

the navigation schedule. Calculations based on this condition conclude that two 22 KW compressor, each with a 2-stage compressor, will be necessary. The 2-stage compressor is highly energy efficient when the evaporating temperature is low, and IFP people have used it with various kinds of equipment in on-shore factories. Hence a compound 2-stage compressor (which enables double-stage compression only with one refrigerator) with an unloader, to be used when the intake temperature is high, will be adopted.

The following load calculations were made for the proposed refrigerator. With necessary loads of 28,000 Kcal/h and a working load ratio of 70%, after allowing for high loads at the start of freezing, the required performance of the refrigerator will be 38,700 Kcal/h.

Table 4-6 Refrigeration Load

| Type of loads                                     | Capacity              | Necessary loads |
|---|-----------------------|-----------------|
| Plate type quick refrigerating equipment          | 0.6 tons/6 hrs.       | 10,274 kcal/h   |
| Semi-air blast type quick refrigerating equipment | 0.5 tons/6 hrs.       | 9,853 kcal/h    |
| Fish hold   | 80 m <sup>3</sup>     | 8,000 kcal/h    |
| Total   |                       | 28,127 kcal/h   |
| Capacity of the compressors                       | 19,350 kcal x 2 units | 38,700 kcal/h   |

The plate type quick refrigerating equipment will be placed on the deck since it is used frequently. It will be defrosted by sprinkling sea water. Due to the limited space on the deck, the semi-air blast type will be installed inside the fish hold.

### 3) Control method

Since a direct dry expansion system using freon gas has been adopted as the freezing method, the automatic expansion valve will be used to simplify the operation procedure. An electronic thermometer will be installed to measure the temperature of the fish hold so that operation temperatures can be easily monitored.

#### 4-3-8 Auxiliary Equipment in the Engine Room

Auxiliary equipment are machines to supply fuel, cooling water, and compressed air to operate the major machines and equipment discussed earlier. According to the

capacities of the main engine, generators, and refrigerating equipment the following auxiliary equipment will be installed in the engine room.

- 1) Starting air compressor and air tank: For starting the main engine and driving units
- 2) Emergency air compressor and air tank: For starting the main engine and driving units
- 3) General service and firefighting pump: For general use
- 4) Sea water pump for main engine cooling water: For the main engine
- 5) Fresh water service pump: For cooking and sanitary facilities
- 6) Sea water service pump: For sanitary facilities
- 7) Bilge pump and bilge oil separator : For preventing marine contamination
- 8) Condenser cooling water pump: For the refrigerators
- 9) Centrifugal purifier: For the fuel
- 10) Fuel transfer pump: For the transfer of fuel (between major capacity tanks)
- 11) Fuel service pump: For fuel (service tank)
- 12) Hydraulic pump driving unit: For increasing speed
- 13) Generator panel: For the generators
- 14) Feeding panel: For the power supply to the power source.
- 15) Transformer: For supply a lighting power from the power source
- 16) Distribution panel for lighting: For supply to the small power source and the lighting power source
- 17) Shore power connecting panel: The connection box for an onshore power supply

- 18) Monitoring panel: For monitoring the equipment operation conditions (including alarm panels)
- 19) Emergency battery: Emergency power source (for lighting, radio, and alarm)

#### 4-3-9 Accommodations

For a vessel the size the Project ship, the deck house room height is generally about 1,900mm from ceiling to floor. Allowing for the Indian lifestyle, a height of 2,000mm should be the basis for designing the Project ship's rooms.

##### 1) Rooms

Examination of the navigation schedule shows that the complement of a Project ship will be sixteen people. Thus, a two-bedroom x 3, a four-bedroom x 1, and a six-bed room x 1. The room arrangement, according to crew, is as follows:

Table 4-7 The Room Arrangement

| Title         | Number of beds | Number of rooms |
|---------------|----------------|-----------------|
| Officer       | Two-bed room   | Two rooms       |
| Lower officer | Two-bed room   | One room        |
| Sailors       | Four-bed room  | One room        |
|               | Six-bed room   | One room        |

##### 2) Mess room

The mess room should be designed to accommodate half of the crew at a time.

##### 3) Galley

The galley should have cooking equipment and space to fix meals for sixteen people. The cooking equipment will be powered by electricity. Equipment including microwave oven, hot plates, electric rice cooker, and small refrigerator will be installed. In addition to usual fixtures, sink faucet etc. as the galley is generally prone to excessive heat, it will be located at the broadside for easier natural heat emission and it will be equipped with an electric ventilator for good air ventilation.

#### 4) Provision store

The provision store should be large enough to stock provisions for sixteen people for twenty-one days. Rice or meat will be stocked in the freezer fish hold, vegetables in the refrigerating box and in vegetable boxes (boxes with good ventilation for storing vegetables such as onions and, potatoes which are durable under room temperatures).

#### 5) Sanitation

Officers and sailors customarily have separate lavatories and shower rooms. Similarly, the Project ship will have one toilet for officers (one for four) and two toilets for sailors (one for six). To save space both a toilet and a shower room will be installed in each location. This system is acceptable as it is widely used by the Spanish, Arabs and Indians.

### 4-3-10 Fishing and Nautical Instruments

The following fishing and nautical instruments will be installed.

#### 1) Nautical instruments

Name of instruments: Remarks

- |                                      |   |
|--------------------------------------|---|
| (1) Standard magnetic compass:       | Legally certified product                             |
| (2) Gyro compass :                   | With automatic steering unit                          |
| Repeater:                            | For direction measurement, radar and direction finder |
| (3) GPS (global positioning system): | For positioning                                       |
| (4) Radar:                           | 10 inch, coverage of 48 nautical miles                |
| (5) Direction finder:                | For middle and middle/short waves                     |
| (6) Weather facsimiles:              | To receive weather charts                             |
| (7) Public addresser:                | Loudspeaker   |
| (8) Search lights:                   | For bringing the ship alongside the pier at night     |
| (9) Signal light:                    | Aldis lamp  |

- (10) Doppler Speed log. For speed, distance run measurement
- (11) Navigation lights: Including control panels
- (12) Anemometer: Analog type
- (13) Binoculars: For navigation

2) Fishing instruments

Name of instruments: Remarks

- (1) Color fish finder: With temperature indicator
- (2) Recording type fish finder: Dry type
- (3) Net sonde: With a paravane type receiver

3) Radio equipment

Name of instruments: Remarks

- (1) SSB radio transceiver: 400W
- (2) VHF radio transceiver: 25W
- (3) EPIRB: Satellite type

4-3-11 Life Saving Equipment

The following life saving equipment will be installed:

|                              |  |                    |
|------------------------------|--|--------------------|
| Inflatable life saving rafts | To accommodate the entire crew — placed on each side of the ship | SOLAS "A" type     |
| Life buoys                   | About six  | As per regulations |
| Life jackets                 | For sixteen persons  | As per regulations |

4-3-12 Principal Particulars

The principal particulars of the Project ship are outlined as follows:

#### 1) Particulars of the hull

|                               |  |
|-------------------------------|--|
| Type of vessel:               | Long forecastle, single deck stern trawler |
| Type of fishing:              | Bottom and midwater trawl                  |
| Material:                     | Steel                                      |
| Classification:               | Nippon Kaiji Kyokai (NK)                   |
| Length overall                | Loa: (Approx.) 28.80m                      |
| Length between perpendiculars | LPP: (Approx.) 24.80m                      |
| Breadth molded                | B: (Approx.) 7.20m                         |
| Depth molded                  | D: (Approx.) 3.30m                         |
| Design draft:                 | (Approx.) 2.80m                            |
| Gross tonnage:                | (Approx.) 180 tons                         |
| Main engine:                  | (Approx.) 600 Ps                           |
| Propeller:                    | Variable pitch propeller                   |
| Speed:                        | (Approx.) 9 knots                          |
| Fish hold capacity:           | (Approx.) 87 m <sup>3</sup>                |
| Fuel tank capacity:           | (Approx.) 60m <sup>3</sup>                 |
| Fresh water tank capacity:    | (Approx.) 33m <sup>3</sup>                 |
| Complement:                   | 16   |

#### 4-4 Construction Plan

##### 4-4-1 Construction Policy

It is planned to use the Project ships to develop fishing grounds in waters deeper than 50m off the West Coast of India. No novelty will be sought after in the design of the Project ship and selection of its equipment and machines. Sound and safe design,

and steady and reliable construction, is required to build ships which are easy to operate and which require relatively little maintenance.

#### 4-4-2 Responsibility Sharing

##### 1) Responsibilities of the Government of Japan

In the case of the Project being carried out by Japan's grant aid cooperation, the responsibilities of the Japanese Government are as follows:

- (1) Building of the Project ships and coverage of all expenses occurring in Japan related to it, including, testing.
- (2) Preparation of fishing gear, spare parts, tools, other furniture, drawings, and instruction manuals to be handed over together with the Project ships.
- (3) Implementation of navigation and marine transportation of the Project ships and the other items described in above (1) and (2) and insurance expenses related to their transportation.
- (4) Assistance in implementing the Project and bidding work and consulting services including, but not limited to, construction management.

##### 2) Coverage of the Government of India and the Implementing Organization

In the case of the Project being carried out by Japan's grant aid cooperation, the responsibilities of the Government of India and its implementing organization are as follows:

- (1) All authorization related to the ownership of the Project ships and the implementation of the Project.
- (2) Smooth customs clearance of the Project ships and all their related equipment and machines to be handed over to India in respect with this Project and all necessary preparations related to such customs clearance.
- (3) Coverage of extra expenses for modification of the Project ships if India's laws and regulations relating to ships were amended after calling for bids.
- (4) Expenses and fees for the Indian authority's inspection of the Project ships during their construction or upon their completion.

- (5) Other responsibilities which are necessary for implementation of the Project and not covered by the responsibilities of the Japanese Government.

#### 4-4-3 Supervision of Shipbuilding

##### 1) Implementation system

After conclusion of the exchange note regarding the Project, a Japanese consultant will be selected for the Project. The consultant will hold discussions with the implementing organizations of both countries regarding preparation of detailed designs and bid specifications, procurement of necessary materials, equipment, and machines, and preparations of India's acceptance of the Project ships according to the Basic Design policy, and will conduct the implementation planning of the Project.

The implementation plan shall be carefully and thoroughly worked out to allow for time necessary for building the Project ships and for the procurement and delivery of the necessary materials, equipment, and machines in order that all work shall be completed within the time range described in the E/N (Exchange of Notes).

The Department of Fisheries, Ministry of Agriculture of India shall be responsible for the implementation of the Project and shall conduct all works related to the Project including, but not limited to, contracting with the consultant and shipbuilders, opening a bank account as required by the Contract, and payment arrangement.

##### 2) Management system

The consultant will organize a project team to manage work including the design, implementation, and control of the Project, based on the policy of Japan's grant aid cooperation and the consultant's contract. The consultant will also conduct all necessary works including, but not limited to, authorization of drawings, carrying out of on-site inspection, supervision of shipbuilding, without any delay and will provide instructions and recommendations necessary for work completion within the scheduled period. Two Project ships will be constructed, spot management may be sufficient during their initial construction period, but, when the ships are placed on the slipway for advanced construction work, the construction shall be supervised by specialists.

Construction of the ships, even after launching, will be supervised by specialists depending on the progress of the work, and one of those supervising specialists will always be stationed at the work site.



### 3) Construction schedule

The construction schedule of the Project ships is given in Table 4-8.

### 4) Navigation

The completed Project ships may be transported to India (Cochin Port) in two ways: self-propelled navigation, or aboard heavy cargo ships. Considering the present situation, the former way is considered to be the most suitable both economically and with regards to the schedule.

#### (1) Self-propelled navigation

Self-propelled navigation has the advantage of flexible scheduling. Even though the Project schedule is very tight, a suitable navigation schedule can be drawn up. Attention may have to be paid to negative climatic conditions, including seasonal wind, since the estimated departure of the Project ships from Japan will be in winter. Farther away from Japan, weather conditions will improve and stabilize. The Project ships will face almost no major problems during navigation except for possible stops for refueling (theoretically no refueling stops are necessary, but depending on weather conditions, a stop at Singapore, for example, may be necessary.) This method is superior to the use of heavy cargo ships in terms of expenditure.

#### (2) Heavy cargo ship

Following a recent decrease in the number of big projects in the Middle East, the number of heavy cargo ships available on this route is very low. The navigation schedule of heavy cargo ships to India can be prepared only one month before their actual departure. Considering the possible delay in completion, due to the tight schedule, the use of heavy cargo ships as a means of transportation is judged to be inappropriate.

Table 4 - 8 Construction Schedule

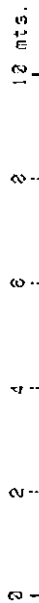
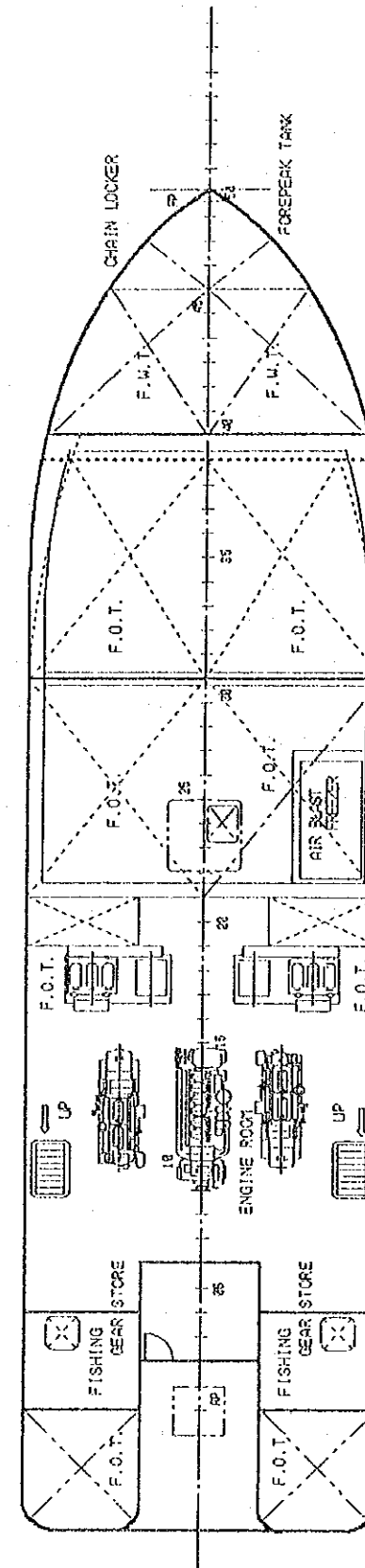
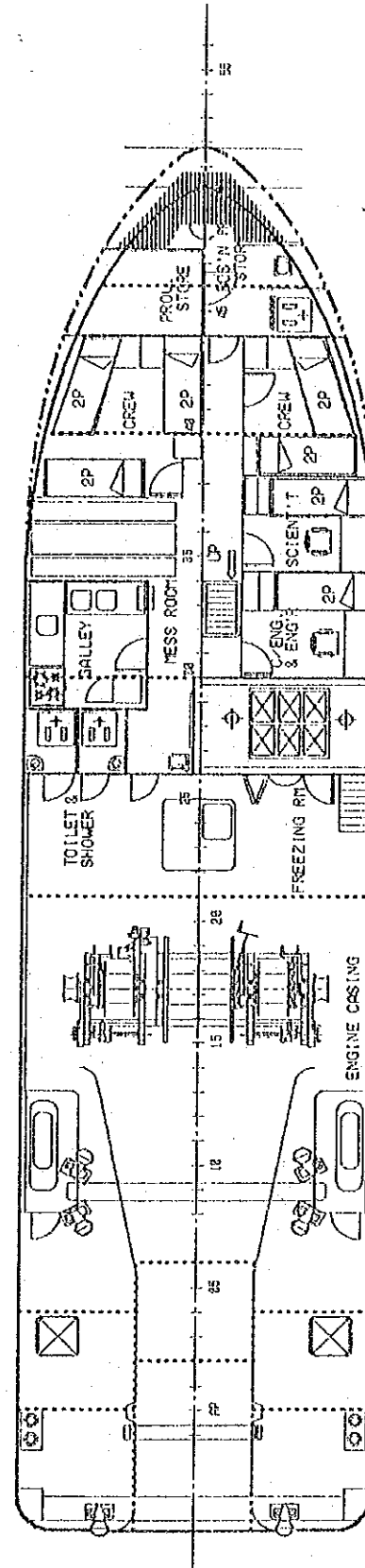
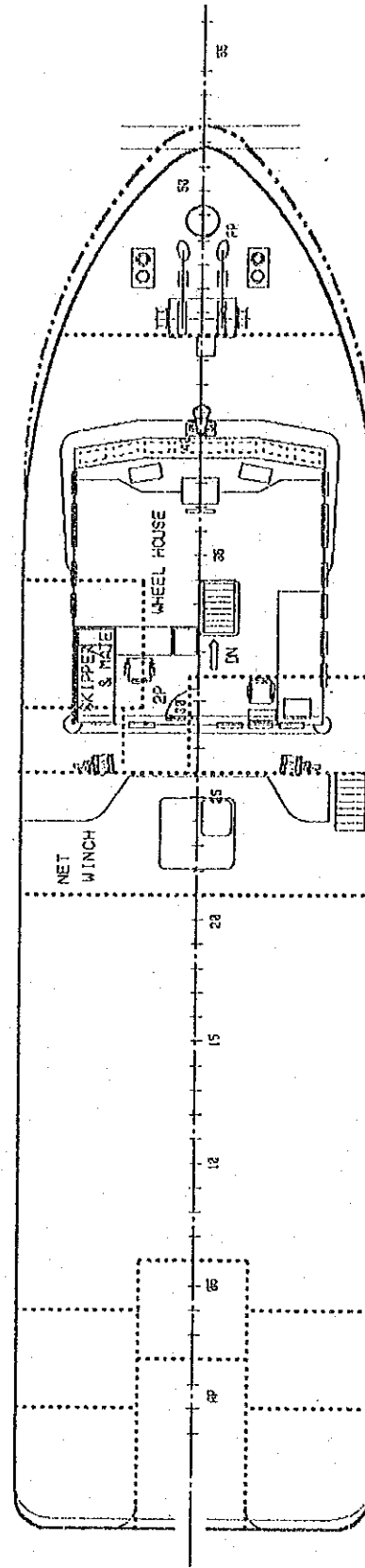
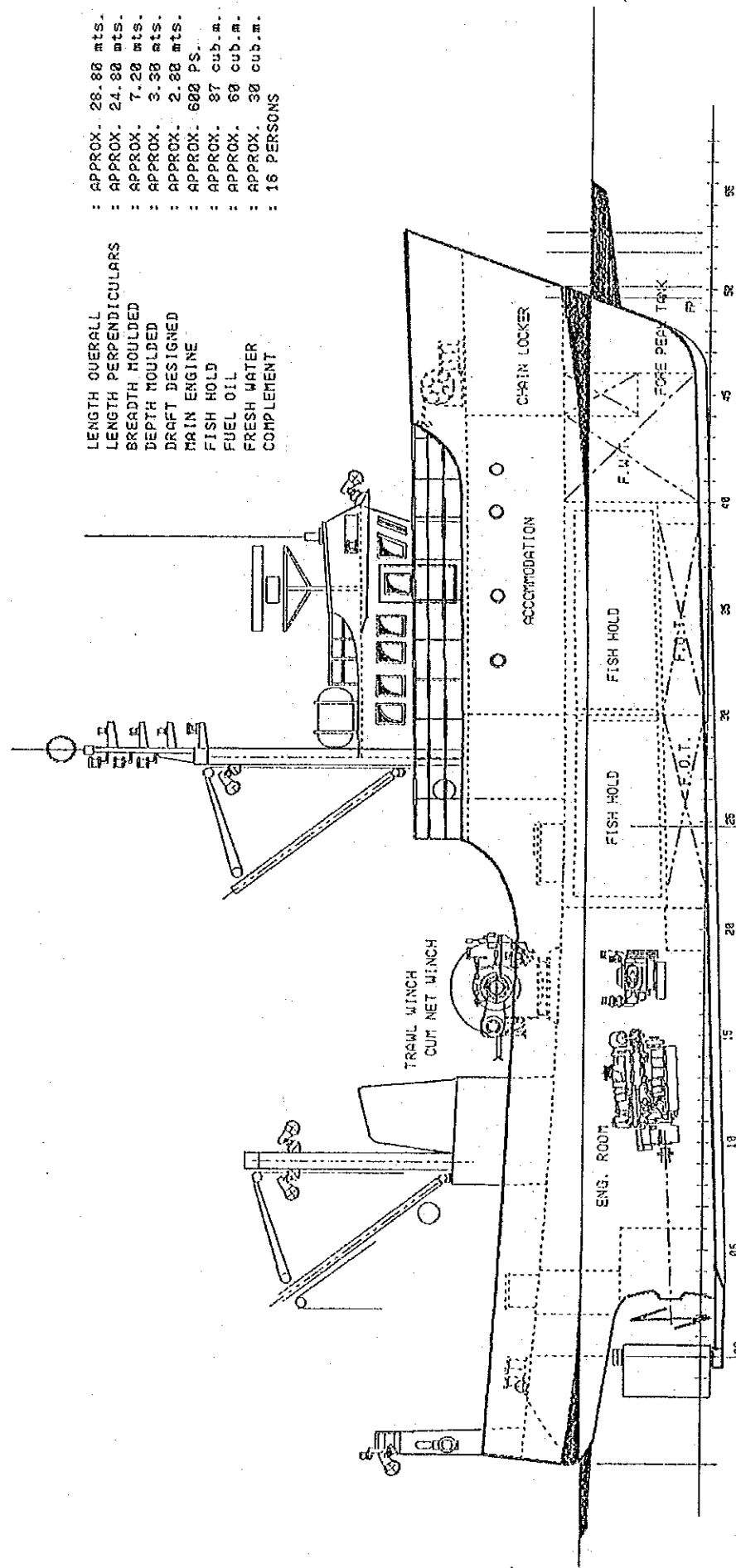
| DETAIL DESIGN               |   |   |   |   |   |   |   |   |   |    |    |
|-----------------------------|---|---|---|---|---|---|---|---|---|----|----|
| (Month)                     | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|                             |   |   |   |   |   |   |   |   |   |    |    |
| SUPERVISION OF CONSTRUCTION |   |   |   |   |   |   |   |   |   |    |    |
| (Month)                     | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|                             |   |   |   |   |   |   |   |   |   |    |    |





GENERAL ARRANGEMENT

- : APPROX. 28.88 mts.
- : APPROX. 24.88 mts.
- : APPROX. 7.28 mts.
- : APPROX. 3.38 mts.
- : APPROX. 2.88 mts.
- : APPROX. 600 PS.
- : APPROX. 87 cub.m.
- : APPROX. 68 cub.m.
- : APPROX. 30 cub.m.
- : 16 PERSONS







#### 4-4-5 Component of Fishing Gears

Fishing gears consist of following parts.

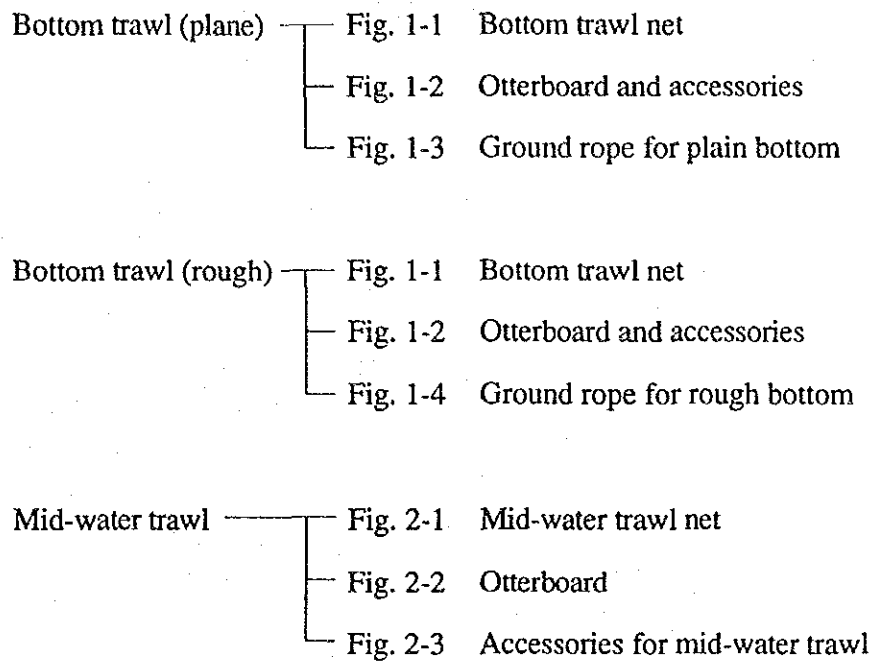








Fig. 1-3 Ground Rope (for Plane Bottom)

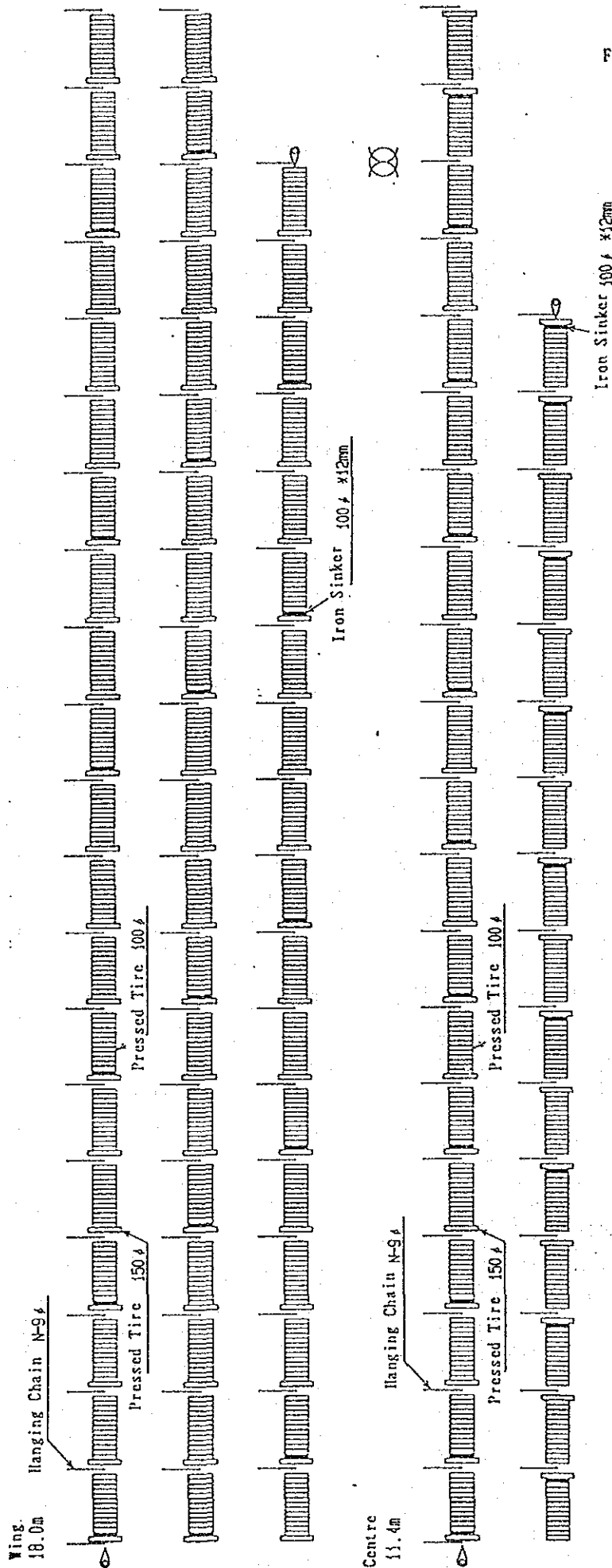


Fig.1-3 Ground Rope (for Plane Bottom)

| W/R                     | Wing      | Centre    | Total         | Remarks |
|-------------------------|-----------|-----------|---------------|---------|
| C.P.R 16φ               | 18.0m x 2 | 11.4m x 1 |               |         |
| Pressed Tire 100φ       | 695       | 432       | 1824 枚        |         |
| Pressed Tire 200φ       | 58        | 37        | 153 枚         |         |
| Iron Sinker 100φ x 12mm | 17        | 20        | 54 本          | 12mm    |
| Hanging Chain N-9φ      | 58        | 37        | 153 本         |         |
| Wire Cripリッブ 14φ        | 0         | 8         | 24 ケ          |         |
| Swivel 19φ              | 2         | 2         | 6 ケ           |         |
| Weight (in water/dry)   |           |           | 181kg / 194kg |         |

Fig. 1-4 Ground Rope (for Rough Bottom)

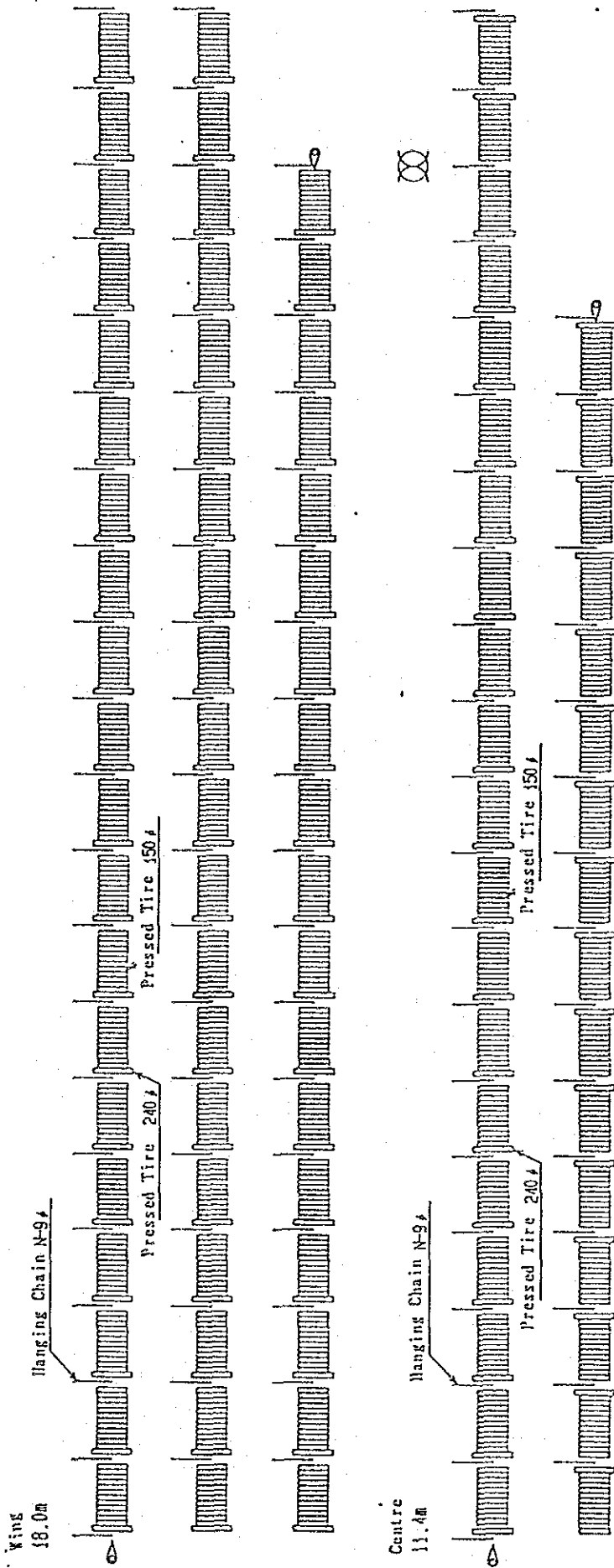


Fig.1-4 Ground Rope (for Rough Bottom)

| N°R                   | Wing     | Centre   | Total         | Remarks |
|-----------------------|----------|----------|---------------|---------|
| 14                    | 18.0m x2 | 11.4m x1 |               |         |
| C.P.R 16              | 638      | 396      | 1672 枚        |         |
| Pressed Tire 150      | 58       | 37       | 153 枚         |         |
| Pressed Tire 240      | 50       | 37       | 153 本         |         |
| Hanging Chain N-9     | 8        | 8        | 24 个          |         |
| Wire grip             | 2        | 2        | 6 个           |         |
| Swivel                |          |          |               |         |
| Weight (dry in water) |          |          | 722kg / 181kg |         |



Fig. 2-2 Otterboard for Pelagic Trawl

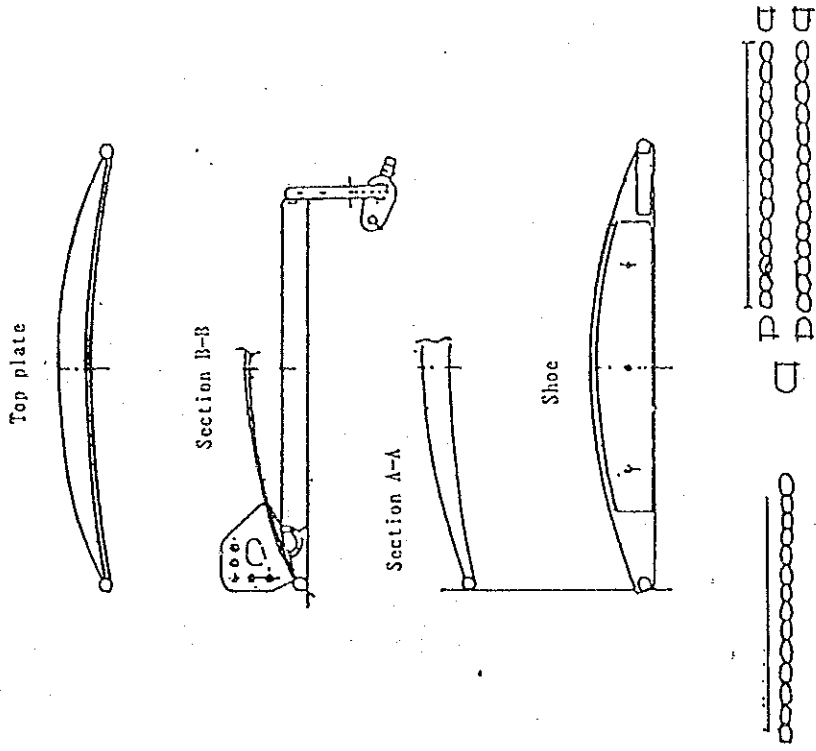
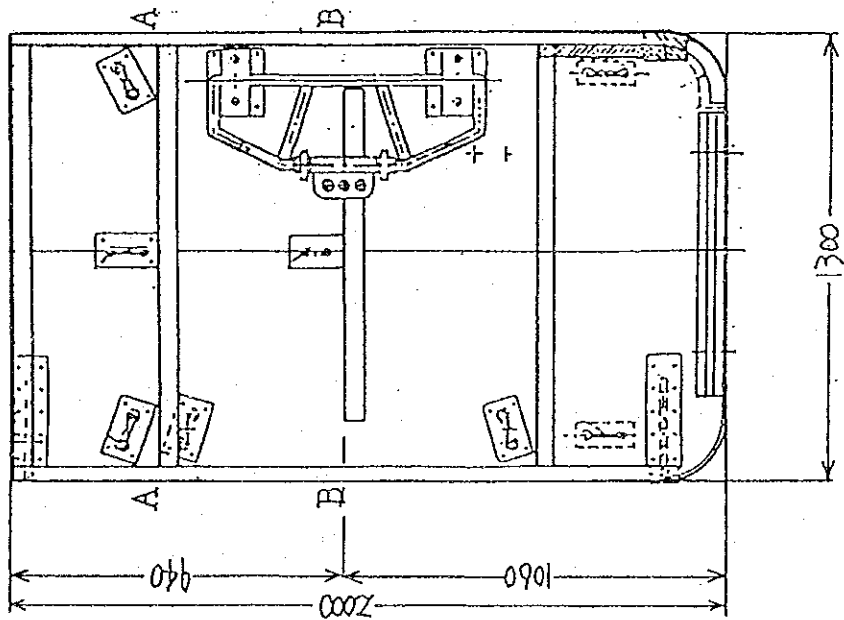


Fig. 2-2 Otterboard for Pelagic Trawl





## **Chapter 5 Effect of the Project, Conclusion and Recommendations**





## Chapter 5 Effect of the Project, Conclusion and Recommendations

### 5-1 Effect of the Project and Progress of Current Improvement Efforts

#### [Current Situation and Problems]

1. The fisheries production growth program is mapped out in the eight Five-Year National Plan. Landing of fish beyond the potential yield in water less than 50m deep has already been noticed in some coastal areas. Consequently, India's coastal fish resources are being exhausted and there is a drastic decline of landing by small-scale fishermen. However, the development of a fisheries for unexploited fish stock in water deeper than 50m, especially in depths between 50 and 150m where development is relatively easy, has been delayed.
2. The IFP, in charge of development of harvest and post-harvest technology development, off-shore fishing ground development, is unable to effectively carry out off-shore fishery research because of deteriorated state of their fishing boats, due to the fire and aging.
3. Because of the reasons described above, the IFP cannot accept CIFNET trainees and carry out the necessary training for the development of qualified fisherman. (A total of 242 trainees were accepted by the IFP.)

#### [Countermeasures prepared in this Project]

##### Building of off-shore fishing boats

#### [Effect of the Project and Progress of Current Improvement]

Utilization of off-shore fishing resources will accelerate the achievement of the eighth Five-Year National Plan's objectives.

Disclosure of research data to private companies will allow the promotion and encouragement of off-shore fishing.

Dependency on coastal fishing stock will be lessened, which will help the recovery of coastal fish resources and protect the lives of a total of 9.5 million small-scale fisherman.

Fishing boats to benefit

= Fishing boats to directly benefit:

|                             |              |
|-----------------------------|--------------|
| Shrimp trawlers             | 200 boats    |
| Small powered fishing boats | 23,000 boats |

= Fishing boats to indirectly benefit:

|   |                 |
|---|-----------------|
| Small fishing boats with onboard engines: | 150,000 boats   |
| Small unpowered boats:                    | 1,680,000 boats |

The IFP will be able to resume training of trainees and providing fishing technical instructions to general fisherman.

## 5.2 Conclusion

As discussed above, the Project will greatly benefit both off-shore fishermen and small-scale fishermen in addition to improving the life of fisherman in general. It is therefore judged to be quite appropriate to implement the Project as Japan's grant aid cooperation. Besides, judging from the personnel, their competence, and the budget allotted for the Project, the recipient country is sufficiently capable of managing and administrating the Project as a whole.

## 5.3 Recommendations

As mentioned earlier, India's sea fishery recorded a landing of 2.21 million tons, and 90% of it (1.99 million tons) was catches from sea waters less than 50m deep. It is a fact that the fish stock of India's coastal waters has already started to dry up. Preservation and development of coastal potential yield surely leads to the protection of India's 9.2 million small-scale fishermen's life.

To cope with this situation, the Government of India started a grant-in-aid system which would provide conditional financial assistance for promoting off-shore operations,

and many fishermen when they modify their ship or conduct fishing operations are already benefiting from the system. The promotion and development of off-shore fishing requires economic assistance, but it also strongly needs a regulatory backup to preserve the coastal fish stock.

In the long term, the combination of both these types of assistance can only realize the preservation of coastal fish and the promotion of off-shore fishing. Either one of them alone would probably not manage to achieve the National Plan's goal. The Project intends to promote off-shore fishing through feasibility study efforts. If backed up, by the establishment of fishing regulations related to coastal waters (less than 50m deep) — especially ones designed to preserve coastal fish stock, the project will help establish lasting and effective utilization of marine resources. Examples of fishing laws which need to be enacted are as follows:

- ① Establishment of closed seasons for fishing.
- ② Limitation of mesh size for fishing gear.
- ③ Establishment of fishing boat size and closed areas for fishing.
- ④ Establishment of penalties on law violating boats.
- ⑤ Privileges to off-shore fisherman.
- ⑥ Protection of small-scale fishermen engaged in coastal water operations.
- ⑦ Utilization of by-catch fish of shrimp trawlers and privileges to such utilizers.



## Appendix



**1-1 Member List of Basic Design Study Team**

Basic design study on the project for acquisition of fishing vessel for deep sea and offshore fisheries in India

1. Hiroshi Saito

TEAM LEADER

Deputy Director, Training Division,

KANAGAWA International Fisheries Training Center

Japan International Cooperation Agency

2. Tadahiro KAWATA

PLANNING OF VESSEL CONSTRUCTION

Fishing Boat Inspector, Marine resources, Division,

Research Department, Fisheries Agency, Ministry of Agriculture,

Forestry and Fisheries

3. Eiji IWASAKI

PROJECT COORDINATION, GRANT AID PROGRAMME

Staff

Second Basic Design and Study Division Grant Aid

Study and Design Department, Japan International Cooperation Agency

CONSULTANT

Overseas Agrofiseries Consultants Co., Ltd.

4. Satoru HIRASHIMA

NAVAL ARCHITECT (Hull design)

5. Mikio WAKAMATSU

DECK MACHINERY AND FISHING GEAR DESIGN

6. Nobuo ITOI

MACHINERY AND ELECTRICITY

7. Kenji OKAMURA

OPERATION PLANNING



## 1-2 Member List of Draft Report Explanation Team

Basic design study on the project for acquisition of fishing vessel for deep sea and offshore fisheries in India

1. Hiroshi Saito

TEAM LEADER

Deputy Director, Training Division,

KANAGAWA International Fisheries Training Center

Japan International Cooperation Agency

2. Tadahiro KAWATA

PLANNING OF VESSEL CONSTRUCTION

Fishing Boat Inspector, Marine resources, Division,

Research Department, Fisheries Agency, Ministry of Agriculture,

Forestry and Fisheries

3. Eiji IWASAKI

PROJECT COORDINATION, GRANT AID PROGRAMME

Staff

Second Basic Design and Study Division Grant Aid

Study and Design Department, Japan International Cooperation Agency

CONSULTANT

Overseas Agrofiseries Consultants Co., Ltd.

4. Satoru HIRASHIMA

NAVAL ARCHITECT (Hull design)

5. Nobuo ITOI

MACHINERY AND ELECTRICITY

## 2-1. Basic Design Study Schedule

| Days | Date    |      | Activities   |
|------|---------|------|--|
| 1    | Jul. 30 | Thu. | Departure from Narita and arrival at New Delhi.  |
| 2    | Jul. 31 | Fri. | Courtesy call to the Embassy of Japan and the JICA office, and a visit to Ministry of Agriculture, and Ministry of Finance to explain Japan's grand aid cooperation system.      |
| 3    | Aug. 1  | Sat. | Trameter from New Delhi to Cochin, visit the IFP site.<br>Discussion to be started with an explanation of Japan's grant aid system.  |
| 4    | Aug. 2  | Sun. | Explanation of the purpose of Basic Design Research, confirmation of the Application Letter, check of the navigation schedule, and a technical discussion.                       |
| 5    | Aug. 3  | Mon. | Technical discussion, check and coordination of the navigation schedule, visit the existing refrigerating facility and ships.<br>Observation of Cochin port and coastal fishing. |
| 6    | Aug. 4  | Tue. | Technical discussions and check and discussion of the navigation schedule.   |
| 7    | Aug. 5  | Wed. | Technical discussion on the revised general arrangement plans.<br>Visit Cochin port.   |
| 8    | Aug. 6  | Thu. | Technical discussion. Visit marine processing center.  |
| 9    | Aug. 7  | Fri. | Signing of the minutes. Observation of marine product distribution.  |
| 10   | Aug. 8  | Sat. | Straightening of reference documents. Discussions. Trameter of the Japanese government research group.   |
| 11   | Aug. 9  | Sun. | Straightening of reference documents. Preparation of the technical discussion records.   |
| 12   | Aug. 10 | Mon. | Confirmation of discussion contents, based on the technical discussion records.  |
| 13   | Aug. 11 | Tue. | Trameter from Cochin to New Delhi. Visit the Ministry of Finance.  |
| 14   | Aug. 12 | Wed. | Courtesy call to the Embassy of Japan, the JICA office, the Ministry of Agriculture, etc. Departure from New Delhi.  |
| 15   | Aug. 13 | Thu. | Arrival at Narita.   |

## 2-2. Draft Report Explanation Schedule

| Days | Date    |      | Activities  |
|------|---------|------|---|
| 1    | Sep. 17 | Thu. | Departure from Narita and arrival at New Delhi.   |
| 2    | Sep. 18 | Fri. | Courtesy call to the Embassy of Japan and the JICA office, and a visit to Ministry of Finance to explain the result of Draft Final Report and Japan's grand aid cooperation system. |
| 3    | Sep. 19 | Sat. | Trameter from New Delhi to Cochin, visit the IFP site.<br>Discussion to be started with an explanation of the Draft Final Report.   |
| 4    | Sep. 20 | Sun. | Explanation of the purpose of Draft Final Report and result of outline of analysis  |
| 5    | Sep. 21 | Mon. | Technical discussion, Basic Design of the project vessels, genral arrangement, principal particulars etc.   |
| 6    | Sep. 22 | Tue. | Technical discussions on fishing equipment and fishing gears.<br>Explanation of spare parts and tools   |
| 7    | Sep. 23 | Wed. | Signing of the minutes. Confirmation of the memorandum based of the explanation   |
| 8    | Sep. 24 | Thu. | Trameter from Cochin to New Delhi   |
| 9    | Sep. 25 | Fri. | Courtesy call and report of study result to the Embassy of Japan, the JICA office, the Ministry of Agriculture and Ministry of Finance  |
| 10   | Sep. 26 | Sat. | Departure from New Delhi<br>Arrival at Narita (Consultants)   |
| 11   | Sep. 27 | Sun. | Arrival at Narita (Officials)   |

## Appendix-3

## Member List of Concerning Party in India

## 3-1. Basic Design Study (July 30 - Aug. 13)

## Indian Officials Concerned

- : Mr. Shiri Bhagat Singh, Joint Secretary (Fisheries)  
Ministry of Agriculture,
- : Mr. Navin Kumar, Director, Dept. of Economic Affairs  
Ministry of Finance, New Delhi

## Ministry of Agriculture, New Delhi

- : Mr. K. M. Joseph, Fisheries Development Commissioner  
Dept. of Agriculture and Cooperation, New Delhi
- : Dr. Vijai Dev Singh, Joint Commissioner (Fisheries)  
Ministry of Agriculture,  
Dept. of Agriculture and Cooperation, New Delhi
- : Dr. V Smapath, Assistant Commissioner (Fisheries)  
Ministry of Agriculture,

## IFP

- |                            |                             |
|----------------------------|-----------------------------|
| : Mr. M.K.R. Nair          | Director of IFP             |
| : Mr. K. Ninan             | Mech. Marine Engineer       |
| : Mr. G. Hassan Manikfan   | Dupty Director              |
| : Mr. R. Krishnaswani      | Asst. Engineer (Fisheries)  |
| : Mr. T. J. Anto           | Accounts Officer            |
| : Mr. K. Ravinathan        | Marketing Officer           |
| : Dr. Varghese P. Oomen    | Fishery Officer             |
| : Mr. K. Gopi              | Refrigeration engineer      |
| : Mrs. SMT. S. Girija      | Processing Technologist     |
| : Mr. C. J. Jose           | Processing Technologist     |
| : Mr. K. S. George Vincent | Asst. Engineer (Electrical) |
| : Mr. C. K. Ramesh         | Asst. Enginner (Design)     |
| : Mr. K. V. Abraham        | Statistician                |
| : Mr. L. A. Hakkim         | Service Technologist        |
| : Mr. K. Ramachandram      | Asst. Engineer (Work)       |

## Japanese Officials Concerned;

- |                   |                       |                                |
|-------------------|-----------------------|--------------------------------|
| Embassy of Japan  | : Mr. Katsutoshi Hama | First Secretary                |
| JICA India Office | : Mr. Toshifumi Sakai | Deputy Resident Representative |

3-2. Draft Report Explanation (Sep. 17 - Sep 26)

Indian Officials Concerned;

: Mr. Navin Kumar, Director, Dept. of Economic Affairs  
Ministry of Finance, New Delhi  
Dept. of Agriculture and Cooperation, New Delhi  
: Mr. G.E. Samuel, Deputy Commissioner (Fisheries)  
Ministry of Agriculture,

|     |                           |                             |
|-----|---------------------------|-----------------------------|
| IFP | : Mr. M.K.R. Nair         | Director of IFP             |
|     | : Mr. G. Hassan Manikfan  | Dputy Director              |
|     | : Mr. K. Ninan            | Mech. Marine Engineer       |
|     | : Mr. R. Krishnaswani     | Asst. Engineer (Fisheries)  |
|     | : Mr. K. Ravinathan       | Marketing Officer           |
|     | : Dr. Varghese P. Oomen   | Fishery Officer             |
|     | : Mr. K. S George Vincent | Asst. Engineer (Electrical) |
|     | : Mrs. SMT. S. Girija     | Processing Technologist     |
|     | : Mr. K. Gopi             | Refrigeration engineer      |
|     | : Mr. L. A. Hakkim        | Service Technologist        |
|     | : Mr. K. Ramachandram     | Asst. Engineer (Work)       |
|     | : Mr. T. J. Anto          | Accounts Officer            |
|     | : Mr. K. V. Abraham       | Statistician                |

Japanese Officials Concerned;

|                   |                       |                                |
|-------------------|-----------------------|--------------------------------|
| Embassy of Japan  | : Mr. Katsutoshi Hama | First Secretary                |
| JICA India Office | : Mr. Toshio Hida     | Resident Representative        |
|                   | : Mr. Toshifumi Sakai | Deputy Resident Representative |

## 4-1. Minutes of Discussions : Basic Design Study

MINUTES OF DISCUSSIONS  
BASIC DESIGN STUDY  
ON  
THE PROJECT FOR ACQUISITION OF FISHING VESSELS  
FOR DEEP SEA AND OFFSHORE FISHERIES IN INDIA

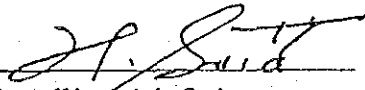
Based on the results of the Preliminary Study, the Japan International Cooperation Agency (JICA) decided to conduct a Basic Design Study on the Project for acquisition of Fishing Vessels for Deep Sea and Offshore fisheries (hereinafter referred to as "the Project").

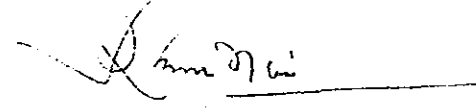
JICA sent to India a study team, which is headed by Mr. Hiroshi Saito, Deputy Director, Training Division, Kanagawa International Fisheries Training Centre JICA, and is scheduled to stay in the country from July 30 to August 12, 1992.

The team held discussions with the officials concerned of the Government of India and conducted a field survey at the study area.

In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The team will proceed to further works and prepare the Basic Design Study report.

Cochin, 7 August, 1992.

  
Mr. Hiroshi Saito  
Leader  
Basic Design Study Team  
JICA

  
Mr. M. K. R. Nair  
Director  
Integrated Fisheries Project  
Cochin - India.

## ATTACHMENT

### 1. Objective

The objective of the Project is to acquire fishing vessels for deep sea and offshore fisheries, which will contribute to development of deep sea and offshore fishing, and use of low value fish.

### 2. Project site & Proposed Home Port

The site of the Project is located at Cochin.

The proposed main home port of the vessels is Cochin, showing in Annex-1

### 3. Executing Agency

Responsible Agency

Department of Agriculture & Cooperation (Fisheries Division) in the Ministry of Agriculture.

Implementing Agency

Integrated Fisheries Project (IFP), Cochin (which is in charge of Aquisition of Fishing vessels).

### 4. Items requested by the Government of India

After discussions with the Basic Design Study team, the following items were finally requested by the India side.

- (1) Two identical stern trawlers with fishing gears

The principle particulars of the vessels are shown in Annex-2

However, the final particulars of the vessels and items will be decided after further studies.

### 5. Japan's Grant Aid system

- (1) The Government of India has understood the system of Japanese Grant Aid explained by the team.
- (2) The Government of India will take necessary measures, described in Annex-3 for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

## 6. Schedule of the Study

- (1) The consultants will proceed to further studies in India until 12 August, 1992.
- (2) JICA will prepare the draft report in English and dispatch a mission in order to explain its contents around late in September, 1992.
- (3) In case that the contents of the report is accepted in principle by the Indian side, JICA will complete the final report and send it to the Government of India around November, 1992.

## 7. Request of Japanese experts

The Government of India requested the need for a dispatch of Japanese experts in the field of operation of the vessels and fish processing.

The Government of India also understood that in case of the official request for the above, A-1 form for the assignment of Japanese experts should be submitted through diplomatic channels.

8. Attendance during the discussion held on 7th August, 1992,  
Integrated Fisheries Project, Cochin-682016

### Japanese side

1. Mr. Hiroshi Saito      Team Leader  
                                 Deputy Director, Training Division,  
                                 Kanagawa International Fisheries Training  
                                 Centre, JICA
2. Mr. Tadahiro Kawata   Vessel Construction  
                                 Ministry of Agriculture, Forestry and  
                                 Fisheries, Fisheries Agency
3. Mr. Eiji Iwasaki       Project Coordination  
                                 Second Basic Design Study Division  
                                 Grant Aid Study & Design Department  
                                 JICA



4. Mr. Satoru Hirashima Vessel Construction, planning (Hull Part)  
Overseas Agro-Fisheries Consultants Co., Ltd.  
(OAFIC)
5. Mr. Mikio Wakamatsu Vessel Construction, (Fishing Equipment)  
OAFIC
6. Mr. Nobuo Itoi Vessel design, (Engine Part)  
OAFIC
7. Mr. Kenji Okamura Fishing Vessel Operation, Planning  
OAFIC

Indian side

8. Mr. M. K. Raveendran Nair Director,  
Integrated Fisheries Project
9. Mr. K. Ninan Mech. Marine Engineer, IFP
10. Mr. R. Krishnaswami Asst. Engineer (Electronics), IFP
11. Mr. T. J. Anto Accounts Officer, IFP
12. Mr. K. Ravinathan Marketing Officer, IFP
13. Dr. Varghese P. Oommen Fishery Officer, IFP
14. Mr. K. Gopi Refrigeration Engineer, IFP
15. Mrs. S. Girija Processing Technologist, IFP

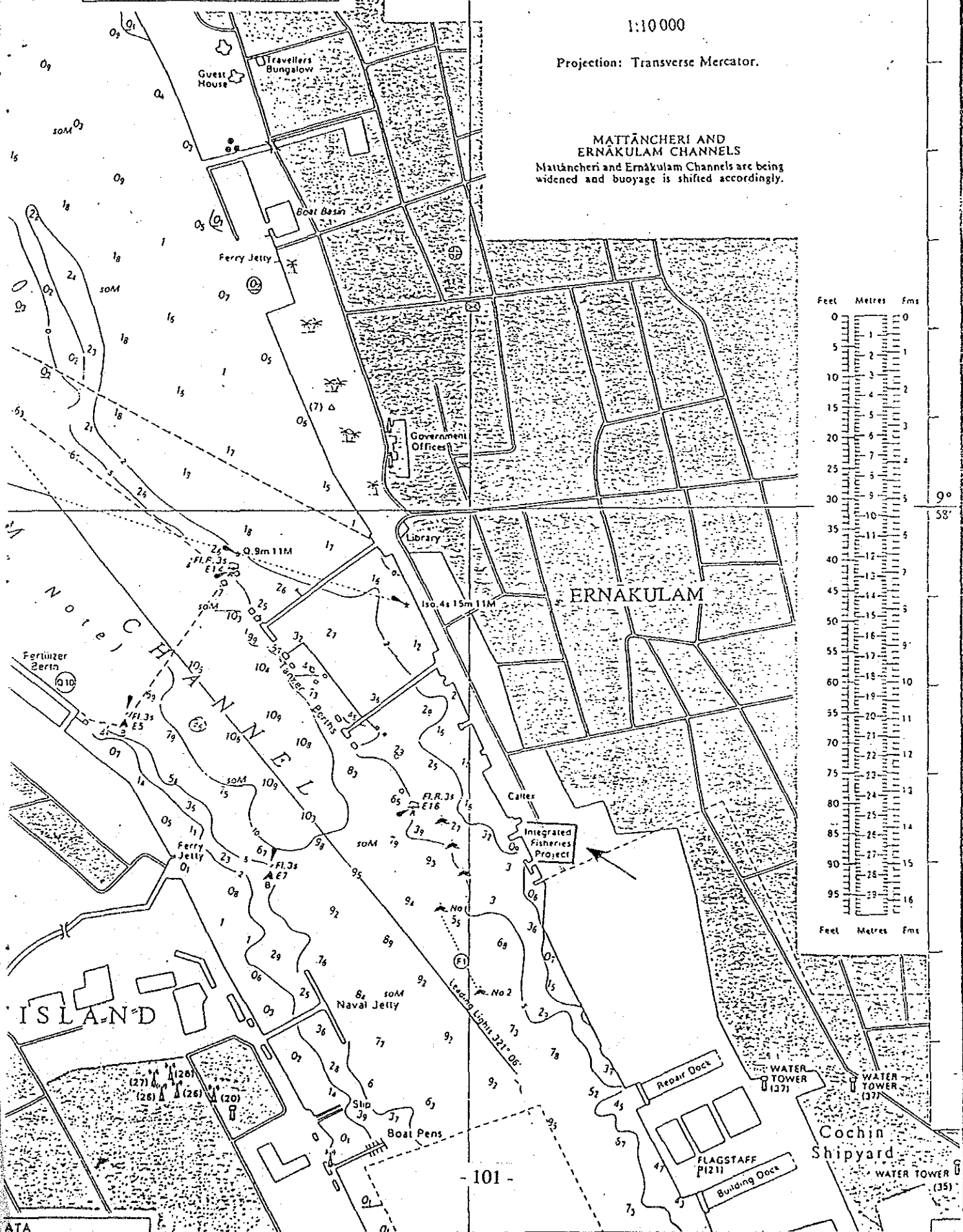
Project Site & Home port

# PORT OF COCHIN

1:10 000

Projection: Transverse Mercator.

MATTANCHERI AND ERNAKULAM CHANNELS  
Mattancheri and Ernakulam Channels are being widened and buoyage is shifted accordingly.



| Feet | Metres | Fms |
|------|--------|-----|
| 0    | 0      | 0   |
| 5    | 1      | 1   |
| 10   | 2      | 2   |
| 15   | 3      | 3   |
| 20   | 4      | 4   |
| 25   | 5      | 5   |
| 30   | 6      | 6   |
| 35   | 7      | 7   |
| 40   | 8      | 8   |
| 45   | 9      | 9   |
| 50   | 10     | 10  |
| 55   | 11     | 11  |
| 60   | 12     | 12  |
| 65   | 13     | 13  |
| 70   | 14     | 14  |
| 75   | 15     | 15  |
| 80   | 16     | 16  |
| 85   | 17     | 17  |
| 90   | 18     | 18  |
| 95   | 19     | 19  |
| 100  | 20     | 20  |
| 105  | 21     | 21  |
| 110  | 22     | 22  |
| 115  | 23     | 23  |
| 120  | 24     | 24  |
| 125  | 25     | 25  |
| 130  | 26     | 26  |
| 135  | 27     | 27  |
| 140  | 28     | 28  |
| 145  | 29     | 29  |
| 150  | 30     | 30  |

## ANNEX-2

### 1. Principal Particulars

|   |      |      |            |
|---|------|------|------------|
| Length overall                          | abt. | 28.8 | m          |
| Breadth (moulded)                       | abt. | 7.2  | m          |
| Depth (moulded)                         | abt. | 3.3  | m          |
| Main engine                             | abt. | 600  | PS         |
| Crusing speed                           | abt. | 9    | knots      |
| Endurance (operation)                   | abt. | 21   | days       |
| Fish hold (including air blast freezer) | abt. | 80   | cub. m     |
| Freezing units (Contact freezer)        | abt. | 2.4  | tons/day   |
| (Air blast freezer)                     | abt. | 0.5  | ton/charge |
| Fuel oil tank                           | abt. | 60   | cub. m     |
| Fresh water tank                        | abt. | 30   | cub. m     |
| Complement                              | abt. | 16   | persons    |

### 2. Accessories

- (1) Fishing gears and spare materials 1 lot.  
(Bottom & Pelagic trawl nets,  
otter boards etc.)
- (2) Spare parts and special tools for the vessels 1 lot.  
(For main engine & auxiliariy engine,  
refrigeration machinerics, hydrauric system,  
electronics etc.)

### 3. Rules and Regulations

- (1) Classification Society : NK (Nippon Kaiji Kyokai)
- (2) Japanese Government's Inspection for Export Vessel
- (3) The International Convention for the Prevention of Collision  
at Sea, 1972
- (4) The International Regulation for Tonnage measurement  
of Ships

The following should be referred as applicable

- (1) IMO Intact Stability, Recommendations for Fishing Vessel  
( IMO A-168 )

ANNEX-3

Necessary measures to be taken by the Government of India are as follows; (in case Japan's Grant Aid is executed.)

1. To bear advising commissions of the Authorization to Pay (A/P) and payment commission to the Japanese foreign exchange bank for banking services based upon the Banking Arrangement (B/A).
2. To ensure prompt customs clearance, registration and other necessary procedures of the vessels and goods for the Project at the home port.
3. To accord Japanese nationals whose services may be required in connection with the delivery of the vessels and goods and services under the verified contract such facilities as may be necessary for their entry into India and stay therein for the performance of their work.
4. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in India with respect to the delivery of the vessels and goods and services under the verified contracts.
5. To maintain and use properly and effectively the vessels constructed and goods purchased under the Grant Aid.
6. To bear all the expenses other than those to be born by the Grant, necessary in connection with the implementation of the Project.
7. To coordinate and solve any matters related which may arise with third party and inhabitants living in the Project area during implementation of the Project.
8. To ensure the necessary budget and personnel for proper and effective operation and maintenance of the Vessels purchased under the Grant Aid.

4-2. Minutes of Discussions : Draft Report Explanation

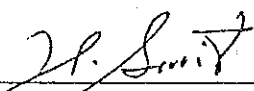
MINUTES OF DISCUSSIONS  
BASIC DESIGN STUDY  
ON  
THE PROJECT FOR ACQUISITION OF FISHING VESSELS  
FOR DEEP SEA AND OFFSHORE FISHERIES IN INDIA  
(CONSULTATION ON DRAFT REPORT)

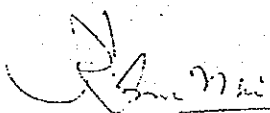
In July 1992, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study team on the Project for Acquisition of Fishing Vessels for Deep Sea and Offshore Fisheries (hereinafter referred to as "the Project") to India, and through discussions, field survey, and technical examination of the results in Japan, has prepared the draft report of the study.

In order to explain and to consult the Government of India on the components of the draft report, JICA sent to India a study team, which is headed by Mr. Hiroshi Saito, Deputy Director, Training Division, Kanagawa International Fisheries Training Centre JICA, and is scheduled to stay in the country from September 18 to 25, 1992.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Cochin, 23 September, 1992.

  
\_\_\_\_\_  
Mr. Hiroshi Saito  
Leader  
Draft Report Explanation Team  
JICA

  
\_\_\_\_\_  
Mr. M. K. R. Nair  
Director  
Integrated Fisheries Project  
Cochin - India.

## ATTACHMENT

### 1. Components of Draft Report

The Government of India has agreed and accepted in principle the components of the Draft Report proposed by the team.

### 2. Japan's Grant Aid system

- (1) The Government of India has understood the system of Japanese Grant Aid explained by the team.
- (2) The Government of India will take necessary measures, described in Annex-1 for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

### 3. Further schedule

The team will make the Final report in accordance with the confirmed items, and send it to the Government of India around December, 1992.

4. Attendance during the discussion held from 19 - 23 September, 1992. Integrated Fisheries Project, Cochin-682016

### Japanese side

1. Mr. Hiroshi Saito      Team Leader  
Deputy Director, Training Division,  
Kanagawa International Fisheries Training  
Centre. JICA
2. Mr. Tadahiro Kawata      Vessel Construction  
Ministry of Agriculture, Forestry and  
Fisheries, Fisheries Agency
3. Mr. Eiji Iwasaki      Project Coordination  
Second Basic Design Study Division  
Grant Aid Study & Design Department  
JICA
4. Mr. Satoru Hirashima      Vessel Construction, planning (Hull Part)  
Overseas Agro-Fisheries Consultants Co., Ltd.  
(OAFIC)

5. Mr. Nobuo Itoi            Vessel design; (Engine Part)  
                                 OAFIC

Indian side    ( Integrated Fisheries Project )

1. Mr. M. K. Raveendran Nair    Director,
2. Mr. G. Hassan Manikfan       Deputy Director
3. Mr. K. Ninan                   Mech. Marine Engineer
4. Mr. R. Krishnaswami           Asst. Engineer (Electronics)
5. Mr. K. Ravinathan             Marketing Officer
6. Dr. Varghese P. Oommen       Fishery Officer
7. Mr. K. S. Geroge Vincent      Asst. Engineer (Electrical)
8. Mrs. S. Girija                  Processing Technologist
9. Mr. K. Gopi                     Refrigeration Engineer
10. Mr. L. A. Hakkim               Service Technologist
11. Mr. K. Ramachandran          Asst. Engineer (Works)
12. Mr. T. J. Anto                 Accounts Officer
13. Mr. K. V. Abraham             Statistician

Appendix-5

**Operation Expenses**

The Exchange rate as of August 1992 is as follows:

29.9 Rs/1US\$ ¥127/1US\$ ¥4.2/1Rs

| Navigation schedule               | Days                            |
|-----------------------------------|---------------------------------|
| Navigation days                   | 21                              |
| Operation days                    | 17                              |
| Days at anchor                    | Preparation for next navigation |
|                                   | At anchor for leave:            |
|                                   | 10                              |
|                                   | 14                              |
| Days in one cycle                 | 45                              |
| Annual voyage frequency           | 7 voyages                       |
| Operation days and days at anchor | 315                             |
| Slipway maintenance (per annum)   | 50                              |
| Days per annum                    | 365                             |
| Service days                      | 147                             |

| Annual Navigation Expenses (Balance is listed for reference.) | One voyage<br>(Rs) | One year<br>(Rs) |
|---|--------------------|------------------|
| [A] Expenditure (navigation expenses)                         | 231,343            | 1,619,402        |
| [B] Revenue   | 139,536            | 976,752          |
| Balance   | -91,807            | -642,650         |



| [A] Navigation expenses                                | One voyage | One year  |
|--|------------|-----------|
| Expenses   | (Rs)       | (Rs)      |
| [1] Salaries (to be paid from administration expenses) | 47,730     | 334,110   |
| [2] Fuel expense                                       | 153,581    | 1,075,070 |
| [3] Lubricant expense (3% of F.O.)                     | 4,607      | 32,252    |
| [4] Meal and navigation allowance                      | 8,764      | 61,348    |
| [5] Expendables  | 10,000     | 70,000    |
| [6] Maintenance expense                                | 15,819     | 110,732   |
| [7] Slipway and maintenance                            | 7,143      | 50,000    |
| [8] Fishing gear cost                                  | 31,429     | 220,000   |
| Sub total (excluding salaries)                         | 231,343    | 1,619,402 |

[B] Catch

|                       |               |
|-----------------------|---------------|
| Operation time        | 12 hours/day  |
| Trawling time         | 9.0 hours/day |
| Catch/hour            | 228 Kgs.      |
| Catch/day             | 2,052 Kgs.    |
| Operation days/voyage | 17 days       |
| Catch/voyage          | 34,884 Kgs.   |
| Fish price/kgs        | 4 (Rs)        |
| Landing/voyage        | 139,536 (Rs)  |
| Landing/year          | 976,752 (Rs)  |

[1] Salaries

| Title                  | No one people | Salaries<br>(Rs) | One voyage<br>(Rs) | One year<br>(Rs) |
|------------------------|---------------|------------------|--------------------|------------------|
| Captain/ Master fisher | 1             | 7,300            | 7,300              | 30,660           |
| Chief officer          | 1             | 5,500            | 5,500              | 23,100           |
| Second officer         | 0             | 4,700            | 0                  | 0                |
| Chief engineer         | 1             | 6,250            | 6,250              | 26,250           |
| First engineer         | 1             | 3,800            | 3,800              | 15,960           |
| Second engineer        | 1             | 3,700            | 3,700              | 15,540           |
| Surveyor               | 2             | -                | 0                  | 0                |
| Engine driver          | 1             | 1,800            | 1,800              | 7,560            |
| Chief steward          | 1             | 2,180            | 2,180              | 9,156            |
| Cook                   | 1             | 1,900            | 1,900              | 7,980            |
| Deck hands             | 6             | 2,550            | 15,300             | 64,260           |
| Total                  | 16            |                  | 47,730             | 200,466          |

[2] Summary of fuel expenses

| Fuel unit price             | 5.60 (Rs)/Liter | 23.52 ¥/Liter  |
|-----------------------------|-----------------|----------------|
| Fuel expenses/voyage        |                 | (Rs) 153,581   |
| Fuel expenses/year          |                 | (Rs) 1,075,070 |
| Fuel oil consumption/voyage | 36,567          |                |
| Frequency of voyage/year    | 7               |                |
| Fuel oil consumption/year   | 255,969         |                |

Fuel consumption calculations (unit: liter)

| Navigation condition                       | Days      | Operation     | Navigation    | At anchor | Total         |
|--|-----------|---------------|---------------|-----------|---------------|
| Fuel consumption                           |           | 1,543         | 2,584         | 0         |               |
| Operation days                             | 17        | 26,231        |               |           | 26,231        |
| Navigation days                            | 4         |               | 10,336        |           | 10,336        |
| Days at anchor/preparation for next voyage | 10        |               |               | 0         | 0             |
| Days at anchor/At anchor for leave         | 14        |               |               |           |               |
| <b>Total</b>                               | <b>45</b> | <b>26,231</b> | <b>10,336</b> | <b>0</b>  | <b>36,567</b> |

Fuel consumption (during operation)

|  |                    |
|--|--------------------|
| Generator fuel consumption                           | 447 liter          |
| Fuel consumption                                     | 1,096 liter        |
| <b>Total fuel consumption (during operation/day)</b> | <b>1,543 liter</b> |

Fuel consumption (during navigation)

|  |                    |
|--|--------------------|
| Generator fuel consumption                           | 280 liter          |
| Fuel consumption                                     | 2,304 liter        |
| <b>Total fuel consumption (during operation/day)</b> | <b>2,584 liter</b> |

Fuel consumption calculations (during operation)

|                     | PS  | Fuel consumption ratio | Specific gravity of fuel |
|---------------------|-----|------------------------|--------------------------|
| Main engine 600 PS  | 600 | 160 g/PS, hour         | 0.85                     |
| Generator 110 PS    | 110 | 180 g/PS, hour         | 0.85                     |
| Towering hours/time |     | 2 hours                |                          |
| Navigation (day)    |     | 24 hours               |                          |

|                        | Time         | Time      | Engine load | PS  | Fuel consumption |
|------------------------|--------------|-----------|-------------|-----|------------------|
| Main engine            | One trawling | One day   | 100%        | 600 | Liter            |
| Net towing hours/time  | 2.00         | 9.00      | 85%         | 510 | 864              |
| Net hauling hours/time | 0.35         | 1.58      | 50%         | 300 | 89               |
| Net casting hours/time | 0.35         | 1.58      | 80%         | 480 | 143              |
| One cycle              | 2.70         |           |             |     |                  |
| Number of net/day      |              | 4.5 times |             |     |                  |
| Operation hours/day    | 12.16        |           |             |     |                  |
| Fuel consumption       |              |           |             |     | 1,096            |

| Generator                   | Engine load | PS  | Fuel consumption ratio | Operati on time | Fuel consumption (liter) |
|-----------------------------|-------------|-----|------------------------|-----------------|--------------------------|
| Net horse power             | 100%        | 110 |                        |                 |                          |
| Service horse power         | 80%         | 88  | 180 g/PS, hour         | 24              | 447                      |
| Number of generators in use |             |     |                        |                 | 1                        |
| Generator fuel consumption  |             |     |                        |                 | 447                      |

Fuel consumption calculations (during navigation)

|                          | Time    | Engine load | PS  | Fuel consumption |
|--------------------------|---------|-------------|-----|------------------|
| Main engine              | One day | 100%        | 600 |                  |
| During navigation/day    | 24,000  | 85%         | 510 | 2,304            |
| Fuel consumption (liter) |         |             |     | 2,304            |

| Generator                          | Engine load | PS  | Fuel consumption ratio | Operati on time | Fuel consumption (liter) |
|------------------------------------|-------------|-----|------------------------|-----------------|--------------------------|
| Net horse power                    | 100%        | 110 |                        |                 |                          |
| Service horse power                | 50%         | 55  | 180 g/PS.hr            | 24              | 280                      |
| Number of generators in use        |             |     |                        |                 | 1                        |
| Generator fuel consumption (liter) |             |     |                        |                 | 280                      |

Appendix-6

**Offshore Fishing Research Operation Time**

Note: See the charts at the end of the table for the number of operation areas

| Operation number | Deep-sea trawl trial operation area | Operation time     |                          |                    |
|------------------|-------------------------------------|--------------------|--------------------------|--------------------|
|                  |                                     | Less than 10 hours | Less than 1 to 100 hours | 100 hours and over |
| 1                | 7-77/2A                             | 3.08               |                          |                    |
| 2                | 7-77/2B                             | 1.25               |                          |                    |
| 3                | 7-77/1B                             | 9.25               |                          |                    |
| 4                | 7-77/2C                             | 1.50               |                          |                    |
| 5                | 7-77/1C                             | 8.00               |                          |                    |
| 6                | 7-77/2D                             |                    |                          | 250.00             |
| 7                | 7-76/6D                             | 2.58               |                          |                    |
| 8                | 7-76/5D                             | 1.50               |                          |                    |
| 9                | 7-76/3D                             | 1.50               |                          |                    |
| 10               | 7-76/6E                             | 1.50               |                          |                    |
| 11               | 7-76/5E                             | 0.25               |                          |                    |
| 12               | 7-76/4E                             | 9.25               |                          |                    |
| 13               | 7-76/3E                             | 6.25               |                          |                    |
| 14               | 7-76/3F                             | 0.50               |                          |                    |
| 15               | 7-76/2F                             | 2.75               |                          |                    |
| 16               | 8-75/4C                             | 0.92               |                          |                    |
| 17               | 8-75/6D                             |                    | 54.25                    |                    |
| 18               | 8-75/5D                             |                    | 34.75                    |                    |
| 19               | 8-75/4D                             | 4.09               |                          |                    |
| 20               | 8-75/6E                             |                    | 85.79                    |                    |
| 21               | 8-75/5E                             |                    | 61.24                    |                    |
| 22               | 8-75/6F                             |                    |                          | 539.03             |
| 23               | 8-75/5F                             |                    |                          | 100.52             |
| 24               | 8-75/4F                             |                    | 47.03                    |                    |
| 25               | 8-76/6A                             |                    |                          | 518.97             |
| 26               | 8-76/5A                             |                    |                          | 1,154.58           |
| 27               | 8-76/4A                             |                    |                          | 117.00             |
| 28               | 8-76/5B                             | 7.50               |                          |                    |
| 29               | 8-76/4B                             |                    | 33.17                    |                    |
| 30               | 8-76/3B                             | 4.08               |                          |                    |

| Operation<br>number | Deep-sea trawl trial<br>operation area | Operation time     |                          |                    |
|---------------------|--|--------------------|--------------------------|--------------------|
|                     |  | Less than 10 hours | Less than 1 to 100 hours | 100 hours and over |
| 31                  | 8-76/3C                                | 9.58               |                          |                    |
| 32                  | 8-76/2C                                | 0.75               |                          |                    |
| 33                  | 8-76/2D                                |                    | 31.24                    |                    |
| 34                  | 8-76/1D                                |                    | 40.83                    |                    |
| 35                  | 9-75/6D                                |                    | 25.19                    |                    |
| 36                  | 9-75/5D                                |                    | 44.18                    |                    |
| 37                  | 9-75/4D                                |                    | 11.82                    |                    |
| 38                  | 9-75/3D                                | 3.00               |                          |                    |
| 39                  | 9-75/2D                                | 4.50               |                          |                    |
| 40                  | 9-75/1D                                |                    |                          | 161.23             |
| 41                  | 9-75/6E                                | 3.00               |                          |                    |
| 42                  | 9-75/5E                                | 1.25               |                          |                    |
| 43                  | 9-75/4E                                |                    | 12.75                    |                    |
| 44                  | 9-75/3E                                |                    | 34.76                    |                    |
| 45                  | 9-75/2E                                |                    | 35.50                    |                    |
| 46                  | 9-75/1E                                |                    |                          | 180.06             |
| 47                  | 9-75/3F                                | 7.25               |                          |                    |
| 48                  | 9-75/2F                                | 6.18               |                          |                    |
| 49                  | 9-75/1F                                |                    |                          | 163.99             |
| 50                  | 10-75/6A                               | 2.83               |                          |                    |
| 51                  | 10-75/5A                               | 1.50               |                          |                    |
| 52                  | 10-75/5B                               | 3.33               |                          |                    |
| 53                  | 10-75/4B                               | 2.00               |                          |                    |
| 54                  | 10-75/4C                               | 2.08               |                          |                    |
| 55                  | 10-75/4D                               | 2.17               |                          |                    |
| 56                  | 10-75/3D                               | 2.08               |                          |                    |
| 57                  | 10-75/2D                               | 2.42               |                          |                    |
| 58                  | 10-75/1D                               | 1.92               |                          |                    |
| 59                  | 11-74/6C                               | 6.00               |                          |                    |
| 60                  | 11-74/5C                               | 4.00               |                          |                    |




| Operation number                        | Deep-sea trawl trial operation area | Operation time     |                          |                    |
|---|-------------------------------------|--------------------|--------------------------|--------------------|
|   |                                     | Less than 10 hours | Less than 1 to 100 hours | 100 hours and over |
| 61                                      | 11-74/4D                            | 1.75               |                          |                    |
| 62                                      | 11-74/4E                            | 8.00               |                          |                    |
| 63                                      | 11-74/3E                            |                    | 14.75                    |                    |
| 64                                      | 11-74/3F                            | 3.50               |                          |                    |
| 65                                      | 11-74/2F                            |                    | 18.74                    |                    |
| 66                                      | 11-74/1F                            | 9.08               |                          |                    |
| 67                                      | 11-75/1A                            |                    | 21.33                    |                    |
| 68                                      | 12-74/6A                            | 1.33               |                          |                    |
| 69                                      | 12-74/5A                            | 2.83               |                          |                    |
| 70                                      | 12-74/4A                            | 3.33               |                          |                    |
| 71                                      | 12-74/4B                            | 1.75               |                          |                    |
| 72                                      | 12-74/3B                            | 4.50               |                          |                    |
| 73                                      | 12-74/2B                            | 7.75               |                          |                    |
| 74                                      | 12-74/1C                            | 3.75               |                          |                    |
| Total research operation time           |                                     | 179.16             | 607.32                   | 3,185.38           |
| Number of research operations           |                                     | 48                 | 17                       | 9                  |
| Research operation time per marine zone |                                     | 3.73               | 35.72                    | 353.93             |

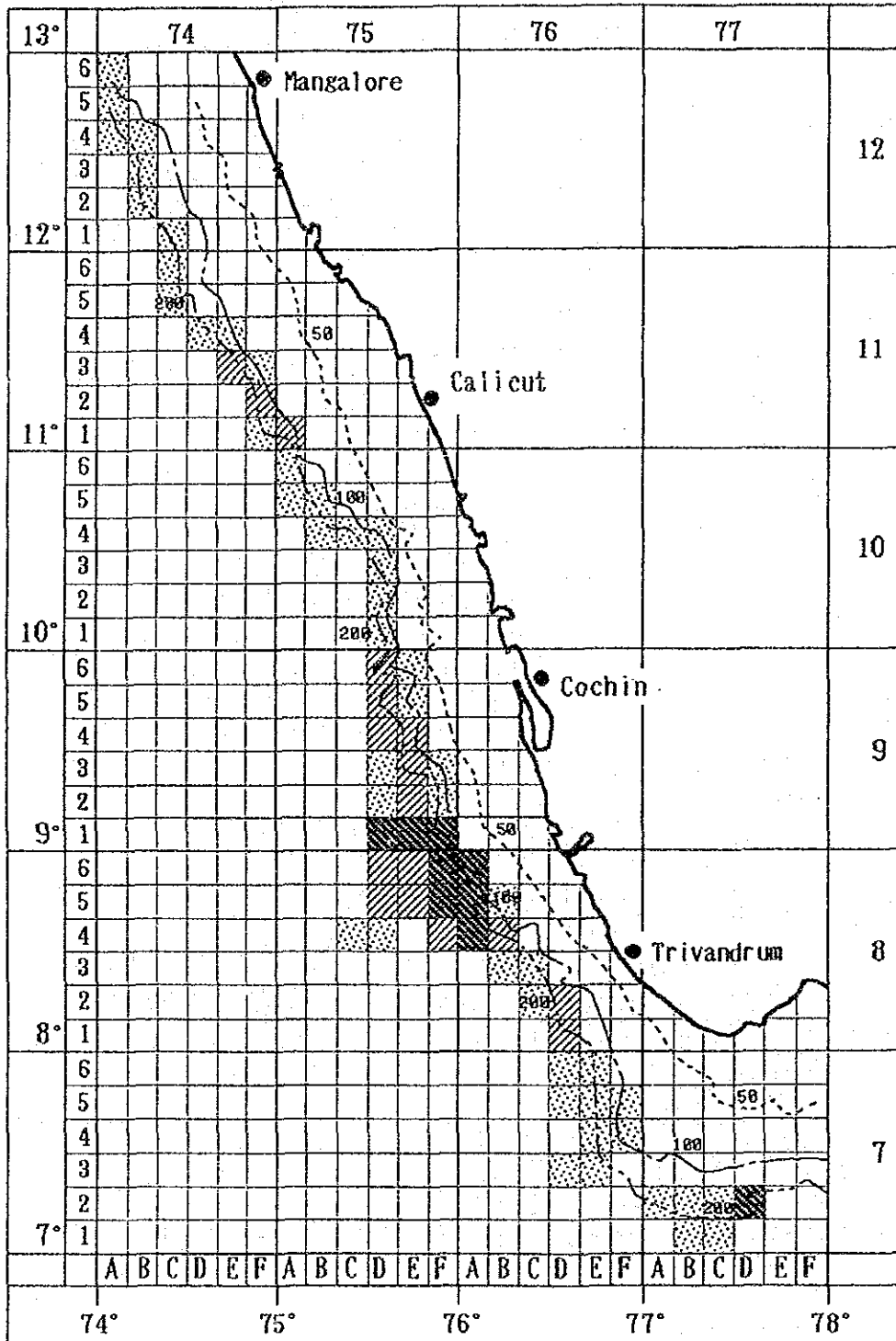
Source: Deep-sea Resources Research by IFP (Deep-sea Resources of the South West Coast of India, Table 10, 1967 to 1979) (Research by deep-sea trawling)



SECTION & TIMES OF TRAWLING SURVEY  
IN DEEP SEA

TIME OF SURVEY

-  LESS THAN 10 Hr.
-  10 ~ LESS THAN 100 Hr.
-  MORE THAN 100 Hr.



DEPTH IN METERS

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