9	28.7	...	...
Bilateral sources	573.0	1,117.4	624.7	1,142.1	...	...
U.S.S.R.	270.3	713.7	309.2	712.5	...	...
China	133.1	148.8	134.6	148.5	...	...
German Democratic Republic	27.6	49.6	32.4	49.5	...	...
Bulgaria	31.9	65.0	34.7	64.9	...	...
Czechoslovakia	18.0	30.5	21.4	33.0	...	...
Hungary	11.0	18.3	11.0	18.2	...	...
Iraq	25.2	32.2	25.2	32.1	...	...
Libya	16.8	16.8	18.2	22.9	...	...
Algeria	28.7	31.0	26.6	31.0	...	...
Denmark	2.9	3.8	3.8	3.2	...	...
France	--	--	0.1	18.5	...	...
Other	7.5	7.8	7.5	7.8	...	...
Total	785.0	1,540.2	893.4	1,584.8	1,027.8	1,736.3

Source: Bank of Yemen.

APPENDIX





JICA