

**CENTRAL MARINE FISHERIES  
RESEARCH INSTITUTE**

**Activities and Achievements**

**Tuticorin Research Centre**



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From time immemorial Tuticorin has been an important fishing centre in India. Apart from the production of quality marine fish it is famous for the valuable pearl and chank fisheries. From its inception, the Central Marine Fisheries Research Institute has realised the need to give proper impetus for the development of the marine fisheries of this area and has set up a Survey Centre in 1948 which was upgraded as a Research Unit in 1959. With further strengthening of the research activities this was elevated to the status of a sub-station in 1969 and subsequently to that of a Research Centre. This Research Centre is conducting researches on diverse aspects of marine fisheries of this region, with a view to evolve suitable management measures for rational exploitation as well as to increase production through aquaculture by developing appropriate technologies.

#### **MAJOR ACTIVITIES AND ACHIEVEMENTS**

Beginning with the estimation of marine fish landings along the Southern Tamil Nadu Coast and ecological studies on the pearl beds, in course of time the Research Centre has given thrusts to multifaceted research projects in capture and culture fisheries and also for the transfer of technologies. The major activities of the Research Centre in the past and at present are studies on the biological and fishery characteristics of important demersal and pelagic groups of fishes for stock assessment, survey of the pearl banks and chank beds in the Gulf of Mannar, experimental trawling, culture of fin fish, prawns, crabs, oyster, pearl oysters and pearl pro-

duction, hatchery production of the seed of the pearl oysters, edible oyster, clams, top shell, prawns, crab and sea cucumber, microalgal culture, fishery environment monitoring and transfer of technologies to the trainers and users, underwater SCUBA diving, hatchery production of oyster, seed, oyster culture and pearl culture. The Research Centre has made significant contributions in ecological studies on pearl oyster resources, development of technologies in the production of cultured pearls, oyster culture, prawn culture in salt pans and crab culture. Major breakthrough has been achieved in hatchery production of the seed of pearl oysters, edible oysters, clams, top shell, crab, prawns and sea cucumber. Other important contributions of the Tuticorin Research Centre are in the transfer of technologies developed in various mariculture projects.

#### **CAPTURE FISHERIES**

The investigations on the capture fisheries are directed towards elucidating information on the biology, fishery and the population characteristics of major exploited fin fish and shell fish resources off Tuticorin. The average annual landings at Tuticorin by the artisanal sector are at 9,275 t and by trawlers at 18,950 t.

#### **Pelagic Resources**

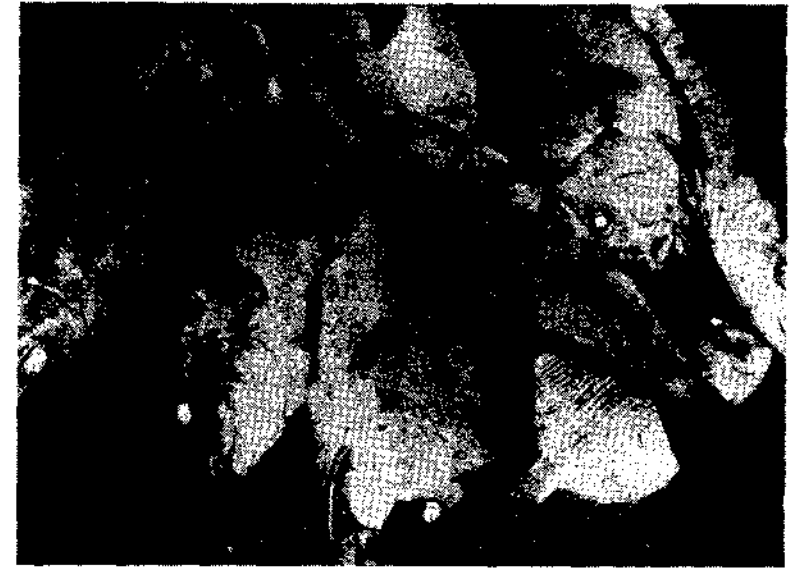
The pelagic fishery resources mainly comprise lesser sardines (2,250 t), tunas (1,650 t), barracudas (685 t), seer fish (650 t), anchovies (525 t) and carangids (450 t). Investigations on the catch trends, effort expended, fish-

ing season, growth, maturity, spawning, sex ratio and mortality rates have been carried out with emphasis on stock assessment of dominant species such as *Sardinella gibbosa*, *S. sirm*, *S. albella*, *Euthynnus affinis*, *Auxis thazard*, *Scomberomorus commerson*, *Caranx leptolepis* and *C. carangus*. Among the sardines, *Sardinella gibbosa* is dominant forming over 60% of the lesser sardine catch. The fishery is supported by 10-17 cm long fish with dominant mode at 13 cm. Females usually outnumber males. Gravid and spent fish occur in good numbers during March-July and sometimes upto September. There are no indications of overfishing of lesser sardine resource at present.

For *Scomberomorus commerson*, the present input of effort by trawl net and drift net is higher than the optimum and it is suggested to increase the age at first capture for rational exploitation. In the case of *Caranx leptolepis*, *Sphyraena jella* and *S. picuda* there is scope to increase the fishing pressure whereas for *C. carangus* and *S. obtusata* any further increase in the effort may not result in increased catches.

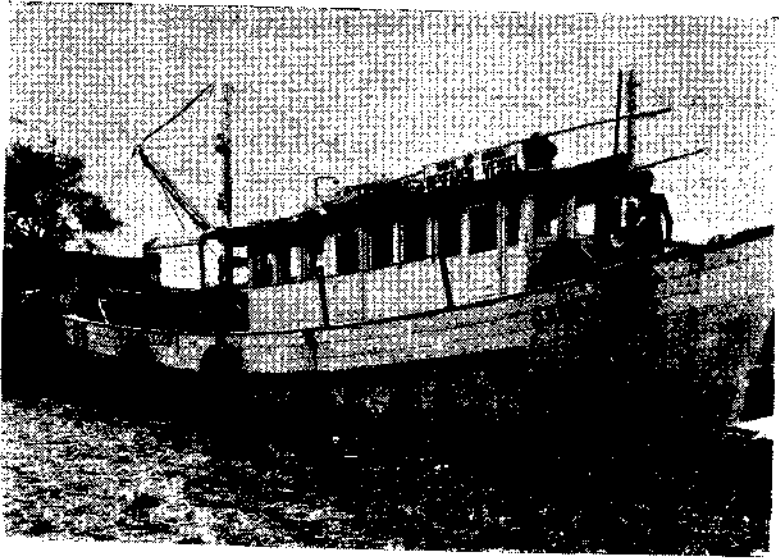
#### Demersal Resources

Important demersal fishery resources are perches (4,700 t), silver bellies (2,900 t), *Thrissocles* (1,350 t), Nemipterids (1,050 t), *Sciaenids*, cat fish, upenoids, *Sau-*



*A part of the perch catch of a commercial trawler off Mannar ready for auctioning.*

*rida* spp. and rays. Stock assessment studies have been made on *Lethrinus nebulosus* and *Nemipterus japonicus*. The former species is exposed to higher fishing pressure by *Podi valai*, *olai valai* and hooks and lines. However, these gears are not conducting aimed fishing for this species. The age at first capture (0.68 yr) of *N. japonicus* is close to the optimum age of exploitation (0.86 yr) and there is scope to increase the fishing effort for sus-



*A view of the Research vessel CADALMIN IV based at the Tuticorin Research Centre of CMFRI which is used in hydrographic and exploratory fishing studies.*

tained production. Experimental trawling by 'R.V. Cadalmin IV, has revealed that off Ervadi, Pinnakayal and Manapad good fishing grounds exist for demersal fish.

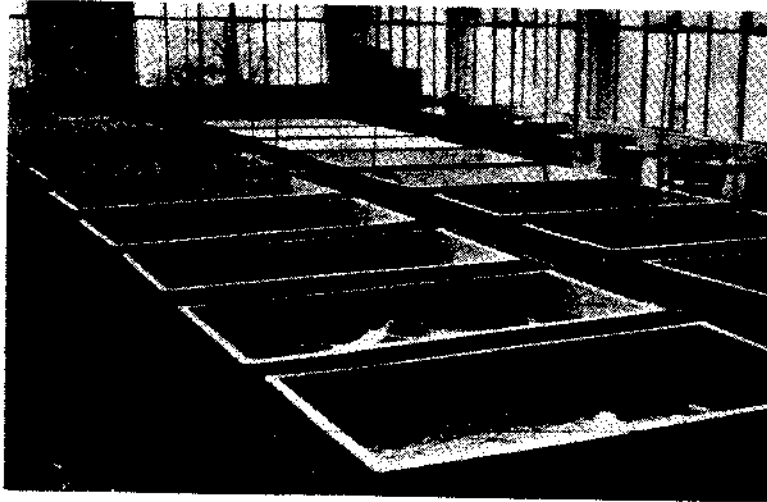
#### **Crustacean fisheries**

About 950 t of crustaceans mostly composed of prawns, *Penaeus indicus* and *P. semisulcatus* are landed annually at Tuticorin. *P. semisulcatus* accounts for 50% of the prawn catch with major landings in June-Septem-

ber. It spawns throughout the year with peaks in June-July and November-December. Among lobsters, *Panulirus homarus* and *P. ornatus* are dominant.

#### **Molluscan fisheries**

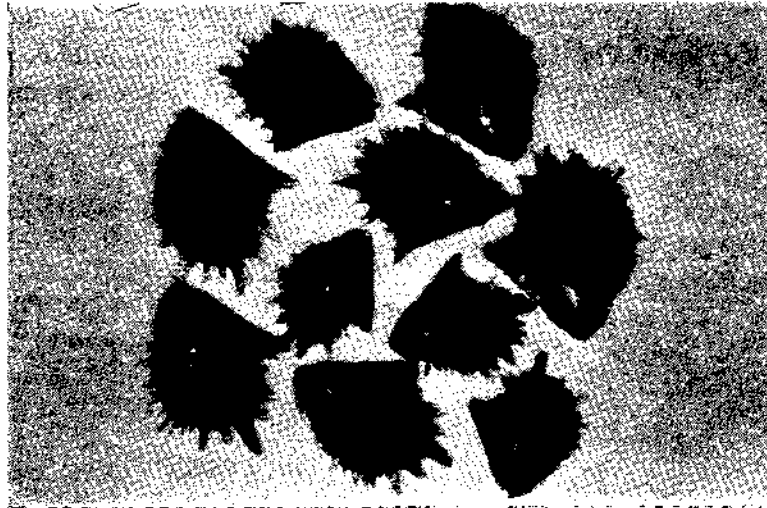
The cephalopod landings amount to 125 t/year and the squid *Loligo duvaucelii* (32%) is dominant followed by the cuttlefish *Sepia breviamana* (29%). July-Septem-



*A part of the molluscan hatchery facility at Tuticorin*

ber period is the most productive for cephalopods. *L. duvaucelii* measures 55 - 195 mm and males are dominant in the commercial catches. They attain maturity at 99

mm length. *S. breviamana* measures 42 - 115 mm, males and females being in equal proportion. males attain maturity at 53 mm and females at 78 mm length. Spawning



*Pinctada fucata* seed produced in the hatchery

occurs during July-September. Close watch is being kept on the stocks of the pearl oyster, *Pinctada fucata* and the chank *Xancus pyrum* to update information on the characteristics of these resources. Regular underwater observations indicate that the settlement of pearl oysters in the paars is poor and there are no prospects of a pearl fishery in the near future.

## FISHERY ENVIRONMENT

### Hydro-biological studies

A detailed study on the hydrological and meteorological features in relation to the primary production and distribution of zooplankton off Tuticorin coast in the Gulf of Mannar has been made. These studies indicate that there are three seasonal peaks of Primary production in the inshore waters during March-April, June-July and October-November. Always a negative correlation has been noticed in the case of nutrients, especially nitrates, phosphates and silicates with the rate of primary production. Similarly, the production of zooplankters also indicates a possibly negative correlation with primary production, revealing two seasonal peaks, one during January-March and another during July-September. The influence of hydrological properties has been correlated with the distribution of fish larval population and the spawning seasons of some fishes have been determined.

### Pollution monitoring

The fast industrialisation along the Tuticorin coast prompted the Research Centre to undertake studies on marine pollution. It has been observed that the Dhran-gadhara Chemical Works and Plastic Resin Centre discharge industrial effluents which contain mercury in the range of 150-900 mg/ml. The water in the lagoon adjoining these industries is highly toxic.

### Bioactive agents from marine organisms

Bioactive substances which are toxic to bivalve larvae have been isolated from two microalgae *Dunaliella salina* and *Oxytoxum* sp.

### Studies on benthos

Recently studies have been taken up on the distribution and abundance of benthic organisms in the trawling grounds off Tuticorin as they play an important role in the distribution of demersal fish.

## CULTURE FISHERIES



String method of oyster culture.

### Culture of finfishes :

The production potential of the milk fish and mullets has been assessed. Polyculture of *Liza macrolepis*, *Chanos chanos* and *Scylla serrata* gave a better yield amounting to 1640 kg/ha/year when compared to monoculture. The potential areas for the collection of seed of cultivable species have been identified.

### Crab culture

Seeds of *Scylla serrata* measuring 2-3 cm when stocked in fenced coastal ponds at 1/m<sup>2</sup> have grown to 12-14 mm (30-60 g) per month. They attained the marketable size of 650 g in 7-8 months with a production of 500-600 kg/ha. The survival has been assessed as 30%.



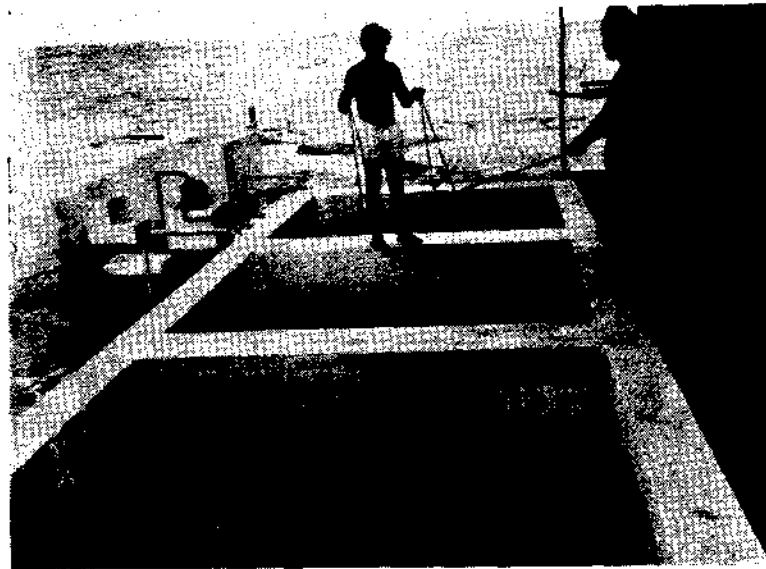
Crab culture ponds of Tuticorin Research Centre.

**Prawn culture :**

Suitable techniques have been evolved for large scale commercial production of marine prawns in salt pans belonging to private entrepreneurs. *P. indicus* seeds of 20 mm have grown to the marketable size of 125 mm in 5 months at 96% survival, giving an yield of 1200 kg/ha with the optimum stocking density at 70,000/ha. The gross income varied from Rs. 35,000 to 41,000 per crop.

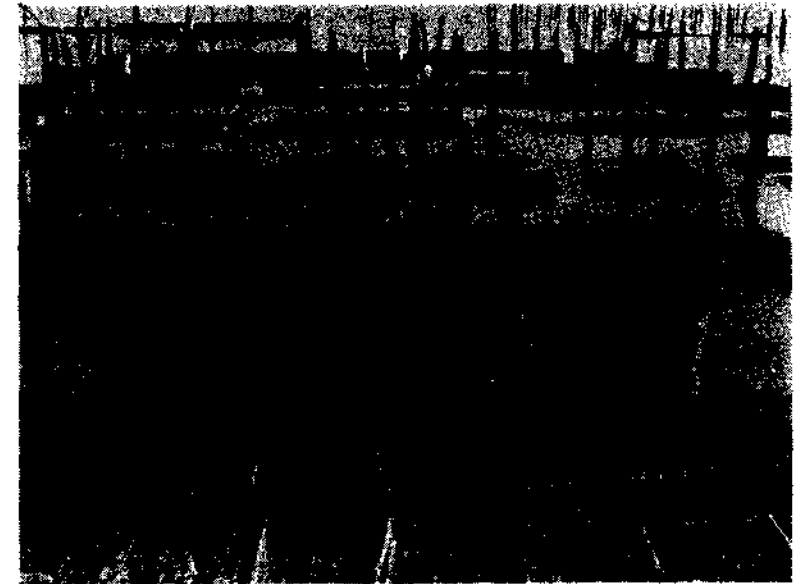
**Oyster culture :**

Techniques for the collection of the seed of the oyster *Crassostrea madrasensis* have been developed by



*Oysters in purification tanks and depuration process*

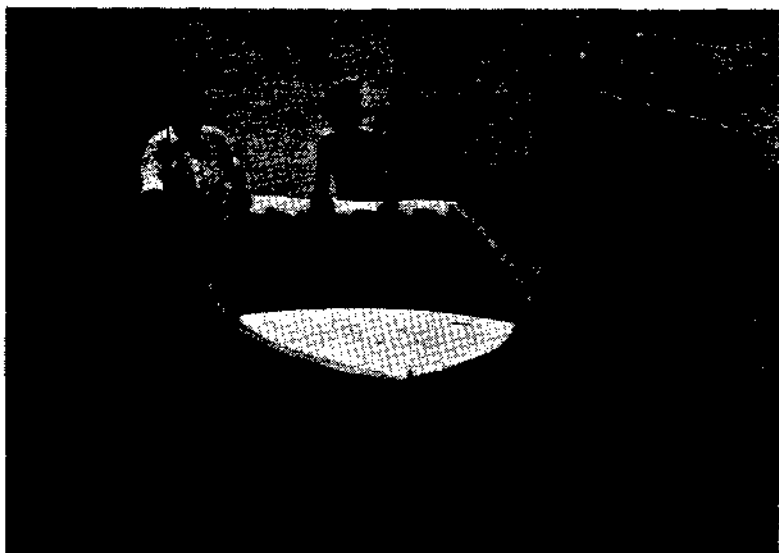
relaying spat collectors during the spawning season, April-May and August-September. By rack and tray methods of culture the oysters have attained the marketable size of 80-90 mm (80-100 g shell on wt.) in 10-12



*A view of the oyster farm —  
Rack and Tray method of oyster culture.*

months, with a production rate of 90-120 t/ha shell on of which 7.5-9 t forms the edible portion. The string and stake methods of culture which are cheaper, have



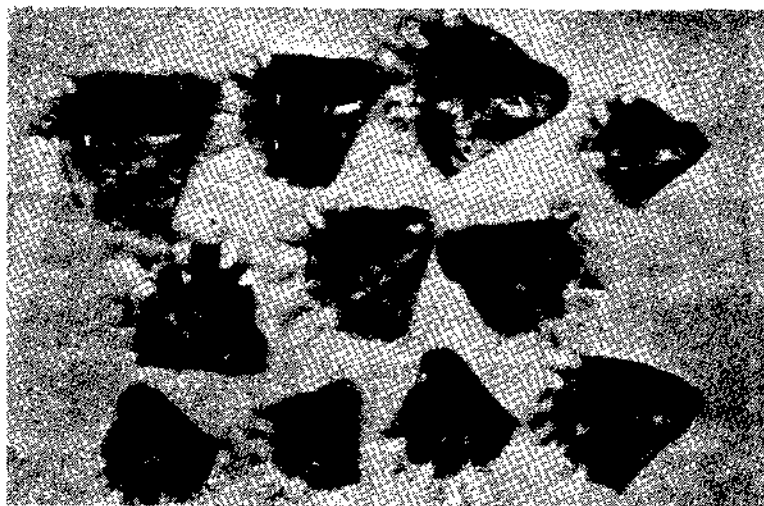


*Harvested oysters*

also been developed, the former with a production of 80 t/ha.

#### **Pearl culture**

The techniques of pearl culture developed at this Research Centre consists of inserting a small piece of graft tissue from a healthy pearl oyster along with a shell bead nucleus in the body of the pearl oyster, *Pinctada fucata* and rearing the operated oysters in cages hung from a raft in coastal waters. This techniques is

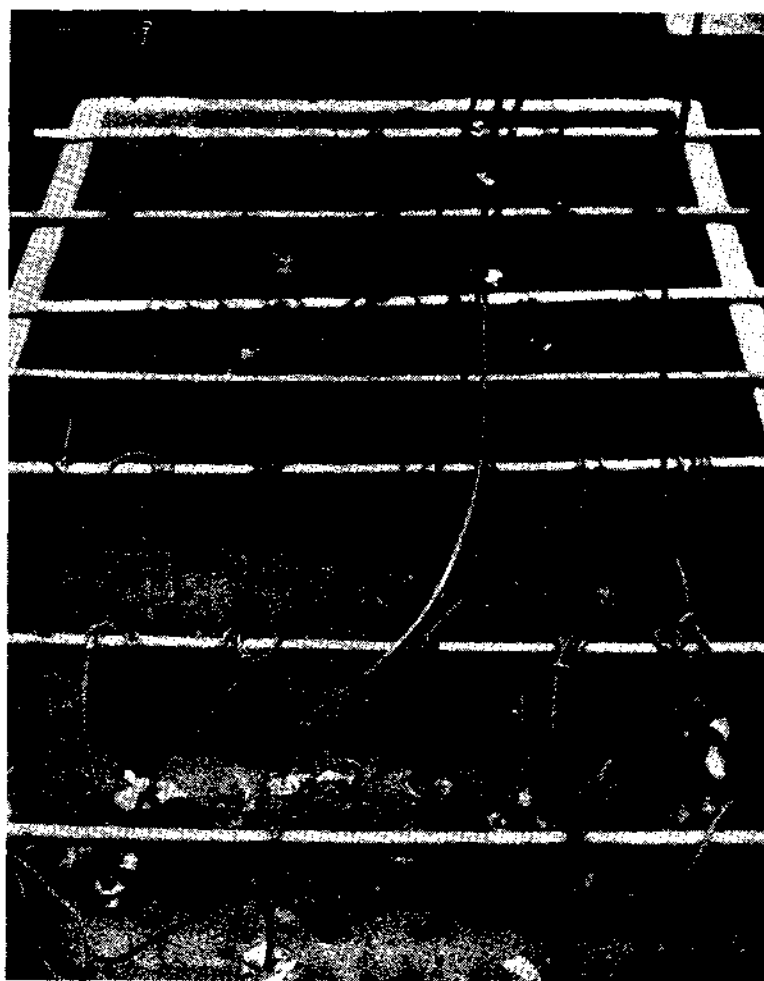


*P. margaritifera* seed produced in the hatchery

being refined and a measure of success has been achieved in the multiple nucleus implantation in a pearl oyster for increasing the production of pearls.

#### **HATCHERY PRODUCTION OF SEED**

The seed availability in nature of cultivable species is not stable and realising that assured seed supply is an important prerequisite for the development of mariculture on large scale, the Central Marine Fisheries Research Institute has given a major thrust in its research programmes to the hatchery production of seed of many candidate species at the wet laboratory facility at Tuticorin.



Setting of hatchery produced oyster spat on polyethylene sheet and shell rens in a tank in oyster hatchery.

#### **Edible oyster seed**

After the initial success in 1982 on the induced spawning by thermal stimulation and rearing the larvae/spat of the Indian backwater oyster *Crassostrea madrasensis* in the hatchery, the technique has been standardised for the mass production of the oyster seed at a rate of 1.5 million seed/year. A recent addition for successful seed production in the hatchery is *C. cristagalli*, a species with potential for cultivation.

#### **Pearl oyster seed**

Breakthrough in the seed production has been achieved first in the Indian pearl oyster *Pinctada fucata* in 1981. Since then about 10 million spat of this species have been produced through a series of experiments. The techniques involve conditioning the brood stock at lower temperatures and inducing maturation by intensive feeding of mixed phytoplankton cultures reared in outdoor tanks. By raising the water temperature spawning is induced. These techniques have been standardized for mass production of pearl oyster seed for a major part of the year and a production of 1.3 million seed has been achieved in a single experiment. Recently, successful breeding has been achieved in the black lip pearl oyster *P. margaritifera* and the resultant spat have grown to adult size.

### Clam seed

Since initiating the work in 1987, a significant breakthrough has been achieved in the hatchery production of the seed of the great clam, *Meretrix meretrix*, blood clam *Anadara granosa* and the venerid clam *Pa-*



*Hatchery produced seed of P. malabarica*

*phia malabarica*. These species have spawned several times in the hatchery and a total of 73,900 seed of *P. malabarica* have been raised recently.

### Sea cucumber seed

Due to intensive fishing there is shortage of sea cucumber in the natural grounds and with a view to aug-



*Sea cucumber seed produced in the hatchery.*

ment sea cucumber production, the Research Centre has initiated work on the laboratory breeding of this species. In 1987 a breakthrough has been achieved in the induced spawning of *H. scabra* by thermal stimulation and after rearing the various larval stages a few thousand seeds have been successfully produced.

#### **Prawn seed**

Suitable techniques have been developed for the production of the seed of the commercially important penaeid prawns *Penaeus indicus* and *P. semisulcatus*.

#### **Crab seed**

A breakthrough has been achieved in the breeding and rearing of the larvae of the crab *Scylla serrata*.

#### **Microalgal culture**

The microalgae are an important food for the larvae of many marine organisms. So far, 20 species of microalgae have been isolated, cultured and tested as larval food. Out of them, *Isochrysis galbana*, *Pavlova lutheri*, *Dicrateria* sp. and *Chromulina* sp. have given good results as food for bivalve larvae. Techniques for the mass production of these nannoplankters have been developed.

#### **Formulation of artificial diets**

The nutritional requirements of the fry and fingerlings of mullets and eels have been established by feed-

ing on microparticulate diets. Microencapsulated supplementary diets have been prepared for feeding oyster and pearl oyster larvae and spat. The results indicate high setting and faster growth when fed with these supplementary diets.

#### **Sea ranching**

As a spin off to the development of the hatchery technology for the production of the seed of many culturable species, the Research Centre has embarked upon a programme of sea ranching of the seed to replenish the natural stocks. During 1988 alone about 1 million hatchery produced seeds of the pearl oyster, *Pinctada fucata* have been ranched at selected pearl banks in the Gulf of Mannar. A total of 64,750 hatchery produced seeds of the clam *Paphia malabarica* have been transplanted to Asthamudi lake in Kerala State in March 1989.

### **TRANSFER OF TECHNOLOGY**

#### **Lab to Land programmes**

Fifteen fishermen were selected and supplied each with 25,000 edible oyster seed and other infrastructure facilities for taking up oyster culture. The fishermen have carried out oyster culture on scientific lines with the help of the Scientists of Tuticorin Research Centre. They have harvested 12.5 t of oysters from the farm and realised Rs. 8,587.50 as sale proceeds. They have effec-

tively utilised 1/3rd of their spare time in oyster culture, without affecting their usual fishing activity.

The Research Centre also monitors and advises the farmers on prawn culture in salt pans at Tuticorin.

### **Training programmes**

The expertise developed by the Scientists of this Research Centre in various research projects is periodically disseminated to the personnel of developmental organisations and end-users by way of training programmes.

The Research Centre has conducted training programmes on culture of edible molluscs, pearl culture, pearl oyster seed production, oyster culture, hatchery production of oyster seed and underwater SCUBA diving for the benefit of technical personnel of various fisheries Departments, Fisheries Colleges, Universities and others interested in the subject.

### **EXTENSION SERVICE**

Over 3t of cultured oyster meat has been supplied to the Integrated Fisheries Project, Cochin for product development and marketing. A total of 32,300 hatchery produced edible oyster seed and 42,800 pearl oyster seed have been supplied to Gujarat Fisheries Department. In 1985 a total of 50,000 pearl oyster seed have been sup-



*Prawn harvest from salt pan pond.*

plied to M/s. Tamil Nadu Pearls Ltd., and in 1986 about 10,000 pearl oyster seed have been supplied to the Lakshadweep State Fisheries Department.

### **STAFF STRENGTH AND INFRASTRUCTURAL FACILITIES**

The present staff complement of the Tuticorin Research Centre of CMFRI is as under :—

Scientific	...	21
Technical Officers	...	2
Technical Assistants	...	37
Ministerial	...	11
Supporting Staff	...	27

In 1989 the ongoing research projects handled by the scientific and technical staff have been revised to make them broadbased and they number 18. The Shellfish Hatchery Laboratory at Karapad has facilities to supply 25,000 litres of fresh filtered sea water to rearing tanks per day. In the hatchery, facilities exist for aeration of water, temperature control and mass production of nanoplankters. The hatchery has facilities to produce 5-10 million seeds of bivalves per year. A 10 acre fish farm has been constructed for experimental culture of fishes, prawns and crabs. The Research Centre has two vessels, *Cadalmin IV* and *Chippi* which are utilised in underwater SCUBA investigations, sea ranching, hydrography and plankton studies, experimental fishing and tagging programmes. Also there are 3 jeeps to meet the requirements in field work.

#### **FUTURE PROGRAMMES**

The on-going programmes on capture fisheries will be continued with emphasis on the data collection and

analysis leading to stock assessment of major exploited resources. More emphasis will be given to vessel-oriented programmes. In culture studies, the accent will be on experimenting with different kinds of grow-out techniques for various cultivable species and developing lowcost technologies. Cost-benefit analysis will also be undertaken for the benefit of the fishing industry. It is envisaged to continuously improve and standardise the techniques for mass production of the seed in the hatchery system. Some of the critical areas where major research effort is required in this direction are broodstock management, determination of optimum food requirements of larvae/spat, effect of density on growth and production within the hatchery and water quality management. Already a beginning has been made in the studies on genetics of oysters and this programme will be given importance. The transfer of technology programmes will be continued.