

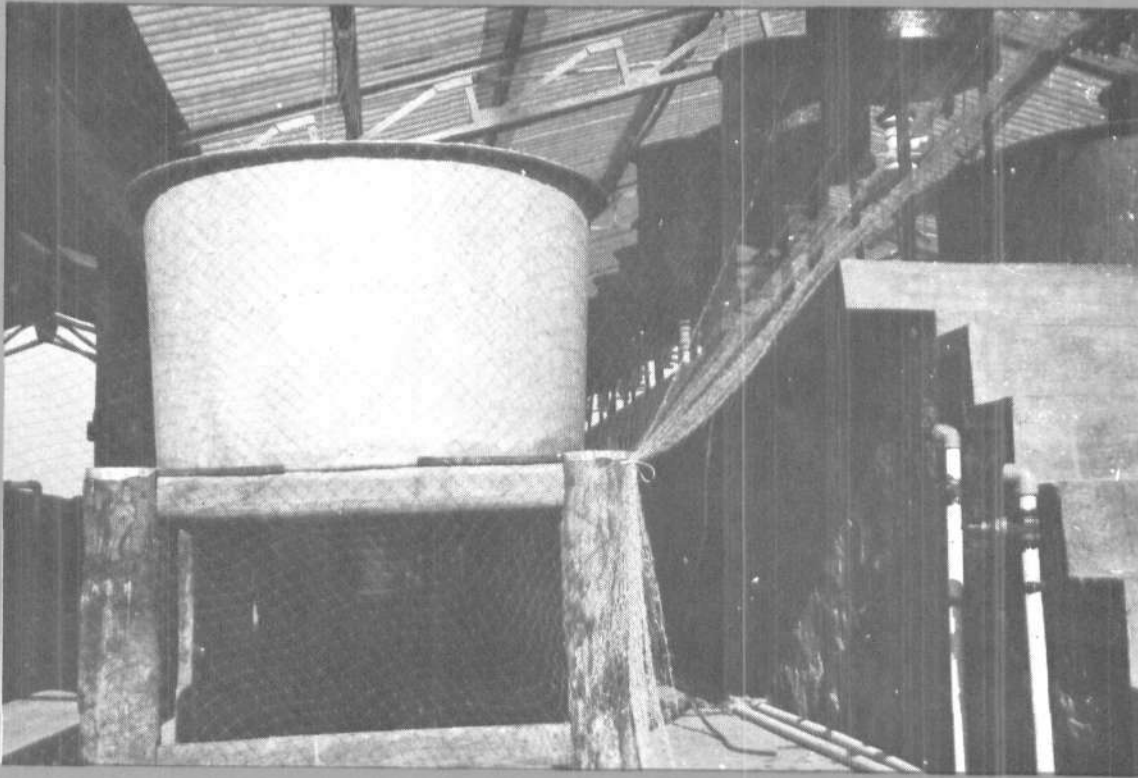


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भारतीय कृषि अनुसंधान परिषद  
INDIAN COUNCIL OF AGRICULTURAL RESEARCH

# PRAWN HATCHERY AT MOPLA BAY WITH CMFRI TECHNOLOGY

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## Background

The prawn hatchery technology was perfected by the Central Marine Fisheries Research Institute in the earlier part of the last decade. However, an economically viable commercial hatchery could not be established for want of enthusiastic entrepreneurs. This became a great handicap in the development of prawn culture in India. Realising this drawback during the 1986-'87 period, Dr. P. S. B. R. James, Director, C. M. F. R. I., initiated negotiations with the Fisheries Department of the Kerala State and the Marine Products Export Development Authority towards establishing a hatchery for the production of seed of white prawns. Eventhough great interest was shown by the two organisations initially, the state Fisheries Department expressed some difficulties in quickly implementing the programme. Later the MATSYAFED, Kerala State was assigned to take up the project in collaboration with CMFRI and MPEDA. A tripartite agreement between CMFRI, MATSYAFED and the MPEDA resulted in which the CMFRI was made responsible for the technical implementation of the project, the MPEDA for financial support and the MATSYAFED for providing the infrastructure facilities. From the CMFRI side the authors, who also were responsible for the development of indigenous prawn hatchery technology in India, were identified for establishing the hatchery. Their work included selecting the site, designing the hatchery, supervising and monitoring its construction, demonstration of seed production and training the staff from the MATSYAFED.

On further discussion and approval of this collaborative programme, the officials of the MATSYAFED and MPEDA and the authors visited the various sites, north of Calicut to locate the hatchery. The Mopla Bay at Cannanore was selected for establishing the hatchery, since good quality sea water (28 - 34‰ salinity) was available for atleast 8 - 9 months in a year. The area was free

from tidal onslaught, sea erosion, silting etc., and away from serious land drainage and also free from pollution due to discharge of industrial waste. A fishing harbour close by facilitates the availability of the spawners. Further it was noted that there was scope for the development of prawn farms for *Penaeus indicus* in this area. After selection of the site, a design of the hatchery having a capacity to produce 8 million seeds of *Penaeus indicus* per year was prepared by CMFRI and the construction work was taken up by the Harbour Engineering Department, Kerala State under strict supervision and timely modifications by the scientists (Mr. M. S. Muthu and Mr. N. N. Pillai) of CMFRI. The various inputs to be provided to start the hatchery were discussed on 22- 1-'90 and decided to start the trial run on 11- 2- '90. Accordingly a demonstration hatchery run was carried out from 12 - 2 - '90 to 13 - 3 - '90 and all the staff of the hatchery were trained in the art of seed production and management of the hatchery as agreed upon in the prodoc.

## The hatchery facilities

The hatchery is designed to produce 10 lakhs of post larvae XV - XX for every hatchery run. The technology of seed production followed was the one perfected by CMFRI, vide CMFRI Special Publication No. 25 (1985). The general lay out of hatchery unit is given in Figs. 1 and 2. The facilities at the hatchery are as follows :

### 1. The larval rearing/hatchery shed

It is 26 x 19 m area (Fig. 3). It has a central raised platform which is used for the regular culture of diatoms as well as for keeping spawners. Glazed roofing sheets are provided over this raised platform to facilitate proper lighting for the development of diatoms. This raised platform helps to transfer the nauplii from spawning tanks to larval rearing tanks as well as diatom culture from the tanks to larval rearing tanks by gravity flow, as the larval rearing tanks are kept at a lower level.

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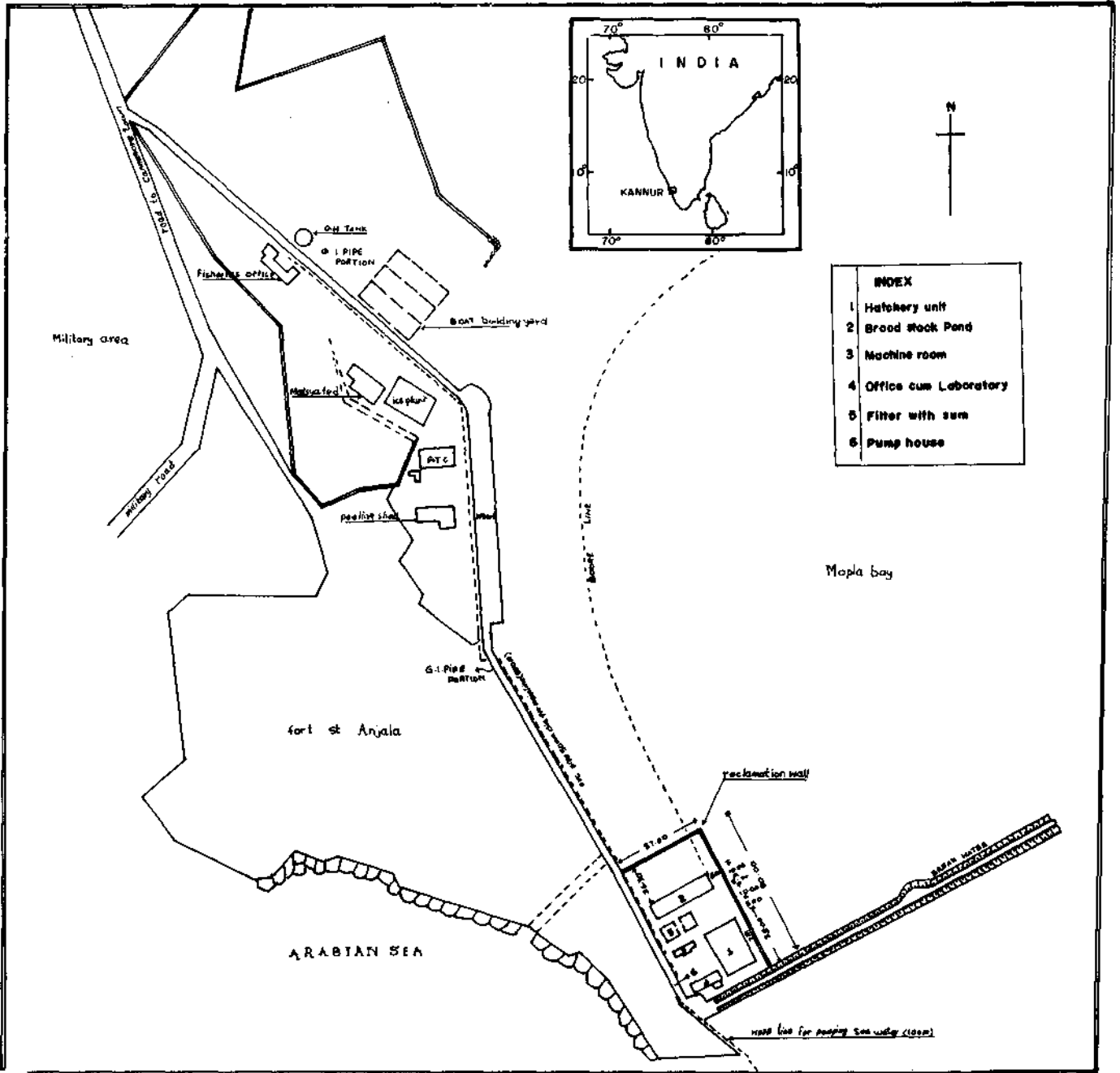


Fig. 1 . Map showing the location of the prawn hatchery at Mopla Bay.

## ii. Spawning tanks

These are cylindro-conical fibreglass tanks of 200 litre capacity (Fig. 4). The inner surface of these tanks is black in colour. Tanks are provided with three fibreglass coated iron legs. The conical bottom has a central drain fitted with a polypropylene ball valve. There are 20 spawning tanks in the hatchery.

## iii. Diatoms culture tanks

These are oval tanks with 1,200 litre capacity. Six tanks are required for the hatchery. The tanks are smooth and white in colour on the inner surface (Fig. 5).

## iv. Larval rearing tanks

These are fibreglass cylindro-conical tanks of 2,000 litre capacity (Fig. 6). The conical bottom

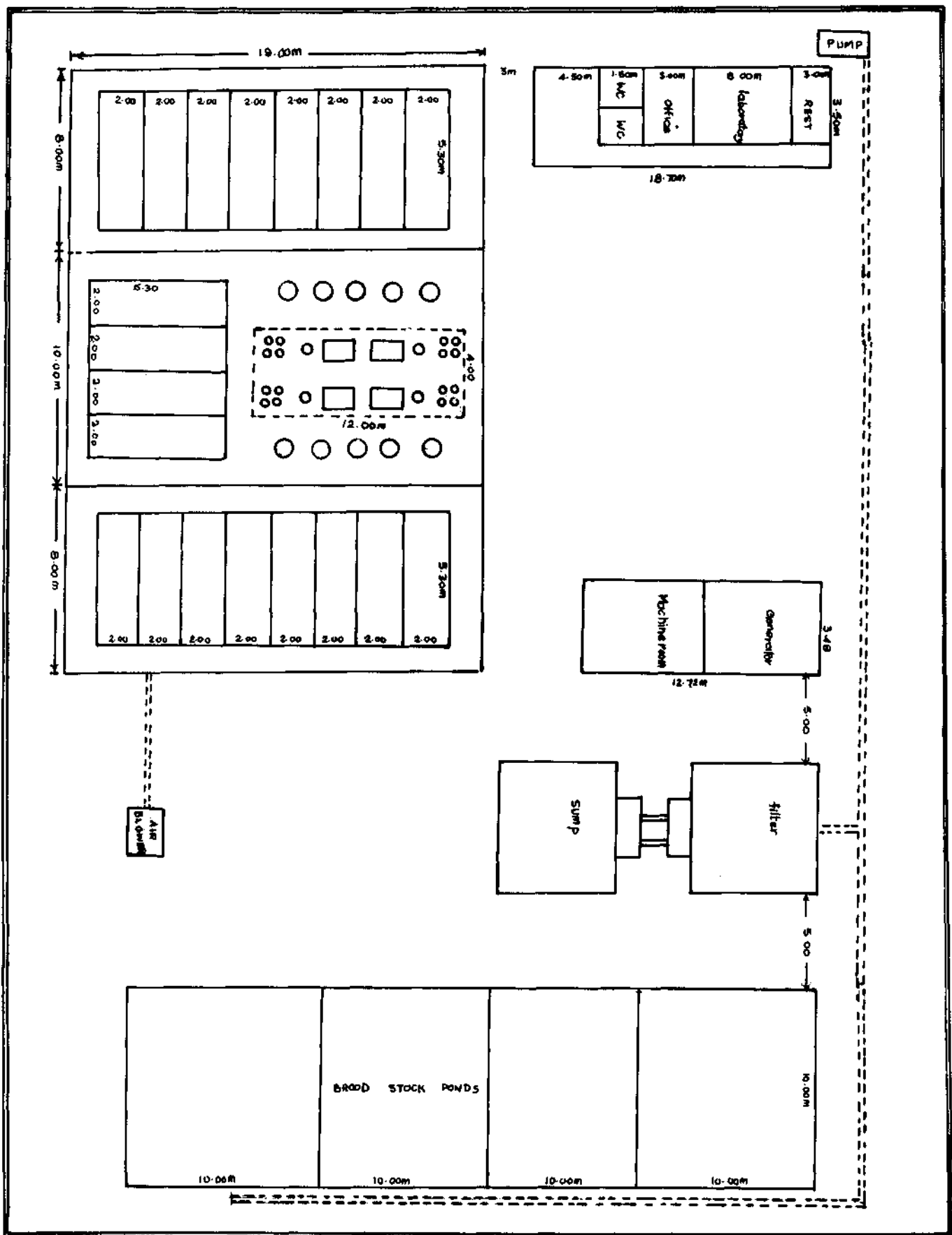


Fig. 2. Lay out of the prawn hatchery and other infra-structure facilities.

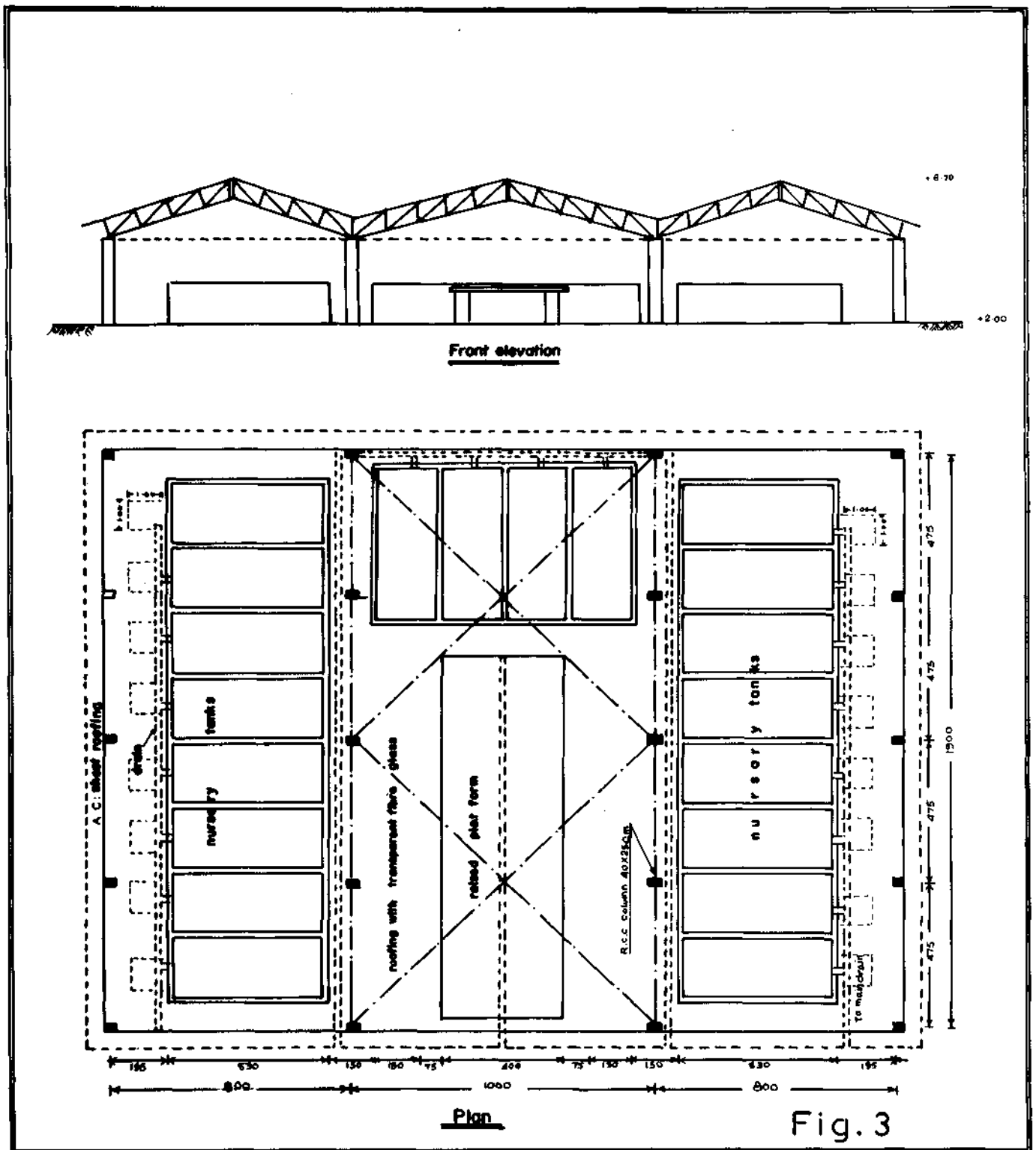


Fig. 3. Front elevation and plan of the prawn hatchery.

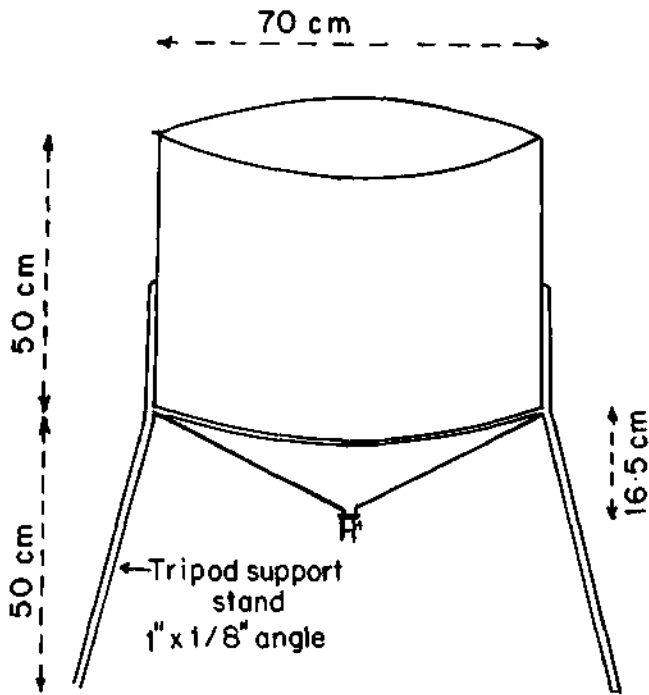


Fig. 4. Fibreglass cylindrical spawning tank with conical bottom.

has a short central drain pipe fitted with a polypropylene ball valve. These tanks are mounted on wooden platforms and are placed on either side of the raised central platform. Ten tanks are required for the hatchery. Larvae from these tanks could be directly transferred to nursery tanks by connecting a hose to the exit valve of these tanks.

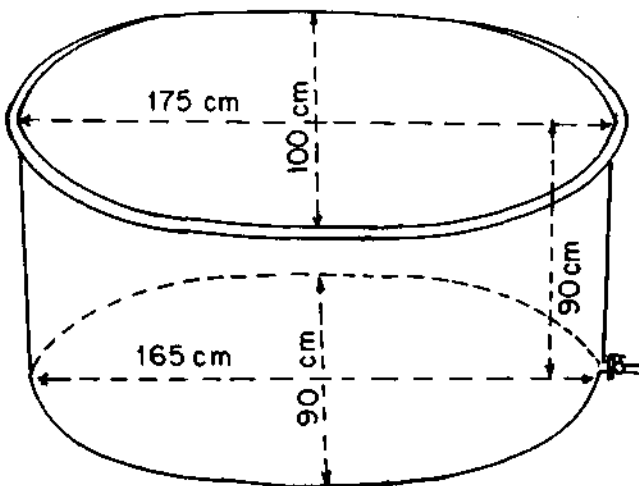


Fig. 5. Oval shaped fibreglass tank of 1.2 tonnes for phytoplankton culture.

#### v. Nursery tanks

Twenty numbers of concrete rectangular tanks of 10 tonne capacity (5.3 x 2 x 1 m) are provided. Facilities are provided to transfer the post larvae from larval rearing tanks to these nursery tanks directly (Fig. 3).

#### vi. Brood stock tanks

Four brood stock tanks of 100 tonne capacity (10 x 10 x 1 m) are constructed as one unit. These tanks are constructed in the open space and are not provided with any kind of roofing (Fig. 2).

#### vii. Maturation tank

One circular FRP tank of 10 tonne capacity is used for this purpose. Inside the tank is black in colour. Other details are given in Fig. 7. This tank is housed in a corner of the office complex (Fig. 2).

#### viii. Pump house

A pump house with 2 Nos. of 3 H. P. diesel pump sets, to pump water directly from sea, is provided.

#### ix. Filtering unit

A filtering unit is provided to filter the sea-water. The filtered water is stored in a sump. The sump has two compartments, each having a capacity to store 50 tonnes of sea water at a time. Details regarding the sump and filtration units are given in Fig. 8. From the sump, the sea water is pumped to an overhead tank constructed over the generator and machine room complex.

#### x. Air blower room

Two twin-lobe air blowers (kay compressors gas pump model) of 7.5 H. P. are installed in this room. PVC distribution lines are provided from the blowers to all tanks in the hatchery so that a continuous air supply is assured.

#### xi. Generator room

A generator of 50 KVA capacity is provided and the same is housed in a separate room. This ensures continuous electricity to the hatchery, in case the regular supply falls.

#### xii. Office cum laboratory

All equipments to carry out observations on salinity, pH etc. are housed in this laboratory. Air oven, refrigerator, mixer and other items are provided to prepare and store the compounded diet properly.

### xiii. Water and air supply lines

Freshwater, seawater and aeration lines (PVC pipes and valves) are provided to all larval rearing, spawning, diatom culture and nursery tanks. Maturation and brood stock tanks are provided with seawater and aeration facilities. In the brood stock tanks, facilities are provided to pump sea water directly from sea.

The hatchery appropriately blends the mechanical and manual systems of operation.

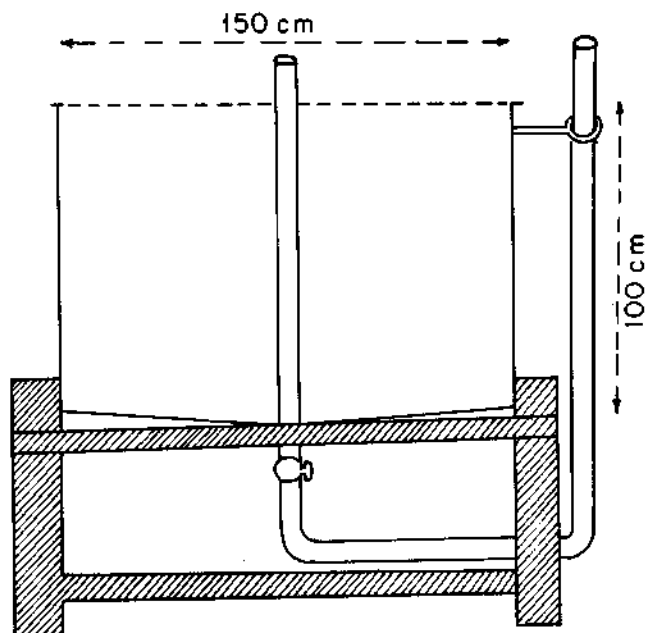


Fig. 6. Cylindro-conical tanks of 2000 litre capacity.

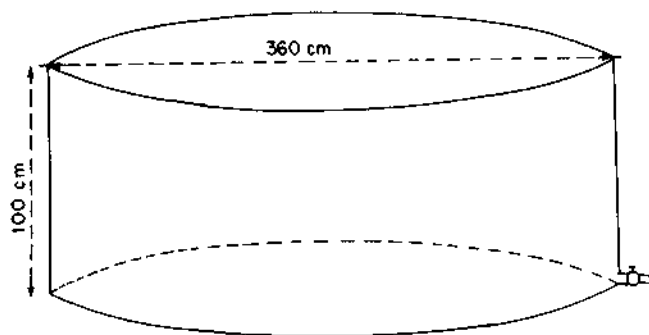


Fig. 7. Vertical, cylindrically shaped fibreglass tank of 10 tonnes for maturation/nursery.

### Production details of the hatchery

1. Number of maturation tank in the hatchery	:	1
2. Number of ablated females kept in a tank	:	30
3. Number of females matured and spawned within 4 - 5 days (70% of ablated females)	:	21
4. Number of spawning tanks	:	20
5. Average number of nauplii per spawner	:	75,000
6. Total number of nauplii from 20 spawner	:	15,00,000
7. Number of larval rearing tanks	:	10
8. Number of nauplii stocked in a larval rearing tank (2 tonne capacity)	:	1.5 lakhs
9. Number of nursery tanks	:	20
10. Average percentage survival of nauplii to PL-XX	:	33.33%
11. Production of PL-XX/hatchery run (every 30 days)	:	10 lakhs
12. Total number of PL-XX expected from the hatchery/ year (8 runs)	:	80 lakhs

### Demonstration of seed production of *P. indicus*

Three trial runs were carried out to test the functioning of the various units as well as to train the MATSYAFED staff of hatchery, on seed production of *P. indicus*. One hatchery manager and three technical officers are involved in all the activities and in different phases of seed production. Two watchmen and five casual labourers help the hatchery manager and technical officers. The details regarding the trial runs are given below :

#### Demonstration No. 1

(Carried out from 12 - 27 Feb., 1990)

Live *P. indicus* spawners were collected by arranging with the local bottom trawl net operators and transported to the hatchery. In the hatchery impregnated females with fully ripe ovary which was dark olive green in colour and had a lateral expansion in the first abdominal segment were selected and kept individually in the spawning tanks containing filtered seawater. Disodium salt of EDTA was added to the water @ 0.1 g per 100 litres of water. After spawning, on

the following day, the prawns were removed in early morning and were transferred to the rematuration tank. The procedures of counting egg and nauplii were demonstrated to the staff. Similarly the transfer of nauplii to the larval rearing tanks and their further rearing upto first post larvae were demonstrated. The technique of developing mixed phytoplankton culture and their maintenance were also demonstrated. For starting the mixed phytoplankton culture, fresh sea water (30 - 34‰ salinity) was filtered through 50 micron bolting cloth and kept in 1,000 litre capacity white fibre glass tanks placed under the transparent roofed shed. The sea water was fertilized with Sodium nitrate - 12 g for one tonne water and Potassium orthophosphate, sodium silicate and EDTA disodium salt each 6 g for one tonne water. Chemicals at the above rate were mixed well in the sea water and continuous aeration was provided. If good sunlight (20,000 to 1,20,000 lux during day) is present and temperature of seawater remains between 28°C to 35°C, diatom cells present in the filtered seawater multiply rapidly and give rise to a golden brown bloom of diatoms in 24 - 48 hrs. *Chaetoceros* spp. dominate this culture. Everyday fresh phytoplankton culture was done using the previous day's culture as an inoculum at the rate of 30 - 35 litres per tonne of seawater. Mixed phytoplankton culture dominated by *Chaetoceros* spp. was used for feeding the larvae from protozoa I onwards. The daily schedule of management of the larval rearing tanks, the phytoplankton culture tanks and the observations to be made to assure the quality of larvae, their activities and well being were informed to the staff undergoing training.

In the above demonstration 15.5 lakhs of nauplii were obtained from 12 spawners and they were reared in 10 larval rearing tanks each with a stocking density of 1.5 lakhs. They were fed with mixed phytoplankton culture dominated by *Chaetoceros* spp. at a feeding schedule of 50 - 100 litres per tank per day. In 4 tanks an estimated total of 2.88 lakhs of postlarva I and II were obtained after 11 - 13 days of spawning. They were transferred to the nursery tanks. Due to excessive bloom of diatoms, the survival of the larvae reared in 6 tanks were adversely affected.

#### **Demonstration No. 2**

(Carried out from 17 to 25 Feb., 1990)

As in the previous demonstration, 4 larval rearing tanks were stocked with nauplii at the rate

of 1.5 lakhs of nauplii/tank. To control the excessive bloom of diatom, which affected the survival of larvae in the previous demonstration, the larval rearing tanks were partially covered with black cloth. However, as the larvae developed to mysis - I stage, they showed necrotic conditions due to stress and subsequently got bacterial infection which led to mass mortality. Only 20,000 post larvae I & II were obtained from one of the tanks. The various causes of larval mortality during rearing, important diseases due to bacteria and fungi and the remedial measures to be taken were discussed with the staff so that they became aware of the constraints and also steps to be taken to meet the situation.

Another trial run was carried out in an outdoor tank of 100 tonne capacity. Fourteen lakhs of nauplii, obtained from 12 specimens (137 - 165 mm TL) were stocked in an outdoor 100 tonne tank containing 90 tonne seawater. The seawater in the tank was fertilized with sodium nitrate, potassium orthophosphate, sodium silicate and EDTA di-sodium salt. The tank was continuously aerated. Five hundred litres of phytoplankton, dominated by *Chaetoceros* spp. were added on the first day as an inoculum. On alternate days  $\frac{1}{6}$  water was exchanged with fresh filtered seawater. From second to ninth day, larvae were fed only with the phytoplankton naturally developed in the tank. Within 10 to 11 days, larvae developed to post larva I & II in this tank. Afterwards larvae were fed with egg custard. Egg custard at the rate of 100 - 200 g was given every day in 5 doses. After 18 days, a partial harvesting was carried out and 1.4 lakhs of PL VII and VIII were harvested from this tank and stocked in 3 nurseries for further rearing. On 20th day, second harvesting of 0.83 lakh of PL IX & X were made and stocked in two nurseries. During final harvesting 2.00 lakhs of PL XX and above were obtained and they were stocked in nurseries for further rearing. A total of 4.23 lakhs seed were harvested from this outdoor tank.

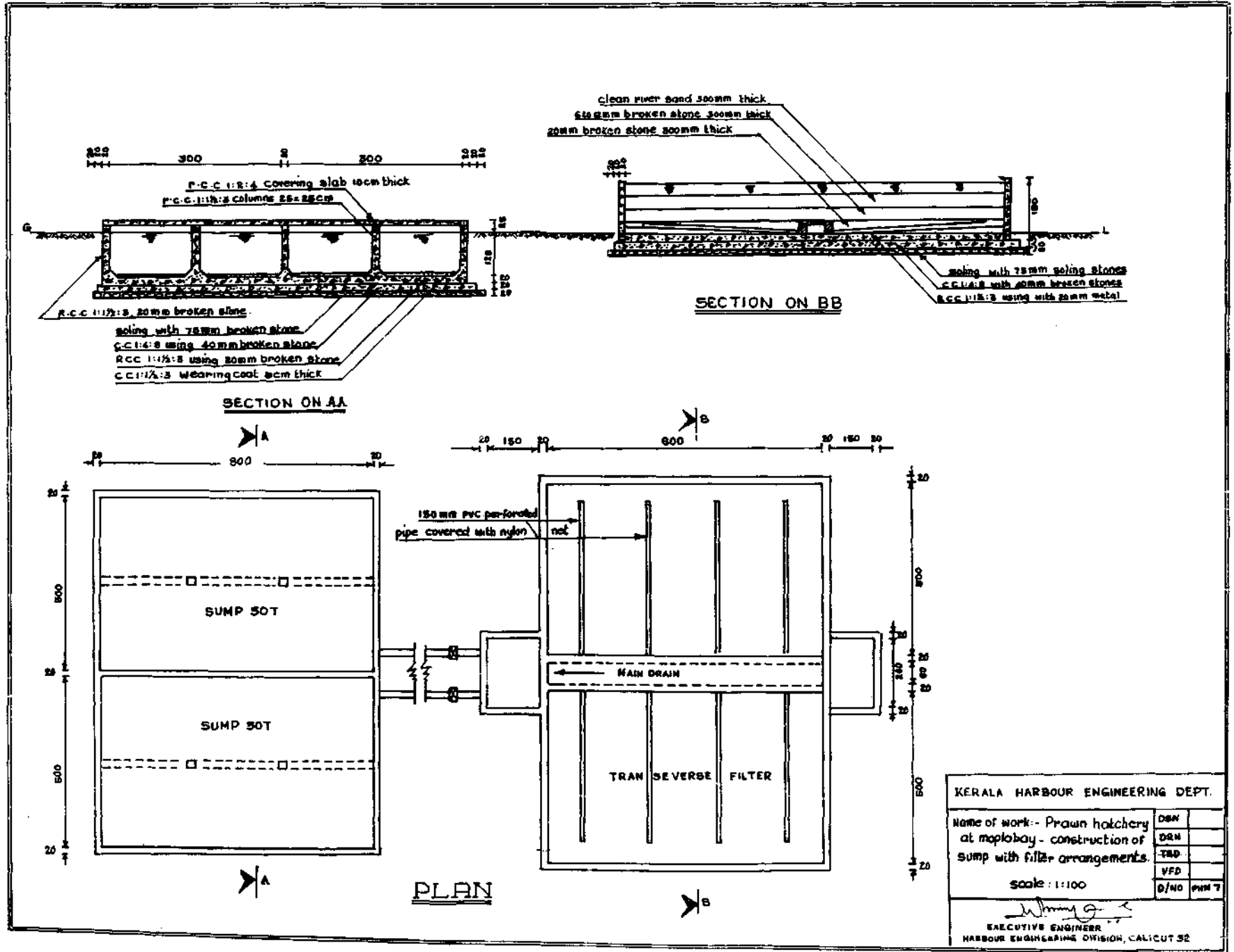
#### **Demonstration No. 3**

(Carried out from 26 Feb. to 10 Mar., 1990)

During the first two demonstration runs, excessive blooming of phytoplankton as well as occurrence of diseases in mysis stages had affected the survival. Measures were taken to control these two adverse conditions affecting survival of larvae in larval rearing tanks. The blooming of diatoms in the larval rearing tanks



Fig. 8. Vertical section of the hatchery.



was controlled by water management. Thus 1,400 litres of water was replaced daily from each of the larval rearing tanks (2 tonne capacity) at 0900 and 1700 hrs. From protozoa III stage onwards. Sediments from the bottom of the tanks were removed daily. Larvae from mysis II onwards were fed with egg custard also in addition to diatoms. The above steps taken, completely prevented the blooming of diatoms in tanks as well as occurrence of disease at mysis stage.

If any symptoms of disease in the mysis stage were observed, 500 mg of erythrocin/tank/day was to be added in the rearing tanks.

Seven lakhs of nauplii were obtained from 4 spawners (130 - 158 mm TL) and were distributed to 4 larval rearing tanks at the rate of 1.5 lakh nauplii/tank. 3.08 lakhs of PL I and II were obtained from them. They were removed to nursery tanks for further rearing. 6 lakhs of nauplii obtained from 4 spawners (127 - 150 mm PL) were distributed to another 4 larval rearing tanks. 2.5 lakhs of PL I & II were obtained from them which were transported to nursery tanks for further rearing.

#### Nursery rearing of larvae of *P. indicus*

For each of the larval rearing tanks, two nursery tanks (10 tonne capacity) were provided. 50 - 75 thousand PL I & II were stocked in a nursery at a time. For the first two days, the larvae were fed with 75 g of egg custard in 5 doses of 5 + 15 + 15 + 20 + 20 g at 0900, 1200, 1500, 1800 and 2100 hrs respectively.

For the preparation of egg custard, meat of *M. dobsoni* and hen's egg at the ratio of 5:1 were mixed well in a mixer, steamed for 15 minutes in a cooker and kept in a refrigerator. This was used for feeding mysis II larvae after passing through zooplankton net. For post larval feeding, egg custard was passed through ordinary tea filter.

From third day onwards, larvae were fed with particulate diet prepared as follows: Finely powdered squilla powder, *M. dobsoni* powder, groundnut oil cake powder and tapioca powder at the ratio of 1:1:1:1 were mixed well with water (40% water for 1 kg of powder) and steamed in a cooker for 10 - 15 minutes. It was extruded through a pelletiser and sundried. The pelletised feed was powdered and passed through suitable

sieves according to the size of the larvae and fed to the larvae. 80 to 125 g of feed in 5 equal doses were given to the larvae in each of the nursery tanks. Every day, half of the water from the nursery tanks was removed and replaced with fresh filtered seawater. On alternate days, the sediments from the bottom of the tanks were removed by siphoning. Continuous aeration was provided. Aeration was stopped only when the sediments were removed or when the seeds were collected. For the final collection of seed, the water level in the nursery tanks was reduced to about 15 - 20 cm and 90% of the seed were scooped out using scoop nets after stopping the aeration. Remaining seed were collected using a scoop net at the exit after opening the exit valves.

#### Total seed produced during trial runs

Within 29 days, 3 trial runs were carried out and altogether 12.89 lakhs of larvae were produced, the details of which are given below:

i.	Number of seed of <i>P. indicus</i> available for ready sale	4.69 lakh
ii.	Number of seed sold to farmers	0.30 lakh
iii.	Number of post larvae I and X remained in the hatchery	7.90 lakh
	<b>Total</b>	<b>12.89 lakhs</b>

#### Brood stock maintenance and induced maturation

To achieve self-reliance in respect of the requirements of spawners for seed production, the technique of brood stock maintenance and induced maturation through eye stalk ablation was demonstrated to the staff. Once spawned specimens and the specimens which were in maturing conditions obtained along with spawners were maintained in the brood stock tanks by proper feeding and water management.

On 16 - 2 - '90, 23 females of *P. indicus* (133 - 195 mm TL) were subjected to unilateral eye stalk ablation by incising the eye stalk and squeezing the contents. In the absence of cauterisation equipment, the care to be taken to minimise handling and excessive bleeding were informed to the staff. After ablation, they were released to the maturation tank (10 tonne capacity) containing filtered seawater. They were fed *ad-libitum* with clam and mussel meat. Every day, half of the water in the tank was exchanged with



Fig. 9. Hatchery shed. Central raised platform with larval rearing tanks on either side.

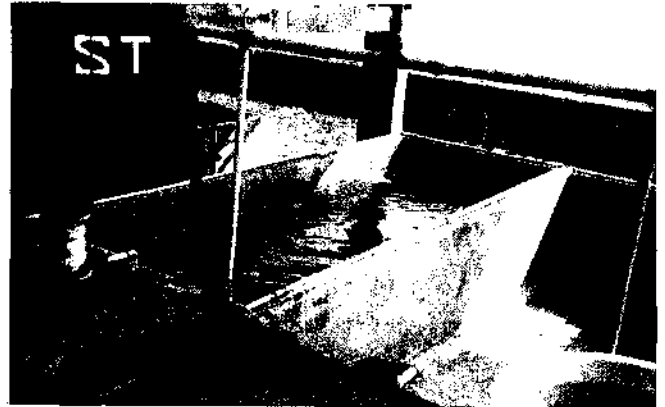


Fig. 12. Nursery tanks (10 tonne capacity).



Fig. 10. A view of hatchery showing sand filter unit and office building.

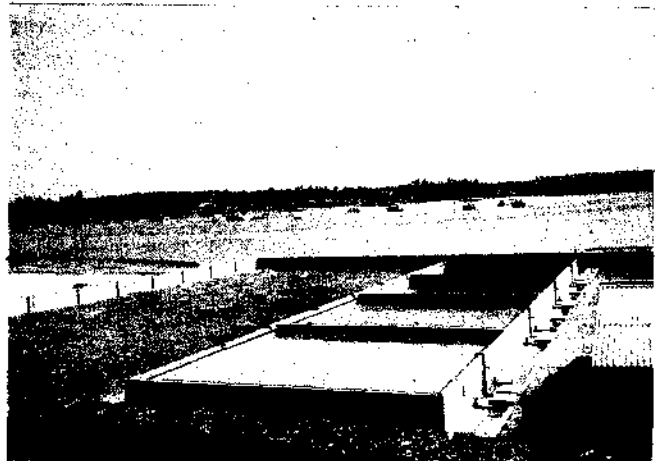


Fig. 13. Brood stock tanks (10 tonne capacity).



Fig. 11. Close up view of raised platform with spawning tanks on either side. Diatom culture tanks in the middle with transparent roofing.

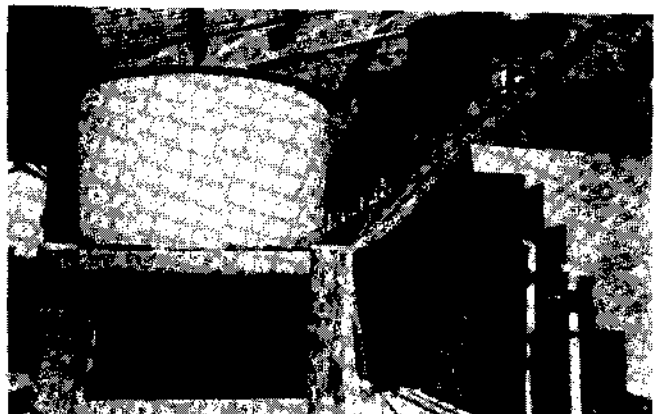


Fig. 14. Larval rearing tanks (2 tonne capacity).

fresh filtered seawater. As no pH meter was available, the pH of the water was not regulated, although this was highly essential for rematuration. On 18 - 2- '90, 15 specimens showed fully developed ovary and were removed and kept for spawning. Eight of them spawned giving 7.6 lakhs of nauplii.

On 21 - 2- '90 another batch of 39 specimens were subjected to unilateral eye stalk ablation and maintained in the maturation tank as described earlier. On the 24th and 25th, 6 and 5 specimens respectively developed ovary and spawned and gave a total of 8.5 lakhs of nauplii, of which 1.5 lakhs were stocked in a larval rearing tank and reared.

C. M. F. R. I. acknowledge the initiative taken by MPEDA to bring together CMFRI and MATSYAFED and initiate the project for the establishment of a prawn hatchery using the technology developed at the CMFRI. The sincere and positive approach of Mr. K. Appukuttan,

General Manager and Dr. O. Divakaran, Inland Production Executive of MATSYAFED is acknowledged Mr. A. N. Narayanan (Rt. Secretary) and Mr. K. J. James, Secretary, District Fisheries Development Co-operative Ltd. have helped in the successful completion of this project. Mr. M. Ayyappan, Executive Engineer, Smt. K. K. Rajamma and Mr. A. Krishnan, Assistant Engineers of the Harbour Engineering Department have assisted in giving their valuable suggestions and helped to complete the construction of the hatchery within a minimum period. The dynamic and sincere efforts put forward by the hatchery Manager Dr. K. Sobhana Kumar throughout the development of this project and the whole hearted and dedicated work of technical officers Mr. V. Mohan Das, Mr. K. P. Adamkutty, and Mrs. K. Vanaja and the assistance given by the supporting staff were instrumental for the successful implementation of this prawn hatchery project which is purely based on the techniques developed and perfected by CMFRI.