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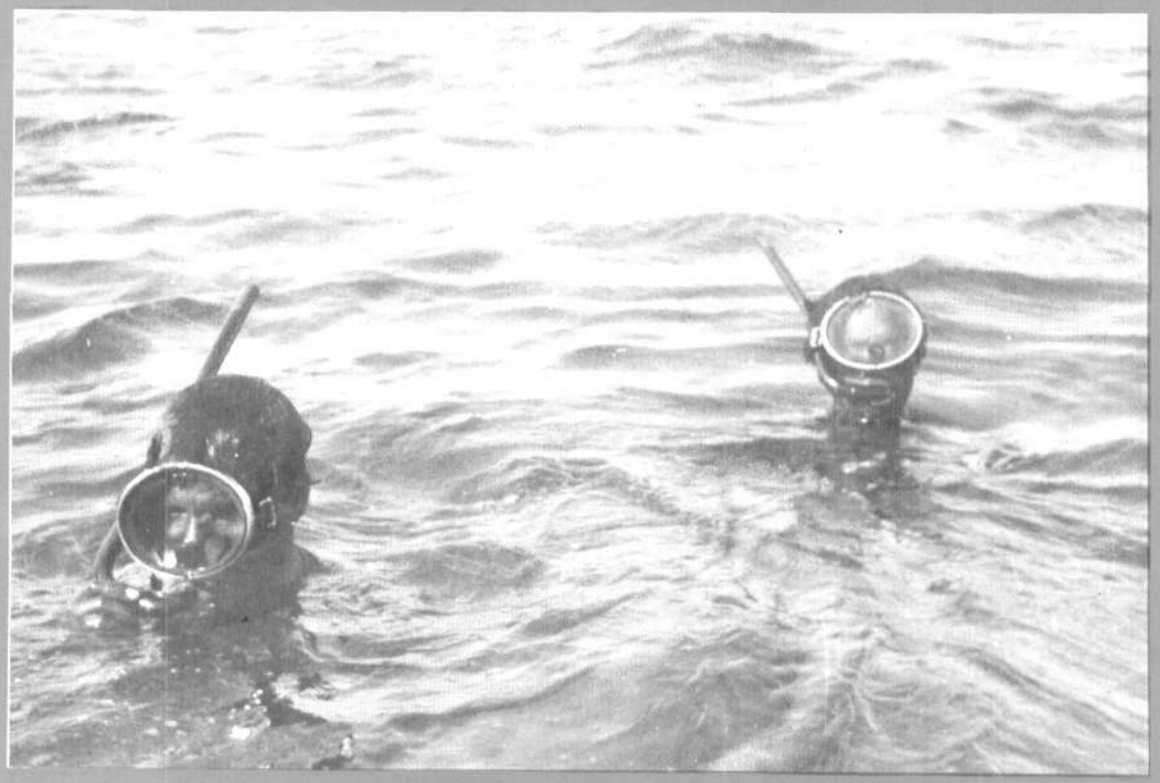

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समुद्री मात्स्यिकी सूचना सेवा : समुद्री मात्स्यिकी पर आधारित अनुसंधान परिणामों को आयोजकों, मत्स्य उद्योगों और मत्स्य पालकों के बीच प्रसार करना और तकनोलजी का प्रयोगशाला से श्रमशाला तक हस्तांतरित करना इस तकनीकी और विस्तार अंकावली का लक्ष्य है।

THE MARINE FISHERIES INFORMATION SERVICE : Technical and Extension Series envisages dissemination of information on marine fishery resources based on research results to the planners, industry and fish farmers and transfer of technology from laboratory to field.

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Back cover photo : *Valinokkam Jetty situated on the banks of Valinokkam bay, Ramanad Dt. Tamil Nadu (Ref. Article 1)*

पृष्ठ आवरण फोटो : वालिनोक्कम खाडी के किनारे में स्थित वालिनोक्कम जेट्टी (संदर्भ : लेख 1)

THE SURVEY OF VALINOKKAM BAY AND ADJOINING AREA TO ASSESS ITS SUITABILITY FOR INTEGRATED SEA FARMING — A REPORT*

Introduction

The Valinokkam Bay is situated in the Ramanathapuram District, Tamil Nadu. Even a cursory look at the bay, with its picturesque background and the calm, clear, unpolluted and sheltered waters with depth not exceeding 5 m, impresses one as a congenial site for sea farming activities. A small beginning was made in this direction by the Central Marine Fisheries Research Institute by mooring a pearl culture raft in the bay in 2 m depth on 11-6-'91 and since then a Research and Development Project on location testing and transfer of technology on pearl oyster farming and pearl culture to the local fishermen is being implemented.

A survey of the Valinokkam Bay and adjoining area was conducted on 8-1-1992 and 9-1-1992 to assess its suitability for developing the Integrated Sea Farming Project. A team of Scientists and Technical Staff drawn from both Mandapam and Tuticorin Research Centres participated in the survey. During this two day survey, data were collected on several parameters, relevant for initiating sea farming of several candidate species. The results of this survey are given in this report.

Topography and other features of the Valinokkam Bay and the adjoining area

The Valinokkam Bay is located along the east coast of India, Tamil Nadu in Ramanathapuram District. It is connected by road and is equidistant (about 95 km) from Mandapam and Tuticorin. The Valinokkam Bay and the adjoining area, east of the Bay surveyed, lie between Lat. 9°9' N and 9°12' N and Long. 78°30'E and 78°42'E (Fig. 1). In the east, the bay opens into the Gulf of Mannar by a wide mouth of about 3.8 km and it is bordered on the other three sides by land. The Bay has a waterspread of 5 sq km and the adjoining area 10 sq km. Thus the total area surveyed is 15 sq km. In the bay, proper the maximum depth is 4.5 m and in the adjoining area it is 7.5 m. In the northern sector there is a channel of 2-3 m depth, running parallel and very close (100 m) to the land. This channel is considered to be ideal for ship breaking and plans are afoot to develop this facility. The tides in the bay are semi-diurnal and the maximum amplitude during the spring tides is 0.9 m. The rainfall is scanty with 47 cm during 1991. Also there are no rivers or canals emptying into the bay to be of significance in diluting the bay waters. There is good exchange of bay waters with sea water since the widest part of the bay is at its mouth. At the same time, it is protected from strong wave action as the tidal amplitude is low and the bay is bordered on three sides by land. On the western side, the bay water is pumped by three 50 H.P. motors into a large 110 acre reservoir for salt maunfacture. Prawns and fin fish like *Chanos, Lates calcarifer* and other quality fishes trapped and grown in this reservoir fetch an annual lease rent of Rs. 1.2 lakhs to the Salt Corporation Department of Tamil Nadu. A plant to extract Magnesium (present capacity utilisation 400 t/year) from sea water is located on the western side of the bay close to salt works and a visit to this plant showed that no pollutants are released from the plant into the bay. There are no other industries in the vicinity of the bay.

Perusal of the available information indicates that the bay and the adjoining grounds in the sea are highly productive. During the season April-December, 431 t of fish were landed by trawls which included 23 t of *Penaeus semisulcatus*. Artisanal gears contribute to about 800 t. During June-September the sea weed *Sargassum* is collected in the bay and nearby islands which amounts to 500 t/season. Apart from Valinokkam, Eruvadi is a major fish landing centre (Fig 1).

The survey results

Apart from the results of the survey conducted on 8.1.1992 and 9.1.1992, the available data for July-December 1991 at the site

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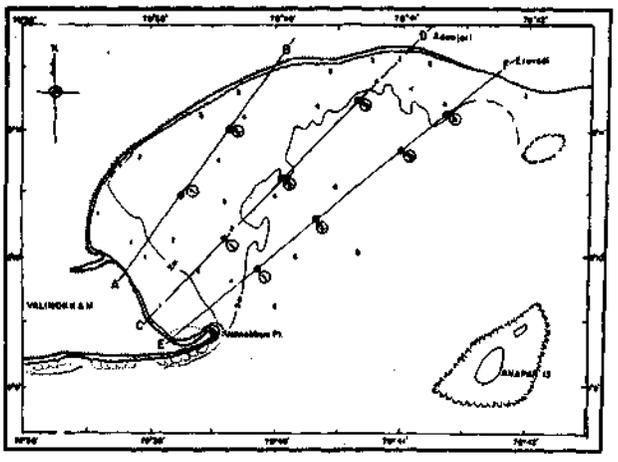


Fig. 1. Map showing the Valinokkam Bay and the adjoining area surveyed. The transects and the stations covered are shown. Small figures indicate the depth in metres.

where pearl culture raft was moored in the Valinokkam Bay are also included in this report.

Depth and transparency : The depth at different stations varied from 1.5 to 7.5 m and the water was clear in all the stations with visibility upto 7.5 m down (Table 1). Sedimentation was poor and turbidity ranged from 0.1 to 0.3 g/l.

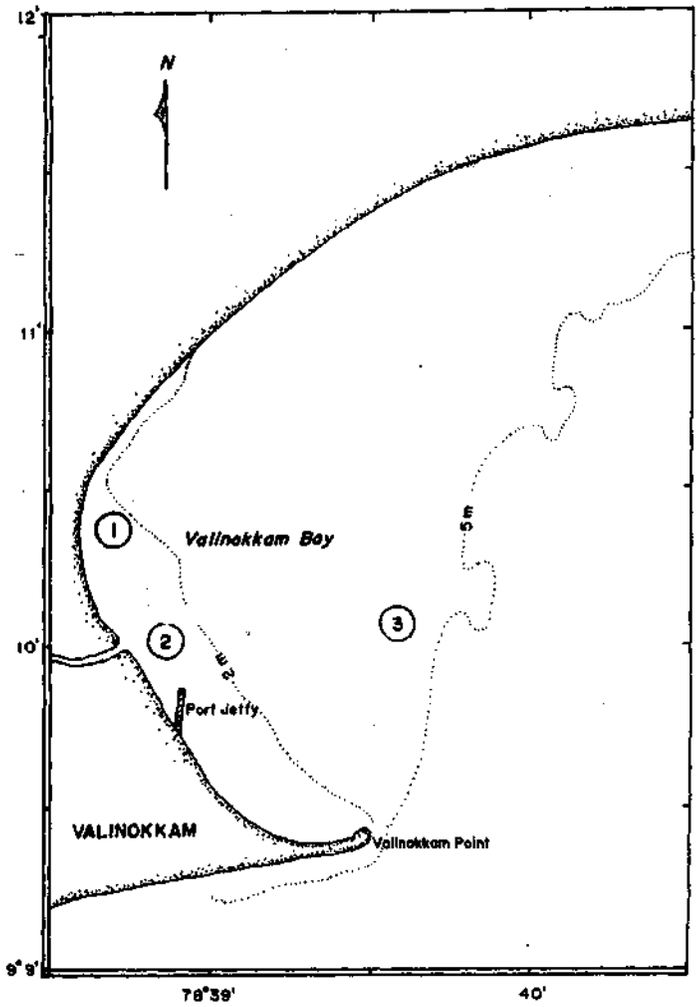
Temperature : The atmospheric temperature varied from 23.5 to 27.0°C; surface water temperature from 25.0 to 26.0°C and bottom water temperature from 25.0 to 25.8°C (Table 1). Near the pearl culture raft site (Fig. 2) water temperature varied from 25 to 28°C.

Salinity : The surface water salinity varied from 30.90 to 32.36 ppt and in the bottom water it ranged from 30.90 to 32.07 ppt (Table 1).

Near the pearl culture raft site, the salinity varied from 33.4 to 38.68 ppt. In November 1991, when the monsoon was at the peak, the salinity value recorded was 33.4 ppt. These data suggest that typical marine conditions prevail in the bay.

The values obtained for the environmental parameters such as dissolved oxygen, pH, inorganic phosphate, silicate, nitrite, nitrate, sediments, phytoplankton, zooplankton and meiofauna are presented in Tables 1-3. The data on seed resources and on the underwater observations are given in Tables 4 and 5.

The nutrients data indicate that the values are generally low and this may be due to the utilisation of the nutrients by the dense sea weed and seagrass populations located in the area surveyed (see below).



1. Site for Prawn Culture. 2. Site for Pearl Culture, Edible Oyster Culture, Clam Culture, Mussel Culture, Sea Cucumber Culture and Seaweed Culture. 3. Site for Cage Culture of Seabass

Fig. 2. Map showing the areas identified in the Valinokkam for taking up sea farming project involving various technologies.

Also in the values of the hydrographic parameters, at majority of the stations, there are not much differences between the surface and bottom waters. This suggests that there is good mixing of the waters.

Zooplankton : The volume of zooplankton varied from 5 to 20 ml (Table 3). It is high in the bay when compared to the values obtained in the adjoining open waters. Copepods were the most dominant component and formed 28.85% to 69.29% in various stations, followed by young ones of bivalves, gastropod young ones, appendicularians, prawn larvae, fish eggs and other decapod larvae.

Sediments : In transect AB, Station 1, the bottom was muddy and in all other stations it was firm, made of fine or coarse sand.

Seed resources : In the low laying areas, adjacent to the bay, seed of *Elops* sp. and *Gerres*

TABLE 1. *Hydrological data and other particulars of the Valinokkam Bay and adjoining area*

Date and time	Transect	Station	Water depth (m)	Water clarity	Nature of bottom	Atmospheric temp°C	Water temp°C Surface/ bottom	pH Surface/ bottom	Dissolved Oxygen ml/l Surface/ bottom	Salinity ‰ Surface/ bottom
8.1.92 10-10	AB	1	1.5	Clear upto bottom	Muddy	27.0	25.0 /25.0	8.4/8.4	4.86/4.92	31.48 /31.77
11-00	"	2	3.75	"	Fine sand	26.5	25.7/25.7	8.4/8.4	3.26/4.80	30.90 /30.90
14-20	CD	1	3.0	"	Coarse sand	25.4	25.5/25.3	8.4/8.4	5.19/5.28	31.77 /31.48
15-00	"	2	6.5	"	Fine sand	26.2	26.0/25.8	8.2/8.2	4.32/4.32	32.36 /31.48
15-35	"	3	6.0	"	"	25.6	26.0/25.8	8.4/8.4	4.21/4.44	31.19 /31.19
9.1.92 08-30	EF	1	6.0	"	"	23.8	25.1/25.1	8.4/8.4	4.52/4.46	31.48 /31.77
09-00	"	2	7.5	"	Coarse sand	23.5	25.3/25.1	8.4/8.4	4.46/4.39	32.07 /32.07
09-30	"	3	7.0	"	Fine sand	25.0	25.5/25.0	8.4/8.4	4.46/4.46	31.77 /32.07
09-50	"	4	6.0	"	Coarse sand	24.8	25.8/25.2	8.4/8.4	4.46/4.37	31.77 /31.48

TABLE 2. *Primary production, nutrients and meiofauna of the sediments of Valinokkam Bay and adjoining area*

Transect	Station	Primary production (mg/m³/day) Surface/bottom	Phosphate (µg. at/l) Sur./bott.	Silicate (µg. at/l) Sur./bott.	Nitrite (µg. at/l) Sur./bott.	Nitrate (µg. at/l) Sur./bott.	Meiofauna
AB	1	313.92 /142.32	0.30 /0.15	9.0 /7.0	0.06 / 0.06	1.25 /1.00	Nil
	2	108.23 /118.17	0.08 /0.08	6.5 /6.0	0.06 /0.06	0.88 /0.88	Polychaetes 2 nos.
CD	1	321.12 /364.96	0.15 /0.18	10.0 /6.0	0.06 /0.04	1.13 /1.00	"
"	2	341.33 /457.09	0.25 /0.05	7.0 /10.0	— /0.06	1.00 /1.00	"
"	3	94.18 /--	0.08 /0.05	8.0 / 8.0	0.11 /0.11	1.25 /1.50	Nil
EF	1	202.11 /107.53	0.05 /0.25	20.0 /5.0	0.15 /0.05	0.75 /0.88	Polychaetes 2 nos.
"	2	478.54 /204.12	0.05 /0.05	8.5 /9.5	0.06 /0.06	0.75 /0.75	"
"	3	114.92 /343.04	0.05 /0.05	16.0 /9.0	0.06 /0.06	1.00 /0.75	Nil
"	4	182.54 /195.28	0.23 /0.05	5.0 /6.0	0.06 /0.08	0.88 /1.25	Polychaetes 2 nos.

sp. were dominant accounting for 41.5 and 33% respectively (Table 4). Seed of white prawn *Penaeus indicus* formed 9% and seed of *Metapenaeus* sp. 4.3%.

Under water observations : The vegetation comprising algae and sea grasses occurred almost at all stations and often profuse growth was observed (Table 5). Totally 31 species of sea weeds (10 species of green algae, 9 species of brown algae and 12 species of red algae) and 6 species of sea grasses were found growing in the Valinokkam Bay and the adjoining area.

In transect AB, station 1, rich growth of sea grass *Cymodocea* was seen. The sea anemones, star fishes, ascidians, tubuculous worms and sea weeds were well represented in this Station. Empty edible oyster shells were strewn here and there. In station 2 empty shells of gastropods were seen. In the area between 1 and 2 stations two speciemens of the holothurian *Actinopyga miliaris* were collected. They measured 140 and 150 mm (wt 125 and 130 g). Both the specimens were immature. This species has commercial value. About 200 m north-east of station 2, the

TABLE 3. *Zooplankton (in percentage) collected at Valinokkam Bay and adjoining area*

Transects & Stations	Volume of plankton (ml)	Copepod	Prawn larvae	Other decapod larvae	Fish eggs	Appendicularia	Salps	Gastropod young	Bivalve young ones	Pteropod	Amphipod	Medusa	Stomatopod	Chaetognaths	Polychaete larvae	Clodoceran	Fish larvae
Tr AB																	
Stn. 1	10.0	50.00	9.62	7.7	11.5	4.9	1.9	3.8	11.54	1.9	-	-	-	-	-	-	-
Stn. 2	20.0	69.29	5.0	3.5	2.1	5.7	0.7	0.7	-	-	1.4	7.25	0.7	3.6	-	-	-
Tr. CD																	
Stn. 1	15.0	34.42	6.5	4.9	13.1	9.8	-	8.2	16.4	-	-	3.25	3.3	-	-	-	-
Stn. 2	15.0	36.11	9.7	6.9	19.4	4.2	-	-	13.9	-	-	8.34	-	-	1.3	-	-
Stn. 3	11.0	28.05	-	7.3	4.8	14.6	-	24.4	15.8	1.2	-	-	2.4	-	1.2	-	-
Tr. EF																	
Stn. 1	6.0	42.55	-	-	-	8.5	-	10.6	25.53	-	-	-	12.7	-	-	-	-
Stn. 2	7.0	35.00	5.2	-	-	3.5	-	22.8	2.0	3.5	-	7.0	1.7	-	-	-	-
Stn. 3	5.0	24.40	14.6	9.7	-	7.3	-	12.3	29.3	-	-	-	2.4	-	-	-	-
Stn.4	6.0	38.45	4.4	5.6	1.1	4.4	-	20.8	17.6	1.1	-	-	1.1	-	-	3.3	1.1

sea grass *Cymodocea* occurred abundantly over a wide area.

In the transect CD, station 1, the sea weed flora was predominantly composed of *Gracilaria edulis* and *Hypnea* sp. Starfishes occurred abundantly in this region. In station 2 there was no vegetation. One specimen of the sacred chank *Turbinella pyrum* and the clam *Meretrix casta* were collected along with empty shells of bivalve molluscs from this station. Station 3 was rich in sea weeds; rays were also found abundantly. A single holothurian *Holothuria spinifera* measuring 230 mm (wt 285 g) was collected. The specimen was immature. Another immature *H. spinifera* (length 252 mm, wt. 290 g) was collected in the region between stations 2 and 3.

In transect EF stations 1 and 2 there was no vegetation. Only empty gastropod shells were collected. Station 3 was rich in sea weeds, dominated by *Gracilaria* sp. and *Dictyota* sp. Also rays were found in abundance. In station 4 several species of sponges and corals were seen.

Observations on the clams of surf beaten open sea coast, south of Valinokkam Bay

The beach is sandy and shore seines are operated in this area. Analysis of the sediments showed good concentration of the wedge clam *Donax cuneatus*. Their density varied from 1 to 54/m². The length ranged from 22.0 to 39.5 (average 30 mm) and the clams were indeterminate stage.

Miscellaneous observations : The edible oyster *Crassostrea madrasensis* was found attached to the inlet pipes of the salt works in the western side of the bay. Ten live oysters measuring 44 to 88 mm were collected. The foulers *Balanus* sp. ascidians, hydrozoans and polychaetes were found attached to these oysters. At a couple of places dead oyster shells were found attached to the boulders and stones along the southern shore of the bay. In the same area gastropods *Patella* sp, *Nasa* sp. and *Nerita* sp. and the crab *Charybdis* sp. were found.

Prospects for sea farming

It is well known that aquaculture of any organism is location specific. The success of any aquaculture venture is largely dependant, apart from other factors, upon the favourable interaction of the candidate species with the environment.

In the selection of site for taking up sea farming projects the following five criteria are considered. (a) Topography (exposure, depth etc.), (b) Physical features (currents, tides, turbidity, sediments and water temperature), (c) Chemical features (dissolved oxygen, salinity PH, organic load, nutrient load and pollutants, (d) Biological features (primary and secondary production, fouling, boring, predators, competitors, parasites etc.) and (e) accessability (road, transport, fresh water availability etc.).

The two day survey was conducted keeping in mind the above five criteria. In such a brief survey the limitations are obvious, notable being the absence of quantitative data for some parameters and the absence of information on

TABLE 4. *Composition of the seed collected in the vicinity of the Valinokkam Bay*

Species	Nos.	%
Fishes		
Caranx sp.	3	0.6
Gerres sp.	172	33.0
Elops sp.	217	41.5
Sphyraena sp.	2	0.4
Scatophagus sp.	4	0.8
Letognathus sp.	2	0.4
Leptocephalus sp.	52	10.0
Elops		
Prawns		
Penaeus indicus	48	9.0
Metapenaeus sp.	22	4.3

seasonal variations of the parameters. Nevertheless, the supplementary information available at the pearl culture raft site since July 1991 and the physiography of the Valinokkam Bay permit us to assess the prospects for undertaking sea farming of several candidate species for which technologies have been developed by the Central Marine Fisheries Research Institute at its several centres during the last two decades.

1. *Pearl oyster farming and pearl culture* : This project in operation since July 1991 generated adequate data to show that the Valinokkam Bay offers more favourable environmental conditions than the Tuticorin Harbour Basin where the Institute is running a R & D project on pearl culture for several years. The positive aspects that emerged in the studies at Valinokkam Bay are (1) The pearl oyster *Pinctada fucata* whose natural habitat in the Gulf of Mannar is in the deep waters of 15-20 m can be successfully farmed in the shallow waters of 2 m depth, (2) The growth of the oyster is faster compared to its growth in the harbour basin, (3) silt load is low which is conducive for good growth, (4) The fouling intensity is low compared to the harbour basin which reduces competition for the food of pearl oyster and cuts down the labour costs involved in farm maintenance, (5) pearl sac formation and the production of cultured pearls is fairly good compared to the harbour basin. (This can be related to the appreciable mixing of the Valinokkam Bay water with the open sea water—a situation not prevalent at harbour basin due to the narrow opening of the Tuticorin Harbour in to the sea) and (6) with scanty rainfall and little land drain typical marine conditions prevail in the Valinokkam Bay even during the peak monsoon month. *P. fucata* thrives well in such environment. As the Valinokkam Bay offers favourable conditions, expansion of the current pearl culture project is suggested. To reduce production costs rack method may be tried.

The blacklip pearl oyster *P. margratifera* occurs in the Andamans and is famous for its black pearls. It prefers clear unpolluted waters. Although this species was successfully spawned and several thousand spat produced in the CMFRI hatchery at Tuticorin, attempts made to grow the spat in the Tuticorin Harbour Basin proved futile. It is worthwhile to grow this species in the Valinokkam Bay as the bay waters are clear and are apparently not polluted.

2. *Edible oyster culture* : The Indian backwater oyster, *Crassostrea madrasensis* is euryhaline and grows well in bays, back waters, creeks, etc. in relatively turbid waters. Ten oysters were collected from the western side of the bay during the survey. Under purely marine conditions with little silt in the water the growth of the species may be slow. On the other hand *Saccostrea cucculata* which thrives well under marine conditions may fare well, but as of now, has little commercial value. It is suggested that culture of *C. madrasensis* by ren method may be tried in the Valinokkam Bay to get basic information on growth, survival and production.

3. *Clam culture* : The blood clam, *Anadara granosa* lives well in areas of soft muddy bottom (silt and clay over 50%), high turbidity and moderate salinity (15-30 ppt). Valinokkam Bay does not appear to be suitable to culture this species. The venerid clams *Paphia malabarica, Meretrix meretrix* and *M. casta* prefer sandy substratum. These three species are also known to prefer brackishwater and growth in the Valinokkam Bay may be slow. It is suggested that experimental farming of the above three species may be taken up in the Valinokkam Bay by adopting the on bottom culture techniques.

The giant clams, *Tridacna* sp. are the inhabitants of marine ecosystem and occur in Andamans and the Lakshadweep. There is considerable work going on in the Pacific islands and elsewhere to develop hatchery technology and culture methods for these clams as their adductor muscle is highly priced. Giant clams are the only autotrophic farm animals known to

TABLE 5. *Occurrence of algae and sea grasses in the Valinokkam Bay*

Transect AB : Station No. 1

Algae :

Caulerpa lessonii f. *tuticorinensis*
Neomeris annulata
Chaetomorpha linoides
Padina tetrastromatica
Dictyota dichotoma
Rosenvingea intricata
Hypnea valentiae
Solieria robusta
Gracilaria verrucosa

Seagrasses :

Cymodocea serrulata
Syringodium isoetifolium
Halodule uninervis
Halophila ovalis
H. ovata

Sampling made between Station 1 & 2 in Transect AB

Depth : 3.0 m
Bottom : Fine sand
Waterclarity : Clear upto bottom

Algae :

Caulerpa lessonii f. *tuticorinensis*
Padina boergesenii
Solieria robusta
Hypnea valentiae
Gracilaria verrucosa

Seagrasses :

Cymodocea serrulata

Transect AB : Station No.2

Algae :

Caulerpa scalpelliformis
Hypnea valentiae
Gracilaria verrucosa

Seagrasses :

Halodule uninervis
Halophila ovalis
Syringodium isoetifolium

Sampling made after Station No.2 in Transect AB

Algae :

Sphacelaria tribuloides
Jania rubens

Seagrasses :

Cymodocea serrulata
Syringodium isoetifolium
Halodule uninervis

Transect CD : Station No.1

Algae :

Resenvingea intricata
Dictyota dichotoma
Gracilaria edulis (wellgrown plants)
G. verrucosa
Hypnea valentiae
Solieria robusta

Seagrasses :

Halodule uninervis
Halophila ovalis
Syringodium isoetifolium

Transect CD : Station No. 2

Vegetation : Nil

Transect CD : Station No.3

Algae :

Rhizoclonium kochianum
Colpomenia sinuosa
Hypnea valentiae
Champia parvula

Seagrasses :

Cymodocea serrulata
Halodule uninervis

Transect EF : Station No.1

Algae : Nil

Seagrasses :

Halodule uninervis

Transect EF : Station No.2

Vegetation : Nil

Transect EF : Station No.3

Algae :

Cladophora sp
Dictyota dichotoma
Hypnea valentiae
Gracilaria corticata var. *corticata*
G. Verrucosa
Solieria robusta
Laurencia obtusa

Seagrasses :

Halodule uninervis

Halophila ovalis

Transect EF : Station No.4

Algae :

Codium tomentosum

Halimeda macroloba

Padina tetrastromatica

Dictyota bartayresiana

Dictyopteris delicatula

Sargassum tenerrimum

Halymenia floresia

H. porphyroides

Solieria robusta

Champia parvula

Jania rubens

Seagrasses :

Cymodocea serrulata

C. rotundata

Halophila ovalis

Halodule uninervis

Syringodium isoetifolium

Sampling made between Transect EF : Station No.4 and shore (*Ervadi*)

Depth : 3.0 m

Bottom : Sand

Water clarity : Clear upto bottom

Algae :

Struvea delicatula

Hypnea valentiae

Jania rubens

Seagrasses :

Cymodocea serrulata

Syringodium isoetifolium

Nearshore area adjacent to port jetty

Depth : 0.5 to 1.5 m

Bottom : Sandy

Water clarity : Clear upto bottom

Algae :

Enteromorpha compressa

Sphacelaria tribuloides

Gracilaria verrucosa

Hypnea valentiae

Grateloupia lithophila

Centroceras clavulatum

Seagrasses :

Cymdocea serrulata

Syringodium isoetifolium

Algae growing on pearl culture raft

Cladophora colabens

Cladophora sp.

Sphacelaria tribuloides

Padina boergesenii

Colpomenia sinuosa

Gracilaria edulis (young plants developed from spores)

G. corticata var. *corticata*

G. corticata var *cylindrica*

G. follifera

G. arcuata

G. verrucosa

Hypnea musciformis

H. valentiae

Jania rubens

man as they make their own food with the help of the symbiotic zooxanthellae occurring in their mantle. In the long range perspective, the Valinokkam Bay seems to offer a favourable habitat for farming the giant clams along the Indian mainland coast.

4. *Sea cucumber culture* : During the survey, specimens of the sea cucumbers *Actinopyga miliaris* and *Holothuria spinifera* were collected. The former has commercial value while the latter was once rated high in the *Beche-de-mer* industry but now not much preferred. It is gathered that large quantitites of *A. miliaris* are collected from the Valinokkam Bay and adjoining areas for processing. Each specimen is sold at Rs. 3 to 4 depending upon size. The most important commercial species is *Holothuria scabra* and not a single specimen of this species was collected during the survey. It is suggested that farming of *H. scabra* may be attempted in the Valinokkam Bay by transplanting the juveniles, either from CMFRI hatchery or collected from the wild, into suitable pen enclosure or cages.

5. *Green mussel culture* : The culture of green mussel *Perna viridis* has considerable potential for sea farming and so far the experimental work conducted by the CMFRI and other organisations at Calicut, Karwar, Goa, Madras and Kakinada have adopted the raft method,

except for a few attempts by the CMFRI to grow the mussels in net bags or ropes suspended from racks in the shallow Muthukadu lagoon and Ennore near Madras. The mussel culture rafts could not be moored in the sea year round wherever it was tried due to rough weather conditions. Valinokkam bay is suitable to keep the rafts in position throughout the year as revealed by the pearl culture project and an attempt can be made to test the viability of mussel culture from raft. However, for the purpose of location testing of the technology, it is suggested that green mussel seed can be cultured in net bags suspended from racks as this method is cost effective. For this purpose seed will have to be brought from other areas like Cuddalore since the Valinokkam Bay is devoid of any green mussel population.

6. *Sea bass culture* : Owing to its fast growth, delicately flavoured flesh, high market value and export potential, sea bass *Lates calcarifer* is an important species cultured in Thailand, Singapore, Philippines etc.

Selection of site suitable for net cage culture of sea bass is demanding. The site should be sheltered so that the net cage is protected from strong winds and waves and can be maintained in position. A tidal amplitude of 0.5 to 1.0 m, good mixing of surface and bottom waters and a minimum of 5 m depth ensure good flow of water, through the floating net cage so that uneaten food, faecus, debris etc. at the bottom of the cage do not pose problems. The fouling of the net cage is caused by silt and fouling organisms, rendering the cage maintenance job difficult. In the selected site, silt load and the presence of foulers should be low. A salinity range of 28-33 ppt is considered as optimum for sea bass farming. The proximity of the farm site to the shore which in turn is well connected by road, facilitates proper management of the farm, easy transport of fingerlings and juveniles, fish feed, farm equipments and necessities of life. The above attributes and other requirements are mostly fulfilled in the Valinokkam Bay and it is suggested that net cage culture of sea bass can be taken up.

7. *Prawn culture* : Two species namely *Penaeus semisculcatus* and *P. indicus* are considered as suitable for sea farming in the bay. The occurrence of prawn seed in the low lying areas adjacenet to the bay suggests that the bay is suitable for prawn farming and the above two species are known to thrive well under marine conditions. The CMFRI has developed the hatchery technology for the production of *P. semisulcatus* seed at Mandapam camp and a programme on sea ranching of the hatchery produced seed of this species is in progress. It is suggested that pen/cage culture of *P. semisulcatus* may be taken up in the Valinokkam Bay.

8. *Sea weed culture* : The following factors observed during the survey are favourable for undertaking seaweed culture in the Valinokkam Bay.

a) Required depths (upto 4 m) are available.

b) Sea is calm without much wave action.

c) Bottom is sandy.

d) Good growth of sea weeds, and sea grasses already occurs in the major part of the bay.

e) Natural growth of *Gracilaria edulis* (fully grown plants) occurs in some areas in the bay and also young plants of *G. edulis* developed from spores were observed on the pearl culture raft.

f) Water is very clear with visibility upto 7.5 m depth. This will provide good light penetration upto the bottom, promoting the photosynthetic activity of the plants.

g) Sedimentation is low.

It is suggested that cultivation of *G. edulis* may be taken up in the Valinokkam Bay on coir ropes and nets using casuarina poles in shallow waters and sinkers (anchors of granite stones) in slightly deeper waters.

The areas selected as suitable for the cultivation of various candidate species are indicated in Fig. 2. It is suggested that during the first year a programme on a small scale with the objective of location testing of the sea farming technologies for various species may be implemented. Based on the results of the interaction of the species with the environment, scaling up of the operations of the selected technologies may be considered in the following years.

The team members are thankful to Capt. Sainath, Port Officer, Rameswaram and the Conservator of Valinokkam Port for the facilities given and the keen interest shown in the survey.

SEASONAL LANDINGS OF OIL SARDINE *SARDINELLA LONGICEPS* AT RAMESWARAM, PAMBAN AND MANDAPAM AREAS *

Unusual and unprecedented landings of oil sardine, *Sardinella longiceps* were noticed at Rameswaram and Pamban during January and February 1992. The resource was exploited by the pair trawlers and fish trawlers. The fishing operations started by 13th January. Initially 30-40 pairs were in operation per day. But once the fishermen found out that there was good demand for the fish and that the merchants and agents were regularly coming with ice and lorries all the way from Kerala for transporting and marketing, the number of pair trawlers increased. Consequently the fish trawling operations of 42-110 units in January got reduced to 25-75 units in February. The estimated catch of oil sardine at Rameswaram for January- February 1992 was 4,561 t. The pair trawlers contributed 4,244 t and fish trawlers 317 t. The C/E varied from 1.5 to 8 t. At Pamban the pair trawling during the period realised 741 t.

It may be stated that the pair trawling on an experimental scale was initiated in this area in 1980-81 under the BOBP to develop the small scale fisheries sector (Gopalakrishna Pillai & Sathiadas, 1982, *MFIS*, 29). Though, initially the response was poor, later it attracted the interest of the fishermen due to the quality and quantity of the fishes such as lesser sardines, silverbellies, pomfrets, etc. Now every year pair trawlers are operated, the season starting by last week of December and extending upto first week of April.

Craft and gear

The mechanised units 9.14-9.75 m OAL (45-70 HP diesal engines) conduct the operation. The normal trawling speed while fishing is 2.5 knots. But for fishing oil sardine the speed is kept at 3.5 knots. The design of the twin boat high speed bottom trawl is in the form of a conical bag consisting of a wing of 15.4 m, overhang 3 m, belly 23 m, throat 5 m and cod end 7.5 m with an overall head rope length of 33 m. There are slight variations in the specifications depending on the power of the engines of the boats. The cod end mesh size is 25 mm. The fish trawl has a wing of 15 m, belly 17 m, throat 3 m and cod end 8 m with an overall rope length of 22 m. The cod end mesh size is 25 - 30 mm. They are operated by single units at a speed of 2.5 - 3.0 knots per hour.

Area of operation

The area of operation is north and north east off Rameswaram, 15- 20 km from shore. The depth of the fishing ground varies from 12-16 m and the bottom is muddy. They start from shore by 0400 hrs and return by 1130 hrs onwards and continue upto 1900 hrs. One to two hauls are made. The earlier they reach the shore better were their returns, as towards late evening the price goes down.

Fishery

Pair trawl - day fishing : The fishing activity started by 13th January 1992. The catch of oil sardine in the pair trawlers at Rameswaram amounted to 1,635.8 t during January 1992 at a C/E of 2,084 kg and 2,618 t at a C/E of 1,192 kg in February 1992. Last year (1991) the oil sardine catch by pair trawlers during February-March '91 was 469 t at a C/E of 1,130 kg. (Table 1, Figures 1, 2, 3, 4). At Pamban the pair trawling realised 203 t and 538 t during January and February 1992 forming 89.3% and 74.8% respectively. Last year no catch was observed.

Fish trawl - day fishing : At Rameswaram 40-110 fish trawlers were in operation daily during January 1992. Their number decreased in February as most of them went for pair trawling. Oil sardine formed 271 t and 45.7 t contributing to 29.6% and 4.1% of the total fish catch of the gear during January and February 1992 respectively (Table 2).

Other fishes occurring in the pair trawlers were lesser sardines, *Dussumieria acuta*, *Tachysurus caelatus*, *Himantura bleekeri*, etc. In the fish trawls silverbellies and lesser sardines dominated. In addition occasional bumper catch of *T. caelatus*, *Alepes kalla* and *H. bleekeri* have been recorded.

* Prepared by R. Marichamy, A. A. Jayaprakash, N. Ramamoorthy and M. Bose, Mandapam Regional Centre of CMFRI, Mandapam Camp - 623 520.

TABLE 1. *Estimated catch (kg), effort and C/E (kg) of Oil sardine*

Day Fishing

	Rameswaram - Pair trawling					Pamban - Pair trawling				
	Units	Total fish	Oil sardine			Units	Total fish	Oil sardine		
	E	C (kg)	C (kg)	C/E	%	E	C (kg)	C (kg)	C/E	%
Jan. 1992	780	2,035,790	1,625,855	2084	79.9	98	227.930	203,430	2,075	89.3
Feb. 1992	2,196	3,895,002	2,618,090	1192	67.2	250	718,750	537,500	2,150	74.8
Total	2,976	5,930,792	4,243,945	1426	71.6	348	946,680	740,930	2,129	78.3
Feb.-Mar. 1991	415	727,120	469,050	1130	64.5	285	557,175	-	-	-

TABLE 2. *Catch (kg), effort (units) and C/E (kg) of Oil sardine by fish trawlers at Rameswaram*

Month	Units	Total fish	Oil sardine		
	E	C (kg)	C (kg)	C/E (kg)	%
Jan. 1992	1045	915,944	271,488	259.7	29.6
Feb. 1992	557	1,107,820	45,655	81.9	4.1
Total	1602	2,023,764	317,143	197.9	15.7

Shrimp trawl- night fishing : In the shrimp trawlers at Rameswaram oil sardine formed 147 t at a C/E of 5.8 kg during October to December 1991, contributing to 2.8% of the total fish catch. Last year for the period the catch amounted to 75.3 t at a C/E of 4.9 kg (Table 3). At Pamban the shrimp trawler catch of oil sardine for October-December 1991 was 22 t which was 10 t less compared to previous year.

Shore seines : The Shore seines are operated every year in the Gulf of Mannar side at Mandapam during October-November to March-April. 668 t of oil sardine was landed at a C/E of 3,358 kg for the period December 1990 to April 1991.

TABLE 3. *Estimated catch (kg), effort and C/E (kg) of Oil sardine*

Night fishing

	Rameswaram - Shrimp trawling					Pamban - Shrimp trawling				
	Units	Total fish	Oil sardine			Units	Total fish	Oil sardine		
	E	C (kg)	C (kg)	C/E (kg)	%	E	C (kg)	C (kg)	C/E (kg)	%
Oct. 1991	8,050	1,600,736	7,418	0.9	0.5	1,176	208,196	2,100	1.8	1.0
Nov. 1991	8,814	1,815,272	39,990	4.5	2.2	1,200	307,520	8,550	7.1	2.8
Dec. 1991	8,615	1,705,629	100,032	11.6	5.9	1,644	383,482	11,375	6.9	3.0
Total	25,479	5,121,637	147,440	5.8	2.8	4.020	899,198	22,025	5.5	2.4
Oct-Dec. 1990	15,179	3,255,192	75,276	4.9	2.3	3,915	-	32,349	8.3	-

TABLE 4. *Size composition of Oil sardine*

Rameswaram - Pair trawlers - Month	Day fishing Size group (mm)	Dominant modes (mm)
Jan. 1992	120 - 190	130, 145, 170,
Feb. 1992	130 - 185	145, 170
Pamban - Pair trawling		
Jan. 1992	120 - 189	170
Feb. 1992	120 - 193	130, 175
Rameswaram - Shrimp trawlers - Night fishing		
Oct. 1991	165 - 190	175
Nov. 1991	105 - 190	120, 170, 180
Dec. 1991	125 - 185	135, 175

Size composition

In the pair trawlers the size ranged from 123-194 mm with modes at 130, 145 and 170 mm, whereas in the shrimp trawlers the size ranged from 105 to 191 mm with modes at 120, 135 and 175 mm. The fishery in general was supported by 165-175 mm size groups.

Sex ratio and maturity

The oil sardines landed by the shrimp trawlers (night fishing) was almost in a spoiled

Fig. 1. A pair trawl unit with deckful of oil sardine.

Fig. 2. Transportation of the catch in cycle cart to the packing site.

condition. Examination showed that they were in spent condition during October to December. Females dominated. Females dominated during January and males during February. All specimens were in the resting stage.

Food and feeding

Studies during January and February revealed that the stomachs of all the specimens were empty. Most of them were lean with the head remaining more prominent than the body showing a starved appearance.

Fig. 3. Catch before packing with ice.

Catch disposal

In the early afternoon the catch in general fetches good price ranging from Rs. 8,000 to Rs. 6,000 per t. By late evening the price goes down to Rs. 3,000 to Rs. 2,000 per t. The catch is auctioned. They are accurately weighed in large baskets of 50-60 kg and transported by cycle cart to the nearby packing site. Daily 30-40 lorries and vans come from Kerala. They bring ice also with them as there may sometimes be shortage of ice. The catch is taken to markets is Kerala such as Quilon, Kottayam, Mavelikkara, Punaloor, Thevally, etc.

A detailed report on the monthly catch, seasonal pattern and biological characteristics covering all the gears in operation in this area and the migratory pattern correlating with the environment is under preparation.

FISHERY FOR THE MARINE CLAM, *SUNETTA SCRIPTA* AT VYPIN ISLAND COCHIN *

Sunetta scripta, the marine clam, locally known as "Kadal kakka" supports a well established commercial fishery in Vypin Island. The clam is pale yellow in colour with dark brown arrow shaped markings. The shell is smooth, glossy and thick and forms the raw material for the flourishing lime based industries. Meat is consumed by a small section of the local community. Recently the fresh meat of the clam is gaining importance as feed for broodstock in the prawn hatcheries.

Extensive beds of this clam occur in the subtidal region off Fort Cochin on either side of

* Prepared by V. Kripa and Mathew Joseph, Central Marine Fisheries Research Institute, Cochin - 682 031.

the Cochin bar mouth. In the Azhikode bar mouth this clam occurs with *Meretrix casta* and *Paphia malabarica.*

The Marine clam fishery at Murukkumpadam

Fishing method : At Murukkumpadam in Vypin Island about fifty four fishermen are engaged in regular fishing of this clam. Fishing is done during low tide for the first eight days after the new moon or full moon phase. Dugout canoe of 2.25 t capacity is used by the fishermen. A 3 to 3.5 m long wooden crowbar called "thoomba" attached with nylon net bag on a spike rod is dragged on the clam beds at a depth of 2.5 to 3 m. The clams collected in the net are emptied into the canoe. In each canoe about 400-500 kg of clam shells are collected every day. The shells are brought to Murukkumpadam and sold to "Clam Fishermen Industrial Co-operative Society".

Annual Production : During the period from 1986 to 1990 a total of 14,207.4 t of the clam shell was landed at Murukkumpadam. The fishery showed a declining trend during this five year period. In 1986 the annual landing was 3691.4 t which declined gradually in the succeeding years and in 1990 only 2,133.81 t of clam was landed showing a reduction of 43% in the annual landings (Fig. 1). On the other hand the number of fishermen engaged in clam fishing increased from an average of 35 in 1986 and 1987, to 43

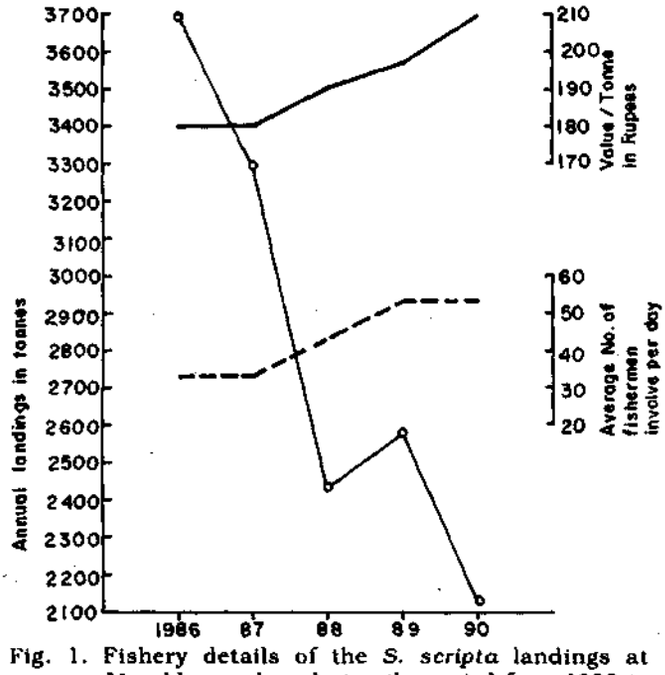


Fig. 1. Fishery details of the *S. scripta* landings at Murukkumpadam during the period from 1986 to 1990.

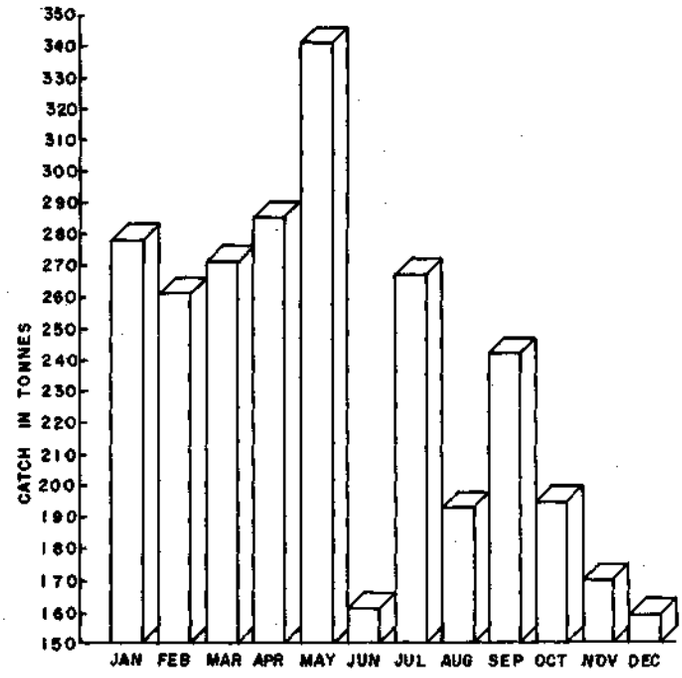


Fig. 2. Monthly average landings of *S. scripta* at Murukkumpadam during the period from 1986-1990.

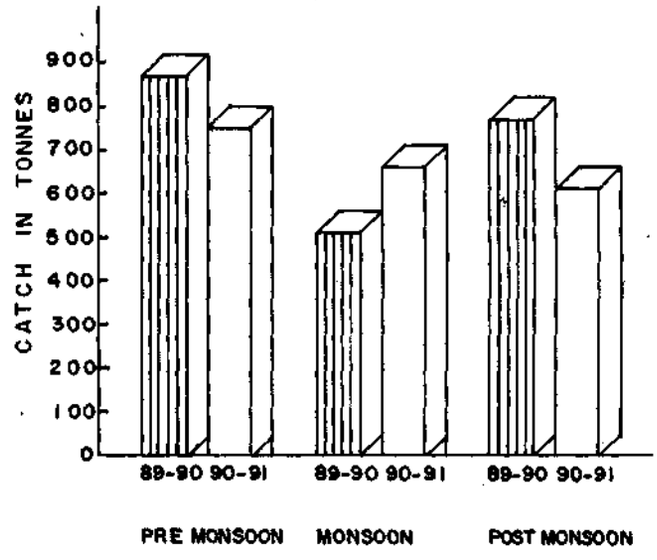


Fig. 3. Seasonwise landings of *S. scripta* at Murukkumpadam.

in 1988 and 54 in 1989 and 1990. Simultaneously the average value per tonne has increased from Rs. 180/- in 1986 to Rs. 209 in 1990. Clam fishermen attribute the cause for the decline in fishery to the non-availability of shells excavated from the channel area. Previously the mud dredged from the channel area was emptied into the inshore waters. This gave the fishermen

access to the population of *S. scripta* from deeper areas. Recently the earth dredged to deepen the channel is emptied about 10-12 km off Fort Cochin, which is inaccessible for the clam fishers.

Monthly and seasonal variation : *S. Scripta* is harvested throughtout the year but fluctuations are observed in monthly landing. During the period from 1986 to 1990, maximum monthly average of 341.2 t was observed in May followed by 284.9 t in April (Fig. 2). The minimum monthly average clam landing was 159.1 t in December followed by 160.9 t in June.

The clam fishery also showed seasonal variation. Maximum landings of 869.4 t and 753.6 t representing 40.4% and 37.7% of the annual landings of the period 1989-'90 and 1990-91 was during the premonsoon period (February-May). In 1989-'90 the minimum landing, 509.6 t was in monsoon whereas in 1990-'91 the minimum landing amounting to 612.6 t was during the postmonsoon period. Clams of size 8 to 46 mm contributed to the fishery. Apart from *S. scripta*, shells of *Meretrix* sp. were also observed in the landing.

Disposal and utilisation : The clams fished from the subtidal area off Fort Cochin are landed at Murukkumpadam. The Clam Fishermen Industrial Co-operative Society buys the clam from the fishermen and sells it to lime manufacturing companies. The profit is utilized for the welfare activities of the society. The society was established in 1976 and is under the administration of the Khadi Board. There are about 112 members in the society but only 54 fishermen are actively engaged in clam fishing. Previously financial aid was given to the fishermen to purchase canoe, anchor and the fishing gear. Most of the members have repaid the loan and now own the fishing craft and the gear without any liability. The society also helps the clam fishermen by way of providing festival allowances, welfare fund, educational fund, insurance etc. The Society disposes the shell after burning, to lime manufacturers, fertilizer companies, poultry feed manufacturers and other small scale inudstries. Small quantity of the meat is presently used in prawn hatcheries as feed for prawn broodstock. Apart from this the clam meat is not utilized for gastronomic purpose.

The marine clam fishery at Munambam

Munambam situated in the northern end of Vypin Island supports a good fishery for *Sunetta scripta*. Clam beds occur in the subtidal area upto 1.5 m depth in a 2 km stretch of coastal area. Men, women and children in the coastal area handpick the clams during low tide. A hand scoopnet is also used at times to harvest the clams. Fishing is done for five to six hours. The shells are accumulated on the beach itself and sold to lime manufacturers at the rate of Rs. 4 per 15 kg. The meat is consumed by local fishermen.

Mixed populations of the *S. scripta* with *Metrix* sp. and *P. malabarica* occur in the Azhikode bar mouth. This is harvested by a hand dredge from a canoe during low tide by fishermen. One or two fishermen drag the net along the clam bed and collect the shells. The peak fishing season is during January-May i.e. the premonsoon period. During monsoon the fishing is at low key, sometimes coming to a standstill.

In the absence of a clam fishermen cooperative society the catch is disposed off by the fishermen themselves or through agents. However, there is no regular practice of separating the meat and selling it in the local market.

Recommendations

The present study has brought to light that considerable quantity of clam shells is fished every year. However, the meat of the clam, when present is sparingly utilised. The demand for the meat is low as it is not conventionally eaten. Moreover, in Vypin Island, the numerous prawn peeling sheds provide job opportunities for fisherwomen which bring them better returns than selling clam meat. Based on the present study the following suggestions are made to develop the fishery.

Extension work should be carried out to create awareness among the people about the nutritive value and palatability of the clam meat. Concurrently, steps must be taken to utilise the clam meat as supplementary feed in prawn culture farms. Effort may be made to explore the possibility of export of *Sunetta* meat. More clam fishermen welfare societies shoud be started in the northern end of the Island which will provide financial assistance to the fishermen and assist in the disposal of their catch.

We acknowledge the co-operation given by Shri. K.G. Lakshmanan, Secretary of Clam Fishermen Welfare Co-operative Society for providing the fishery information.

INTRODUCTION OF FIBRE GLASS 'TEPPA' AS A POSSIBLE SUBSTITUTE FOR CATAMARAN FOR FISHING IN THE INSHORE WATERS OF ANDHRA PRADESH

One of the most primitative crafts used for fishing in the inshore waters in India is 'Catamaran' (locally called as *Teppa* in Orissa and Andhra Pradesh, *Kattumaram* in Tamil Nadu). This craft, as is well known, is made of 2-3 light weight wooden logs tied together and is generally operated manually by one person for fishing in the near shore waters using cast net, gill net, and occasionally hooks and line. Catamarans are mainly used by poor artisanal fishermen because its cost ranges from Rs. 5,000 to Rs. 20,000 depending upon the timber used. They generally last for about 10 years, after which the logs have to be abandoned. This is a serious constraint for the poor artisanal fishermen. Further, another problem is to untie the logs for landing and to tie them together every time before going for fishing. Over the years owing to the greater demand for fish, slight modifications have been made in the construction of the 'Catamaran' to enable fishing in grounds 10 to 15 km away from the shore. The modifications in the construction were mainly effected to give the craft the shape of a boat, so that it can be operated using a sail to reach far off areas and also to safely keep catches in meshed bags tied to the edges. Further 4-5 persons can go for fishing in this craft. These modified catamarans have been fishing using drift nets also.

To get over the difficulties encountered with the catamarans, recently Teppa made of fibreglass having facility to use outboard motor has been introduced first in Orissa and then in northern Andhra Pradesh (Fig. 1 & 2).

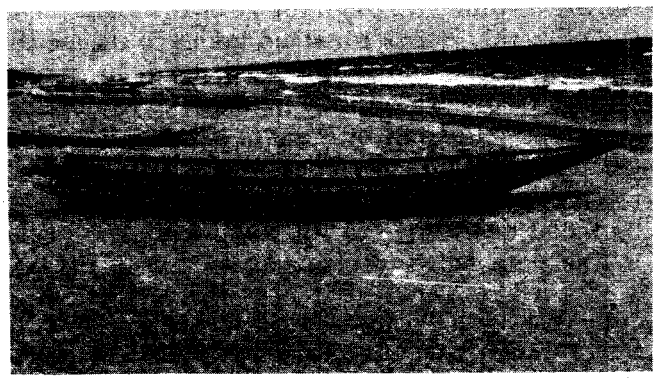


Fig. 1. Lateral view of the 'Teppa'.

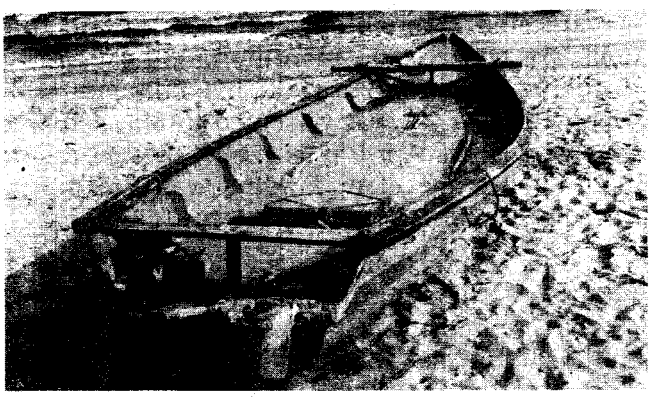


Fig. 2. Inside view of the 'Teppa'.

Its specifications in cm are given below.

Length	850
Width in the middle	185
Width at the engine fitting place	80
Width in the front of the catamaran	30
Depth of fish hold	90
Horse power	6.5
Fuel	Diesel oil

This craft is made of coloured fibre glass shaped like a boat with facility for fitting outboard motor as a single unit. In the centre, there is a big fish hold with a tight lid to keep the fish catch. There are holes on the edges of the craft to drain out water whenever water enters. Maintenance charges are almost nil except expenditure for fuel. It is light in weight and would not soak in water. When wind is favourable, the fishermen use the sail and oar, otherwise they go with the help of engine power.. Fishermen can stay in the sea for more hours. The craft is presently made in Puri (Orissa) by a private small scale Industry and costs about Rs. 30,000/- to Rs. 45,000/- depending upon the length of the craft.

This fibreglass craft is stronger and fishermen can exploit resource better by reaching the fishing ground early and making more number of trips whenever shoaling fishes are present.

Monitoring of the operation of these crafts is being continued to understand the efficiency of this gear over the wooden catamaran.

* Prepared by : P. Venkata Ramana, N. Burayya and K. Dhana Raju, Kakinada Research Centre of CMFRI, Kakinada - 533 004.

ON THE SUCCESSFUL CULTURE OF *GRACILARIA EDULIS* FROM SPORES *

Gracilaria is a commercially valauble agarophyte and its many species are distributed throughout the temperate and tropical seas. With the increasing demand of agarophytes by the industries and the declining trend of wild resources of these seaweeds due to over exploitation, suitable culture method is entailed for increasing their production. Two important culture methods are fragment culture and spore culture. The fragment culture has been tried on an experimental scale in India with economically important seaweed such as *Gelidiella acerosa, Gracilaria edulis, Hypnea musciformis, Acanthophora spicifera* and *Ulva lactusa*. In *Gracilaria edulis*, the fragment culture has been carried out in seawater aquarium, inshore water of Gulf of Mannar, open shore environment, sandy lagoon and Lakshadweep Island by long line rope, nylon rope, coral stones and nets of coir rope.

The life cycle of *Gracilaria* consists of an alternation of isomorphic phase with unisexual gametophytes. The spermatia are produced in the shallow depression of the male plant. Cystocarps are usually prominent hemispherical structure projecting from the thallus surface. Large number of carpospores are embedded in the globular cystocarps. The spores of *Gracilaria edulis* from the cystocarpic and tetrasporic plants were liberated on the nylon raphae and transplanted to the sea within two days of their output under the Bay of Bengal Programme during 1988-'89 at Vedalai and Chinnapalam of Ramanathpuram district. The work was carried out on a large scale but it was a total failure as the spores could not be grown to germling stage (*Bay of Bengal News, No.* 45, March 1992). The reasons attributed for the failure of the crops were predation by rabbit fish, difference between native habitats and the target species, the firm site, unpredictable change of life cycle and lack of access to alternate sites.

CMFRI have taken up the culture of *Gracilaria edulis* from spores on an experimental scale since 1988 liberating the spores on different substrata like coir rope, circular cement blocks, nylon ropes, coral stones and nylon raphae. Series of experiments were conducted to come out with a suitable technology for large scale cultivation.

Culture of *G.edulis* from spores sans nursery rearing

The experiment was started from November 1988 and continued till April 1989, liberating the spores (both carpospores and tetraspores) on cement blocks in plastic trough of 50 l capacity containing unsterilized seawater with moderate aeration. The substrata with the spores were transferred to natural environment at Gulf of Mannar near CMFRI jetty after 4 days of their output. No regular observations were made on the growth of the spores. After 40 days of transplantation young germlings of 2-8 mm size appeared on the cement blocks, which grew to 5020 mm in February. The germlings were again transferred to Palk Bay side, when Gulf of Mannar became turbulant. In April, the plants reached to harvestable size (Maximum length 16 cm; mean length 7.8 cm) after 4 months. The other alga found attached to the substrata were *Ulva lactuca, Enteromorpha intestinalis, Cladophora* spp., *Padina boergesinii* and *Hybnea valentiae*. In this experiment although a large number of spores were transplanted to the sea, only few of them grew to young plants. It was felt necessary to provide the spores with nursery rearing to germling stage before transplanting (Jayasankar *et al.*, 1991,*Seaweed Res. Util.*, 14(1): 21-23).

Nursery rearing of spores to germlings under running seawater

From October 1989, experiments were carried out liberating the spores on cement blocks, coir ropes and coral stones in 1 ton capacity tank containing filtered and stagnant seawater. The spores got attached to the substrata within 16-24 hours of their output, when the reporductive plants were removed. Air and water supply were provided after one day. Regular observation on the growth of the spores settled on glass slides were taken by measuring their diameter using ocular micrometer. Trans-

* Reported by Reeta Jayasankar, Regional Centre of CMFRI, Mandapam Camp, Tamil Nadu - 623 520.

plantation of the substrata to the natural enviornment was done at different days of spore output at every 5 days intervals. One set was kept for nursery rearing. It was observed that the plant grew to 3 - 7 cm length when the spores were transplanted to natural environment from 13 - 18 days of their output. Microscopic observation showed an erect frond developed from the parenchymatous disc of the dividing spores within 15 - 17 days of their output when the size of the circular parenchymatous disc grewe to 557/m in diameter (Figs 1 & 2). Measurement of the germlings were taken by vernier calipers. The germlings grew to 1.40 - 3.80 mm after 47 days of spore output in the nursery tank. On completion of 165 days, the germlings grew to a maximum length of 34 mm which is apparently a slow growth (Jayasankar, *CMFRI Newsletter*, No. 49, 1990). This necessitates transplantation of the germlings to natural environment after nursery rearing of 13 - 18 days.

Nursery rearing of spores in controlled room environment and transplant of germlings to sea for further growth

The spores were liberated from the matured female plants of *G.edulis* on cement blocks, coir ropes, nylon ropes and glass slides in 50 l capacity plastic trough containing sterilized seawater. After 24 hours of spore liberation, they were transferred to the culture room and kept at a temperature range of 23 - 25°C , light intensity of 1000 lux and photoperiod of 16:8 h light and dark cycle. Microscopic observation on the growth of the spores was taken under Olympus monocular microscope. It was observed that the growth of the dividing spores in enriched medium

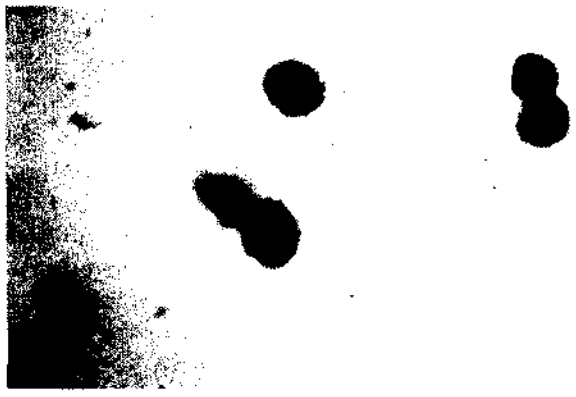


Fig. 1. Growing spores of *G. edulis* on glass slides (10 x 10 magnification)

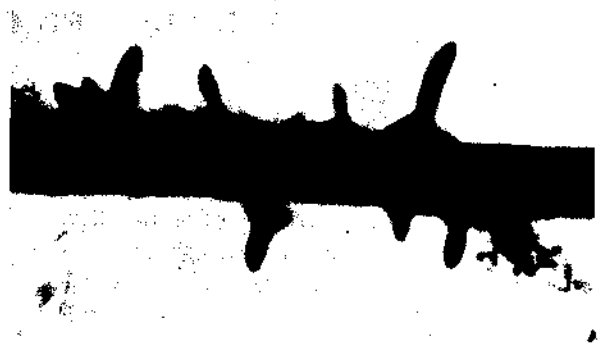


Fig. 2. Growing spores of *G. edulis* on coir ropes (10 x 40 magnification)

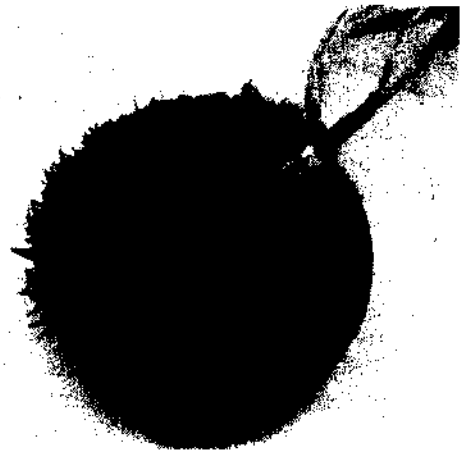


Fig. 3. Young germlings of *G. edulis* on cement blocks.

Fig. 4. Fully grown plant of *G. edulis* on cement blocks (Arrow showing epiphyte of *Ulva reticulata*).

(Conway and Walne's medium) was double to that growth in sterilized seawater and running seawater. The substrata with spores attached to them were transplanted to natural environment after 15 - 17 days of spore output when the erect frond developed. The transplantation was done in the Gulf of Mannar near CMFRI jetty during November 1991. Observations on water quality such as salinity, dissolved oxygen, pH, nitrite, nitrate, phosphate and silicate were made at weekly intervals. After one month of transplantation, young germlings of 3 - 7 mm size appeared during December which reached to harvestable size (maximum length 8.1 cm) after 4 months of spore output. In each substratum, there was luxuriant growth of the seaweeds which were healthy too, thus showing better growth and survival when reared in enriched medium for 17 days in culture room with a weekly change of medium (Figs. 3 & 4). Observations made on the growth of spores reared in enriched medium in outdoor environment, showed good growth but the pigment content were less compared to those reared in controlled room environment.

Further work is being persued in these lines in Palk Bay, Krusadai Island, Gulf of Mannar near Pamban bridge and Thonithurai to find out a suitable culture sites during different seasons. The hitherto experience on the spore culture method of *Gracilaria edulis* apparently suggests the need to rear its spores to germling stage in enriched medium before transplantation. Rearing of germlings in 0.1 - 0. 5% enriched medium can increase the size of the parenchymatous disc of the dividing spores, thereby allowing the spores to attach firmly to the substrata. Smooth substrata such as glass slides and nylon raphae are not suitable as there is every chance of germlings getting disloged from the substrata in wave action. Hard substrata such as coir ropes, coral stones and cement blocks are ideal for spore attachment.

ON A PORPOISE (*NEOPHOCAENA PHOCAENOIDES*) STRANDED ALONG PALK BAY COAST, NEAR THONDI, TAMIL NADU *

On 21-1-1992, a male porpoise *Neophocaena phocaenoides* locally called, 'Minikutty' was found washed ashore afresh at Mullimnnai, a landing centre near Thondi along the Palk Bay coast north of Ramanathapuram District. On examination, it was found that there was no trace of any wounds on the body. Local fishermen told that another 'Minikutty' was seen on that beach a week back. There was information about yet another mammal of this species found stranded in the same week at M.V. Patinam (Soliakudi) a fish landing centre which is about 5 km from this observation centre. Altogether there was stranding of 3 mammals of the same species in a week's duration and that too along the 5 km stretch of beach.

The following were the measurements (in cm) of *N. phocaenoides* :

Tip of upper jaw to deepest part of caudal fluke notch		12
Tip of upper jaw to anus		100
Tip of upper jaw to centre of umbilicus		83
Tip of upper jaw to centre of blow hole		15
Tip of upper jaw to centre of eye		12
Projection of lower jaw beyond upper		7
Length of eye		2
Lenght of blow hole		1.2
Flipper length-tip to anterior insertion (right)		25
Girth at eye		28
Teeth counts -	Right upper	17
	Right lower	15
	Left upper	12
	Left lower	12

* Reported by A. Ganapathy, Mandapam Regional Centre of CMFRI, Mandapam Camp - 623 520.

ON THE LARGEST GREASY GROUPER *EPINEPHELUS TAUVINA* FORSSKAL LANDED AT VISAKHAPATNAM *

A large sized greasy grouper *Epinephelus tauvina* Forsskal, locally called 'Nallabontoo' measuring 236 cm in total length and weighing 300 kg was landed by a trawler of 13.1 m length, on 20th March, 1991 at Visakhapatnam from a depth of 60 m. Talwar & Kacker (*Commercial Sea Fishes of India*, 1984) reported that this species attains a maximum length of at least 220 cm, and 220 kg in weight. According to Fischer & Whitehead (*FAO species Identification Sheets, Eastern Indian Ocean, Area 57, Vol.* 4, 1974) it attains a maximum length of 150 cm. The present specimen seems to be the largest recorded so far.

The morphometric measurements (in cm) of the species are given below.

Total length	236
Standard length	201
Head length	66
Diameter of eye	4.6
Length of spiny dorsal fin base	107
Length of pectoral fin	36.4
Base of pectoral fin	31.3
Base of anal fin	33.5
Base of pelvic fin	7.3
Length of caudal fin	35.2
Maximum width of caudal fin	61.5
Maximum depth of body at dorsal fin	69
Maximum width of body	61

*Reported by C.V. Seshagiri Rao and J.B. Varma, Visakhapatnam Research Centre of CMFRI, Visakhapatnam - 530 003.

ON THE STRANDING OF SEI WHALE, *BALAENOPTERA BOREALIS* LESSON AT MANDAPAM ALONG THE PALK BAY COAST *

The frequency of stranding of whales in the east coast is more as may be seen from the published information. It appears that the Sei whale, *Balaenoptera borealis* frequents the coastal waters more often and gets stranded on many occasions. This is the eighth record of the stranding of Sei whale from the Indian waters. (Table 2).

On 20th January, 1992, the fishermen at Theedai near the marine fish farm of Central Marine Fisheries Research Institute, Mandapam Camp noticed a live whale struggling hard to move towards the coastal waters in the Palk Bay region. In that process, the whale was washed ashore and remained close to the shore in live condition and died in the early morning hours on 23rd January, 1992. The stranded whale was identified as Sei whale, *Balaenoptera borealis* Lesson (Fig. 1). The whale was an adult female, measuring 14.0 m in total length and weighing about 10 tonnes.

The Sei whale, *Balaenoptera borealis* Lesson is widely distributed in all the oceans of the world. It is most abundantly found in Norwegian and South African regions. Though, the whales are equipped with sonar, at times, they get stranded due to some error in navigation while pursuing their prey in shallow areas. In few instances, the whales have been found struggling in shallow waters to get back into the sea. Though they are stranded in all the months of year, most of the strandings take place during December and January which shows the effect of northeast monsoon, when the sea is rough. On the east coast, it was stranded on seven occasions while on the west coast only once at Sikka (Gulf of Kutch). The morphometric measurements are given in Table. 1.

The staff of the Tamil Nadu Fisheries Department made arrangements to extract oil from the carcass before burial near the shore. The authorities of the Gulf of Mannar Marine National Park made arrangements to bury the whale and exhume the skeleton for their reference Musuem.

*Reported by : P. Nammalwar, R. Marichamy, A. Raju, A.A. Jayaprakash, C. Kasinathan, N. Ramamoorthy and V. Sethuraman, Mandapam Regional Centre of CMFRI, Mandapam Camp - 623 520.

TABLE 1. *Morphometric characters of the stranded whale*

Morphometric characters	Measurements (cm)
Total length (tip of upper jaw to the tip of caudal fin)	1400
Tip of upper jaw to the notch of caudal fluke	1240
Tip of upper jaw to caudal peduncle	1200
Tip of upper jaw to origin of dorsal fin	950
Tip of upper jaw to anterior insertion of flippers	360
Flipper length	180
Breadth of flipper at base	45
Number of throat grooves	50
Tip of upper jaw to the origin of eye	240
Diameter of eye	20
Length of lower jaw	280
Length of upper jaw	300
Tip of upper jaw to origin of blow-hole	200
Breadth of blow-hole	25
Tip of upper jaw to origin of genital slit	910
Sex	♀
Approximate weight (in tonnes)	10

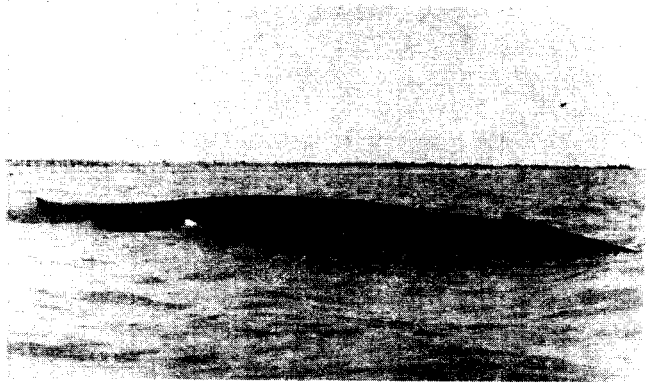


Fig. 1. The Sei Whale *Balaenoptera borealis* Lesson stranded at Mandapam along the Palk Bay Coast.

TABLE 2. *Stranding of Sei whale,* Balaenoptera borealis *along the Indian coasts*

S. No.	Date of stranding	Place	Total length (m)	Sex	Reference
1.	23.12.1971	Manakad near Mandapam Camp	15.53	-	G. Venkataraman *et* al.. (1973). *Indian J. Fish.*, **20** (2) : 634-638.
2.	31.01.1981	Mallipatnam	9.90	-	P. S. B. R. James & R. Soundararajan, (1980). *J. mar. biol. Ass. India*, **22** (1 & 2) : 175.
3.	18.03.1983	Dhanushkodi	13.80	-	P. S. B. R. James & Lal Mohan (1987). *Mar. Fish. Infor. Serv., T & E Ser.*, No. 71 : 1-16.
4.	26.02.1988	Tuticorin	12.00	Male	K. Venkataramanujam *et al.*, (1988). *Inv. Cetacea*, **21** : 247-249.
5.	18.05.1988	Kayalpatnam	10.02	Female	H. Mohamed Kasim & T. S. Balasubramanian (1989). *Mar. Fish. Infor. Serv., T & E Ser.*, No. 95 : 12-14.
6.	May, 1988	Tuticorin	7.50	-	Anon. (1988). *CMFRI News Letter*, No. 40 : 5.
7.	14.08.1988	Sikka (Off Gulf of Kutch)	9.76	Female	Anon. (1988). *CMFRI News Letter*, No. 41 : 6.
8.	21.01.1992	Theedai near Mandapam Camp	14.00	Female	Present report

UNUSUALLY HEAVY LANDINGS OF COWNOSE RAY, *RHINOPTERA JAVANICA* ALONG THE PALK BAY COAST, NEAR THONDI*

James (*J. mar. biol. Ass.India*, **4** (2):217-223,1962 and **12** (1&2):151-157, 1970) has reported heavy landings of *Rhinoptera javanica* from the Gulf of Mannar which was caught by 'Thirukkuvalai', a bottom set gill net. He also indicated about their absence in the Palk Bay coast. In the present report, observations made on the large-scale landings of *R. Javanica* by mechanised trawlers along the Palk Bay coast are presented. The net operated in the present case was trawl net with the mesh ranging from 15 to 20 mm. On 26.12.1991, an estimated 10 tonnes of *R. Javanica* were landed at M. V. Patinam (Soliakudi) landing centre near Thondi. The size of the rays ranged from 350 to 880 mm. The whole catch was sold at the rate of Rs. 4.50 per kg. The local fishermen informed that about 5 tonnes and 0.5 tonnes of the same species were landed respectively on 2.1.1992 and 7.1.1992. In all the cases the boats were operated in the S.E. direction at a depth ranging from 13 to 14 m.

* Reported by A. Ganapathy, Mandapam Regional Centre of CMFRI, Mandapam Camp - 623 520.

वालिनोक्कम खाडी और इसके समीपस्थ प्रदेशों में समग्र समुद्र रैंचन केलिए सर्वेक्षण*

भूमिका:- वालिनोक्कम खाडी तमिलनाडु के रामनाथपुरम जिला में है। खाडी का स्वरूप और पानी की गहराई समुद्र रैंचन कार्य के लिए अनुकूल लगता है। इसको ध्यान में रखते हुए सी एम एफ आर आइ ने मुक्ता शुक्ति खेती और मुक्ता संवर्धन पर 11.6.91 को एक लघु संरंभ शुरू किया। डॉ. पी. एस. बी. आर. जेम्स, निदेशक ने तारीख 24.8.1991 को यहाँ सन्दर्शन किया और परियोजना से संबंधित अधिकारियों से चर्चा की। उन्होंने बताया कि वालिनोक्कम खाडी में संस्थान द्वारा विविध केंद्रों में पहचान किये गये 8 समुद्रजीवी संवर्धन रीतियों का प्रयोग किया जा सकता है। इस निर्देश के अनुसार परियोजना के अधिकारियों ने रामनाथपुरम के जिलाधीश और पत्तन अधिकारी से मिला ताकि मछुओं को भी समुद्र रैंचन तकनोलजी में सहभागिता दें। दोनों अधिकारियों ने इसकेलिए अनुमति दी। संस्थान के टूटिकोरिन और मद्रास केंद्र के अधिकारियों ने 8.1.1992 और 9.1.1992 को वालिनोक्कम खाडी का सर्वेक्षण किया और समुद्र रैंचन केलिए संगत विविध डाटाएं संकलित किए। सर्वेक्षण का परिणाम निम्नानुसार है।

वालिनोक्कम खाडी और समीपस्थ प्रदेशों की स्थलाकृति

वालिनोक्कम खाडी तमिलनाडु के रामनाथपुरम जिला में स्थित है। खाडी का कुल क्षेत्र व्याप्ति 15 वर्ग कि. मी है। खाडी की गहराई 4.5 मी और समीपस्थ क्षेत्र में 7.5 मी है। खाडी का पूर्व भाग मान्नार खाडी में खुलती है और उत्तरी भाग में 2-3 मी. गहराई की एक नली है। ज्वार अर्ध-दैनिक (Semi - diurnal) है। वर्षा बहुत कम है और इस में मिलनेवाली नदियाँ भी यहीं पर समुद्र और खाडी का पानी में विनिमय होता है। खाडी के दक्षिण भाग में नमक और मग्नीशयम का उत्पादन होता है।

सर्वेक्षण रीतियाँ:- सर्वेक्षण 8.1.92 व 9.1.92 को दक्षिण से उत्तर-पूर्वी दिशा में 2-4 स्टेशनों में क्षेत्र को विभाजित करके औटबोर्ड इंजन से चलाये देशी नाव में किया गया।

परिणाम

गहराई और पारदर्शिता:- गहराई 1.5 से 7.5 मी में बदलती रही। जल बहुत ही स्पष्ट था कि 7.5 मी गहराई की स्थिति समझ सकती थी।

नैट्रेट :- प्रतल पानी का नैट्रेट अंश 0.75 से 1.25/ ug.at/l और निचल पानी का 0.75 से 1.50/ug.at/1था।

प्राणिप्लवक:- प्राणिप्लवक की मात्रा 5 से 20 मिलि के बीच थी। सब से अधिक था कॉपिपोड्स। इसके अलावा बैवाल्वस, गास्ट्रोपोड, अप्पोन्डिकुलारिनयनस, झींगा डिभक, मछली अंडा और डेकापोड डिभक भी था।

निचलस्थ पानी का निरीक्षण:- आलगे और सी ग्रास (Sea grass) सब कहीं देखा। इनमें समुद्री शैवाल की 31, ग्रीन आलगे की 10, ब्राऊन आलगे की 12, रेड आलगे की 12 और समुद्री घासों की 6 जातियाँ उपलब्ध थे।

तापमान:- वायुमण्डलीय तापमान 23.5 से 27.0°C के बीच प्रतल पानी तापमान 25.0 से 26°C के बीच और निचला पानी तापमान 25 से 25.8°C के बीच रहा। मुक्ता संवर्धन केन्द्र में पानी का तापमान 25 से 28.0°C के बीच रहा।

लवणीयता:- लवणीयता में प्रतल पानी और निचला पानी में उतना अंदर नहीं था। यह 30.90 से 32.36 ppt के बीच रहा।

विलीन ऑक्सिजन:- प्रतल पानी का विलीन ऑक्सिजन मात्रा 3.26 से 5.19 मि लि/ली और निचला पानी का 4.32 से 5.19 मि लि रहा। मुक्ता संवर्धन रैफट के निकट यह 3.22 से 4.50 मि.ली/ली था।

प्राथमिक उत्पादन:- प्रतल पानी का प्राथमिक उत्पादन 94.18 से 478.54 mgc/m^3/ day और निचला पानी का 107.53 से 457.09 mgc/m^3/ day था। मुक्ता संवर्धन केंद्र में उत्पादकता 764.22 से 1029.13 mgc/ m^3/ day थी।

अजैव फोस्फेट्स:- इसका मूल्य प्रतल पानी में 0.05 से 0.30/ug.at/l और निचल पानी में 0.05 से 0.18 ug. at/1।

सिलिकेट:- इसका मूल्य प्रतल पानी में 5.0 से 200/ug.at/। और निचल पानी में 5.0 से 19.0/ug.at/l था।

नैट्रेट:- प्रतल पानी में इसका मूल्य 0.06 से 0.15/ug.at/। और निचल पानी में 0.04 से 0.11/ ug.at/l था।

समुद्र रैंचन की साध्यताएं: यह सुविक्षित है कि जलजीवियों का संवर्धन अनुकूल परिस्थिति पर निर्भर है अतः वातावरण के साथ संवर्धन के लिए चुनी गयी जातियों का मिलन अत्यंत महत्वपूर्ण है। इसलिये समुद्र रैंचन के लिए स्थान का चयन करने पर पाँच बातों पर विचार करना है।

1. स्थलाकृति (विस्तार, गहराई)
2. बाह्य लक्षण (प्रवाह, ज्वार, आविलता (turbidity) अवसादन और पानी का तापमान)
3. रासायनिक लक्षण (विलीन ऑक्सिजन, लवणीयता पी एच) जैविक भार, पोषक भार।
4. जीववैज्ञानिक लक्षण (प्राथमिक और द्वितीय उत्पादन परभोजी, प्रतियोगी और परजीवी)
5 अन्य सुविधायें (रोग, यातायात, शुद्धजल की उपलब्धता आदि)

सर्वेक्षण उपर्युक्त बातों को ध्यान में रखते हुये किया था। इस सर्वेक्षण के फलस्वरूप विविध जातियों के समुद्र रैंचन कार्यक्रम संस्थान द्वारा विकसित तकनोलजियों के ज़रिए वालिनोक्कम खाडी में शुरू करने का निर्धारण भी किया गया जिसका विवरण नीचे दिया गया है।

1. मुक्ताशुक्ति की खेती और मुक्ता संवर्धन

सवेक्षण ने व्यक्त किया कि टूटिकोरिन हार्बर जहाँ अब संस्थान द्वारा एक आर आण्ड डी योजना चलायी जा रही है की तुलना में वालिनोक्कम खाडी इसकेलिए अधिक अनुयोज्य है।

अध्ययन से व्यक्त हुई अनुकूल स्थितियाँ ये थी।

1. मान्नार की खाडी में 15-20 मी. गहराई में बोयी जानेवाले *पिंक्टाडा फ्यूकाटा* का पालन यहाँ की 2 मी गहराई में सफलता से किया जा सकता है।

2. टूटिकोरिन की तुलना में यहाँ शुक्ति की बढती शीघ्र होती है।

3. शीघ्र बढती को सहायक करनेवाला पंक भार कम है।

4. हार्बर की तुलना में परिदूषण की तीव्रता (fouling intensity) कम है।

5. हार्बर की तुलना में पर्ल साक (pearl sac) का रूपायन और मोती का उत्पादन अधिक होता है। इसका कारण खुला समुद्री पानी से खाडी के पानी का मिलावट ज्यादा होना है।

6. वर्ष के अभाव में यहाँ के समुद्री पानी वर्ष के दौरान व्यतियान नहीं के बराबर होता है जो फ्यूकेटा की बढती के लिए अनुकूल है। टूटिकोरिन में पराजित हुये *पी. मार्ग्रेटिफेरा* जो काली मोती के लिए मशहूर है का संवर्धन यहाँ किया जा सकता है क्यों कि इसके संवर्धन के लिए अनुयोज्य स्वच्छ और अप्रदूषित पानी यहाँ मौजूद है।

2. खाद्ययोग्य शुक्तियों का संवर्धन

भारत के पश्चजल में देखे जानेवाले शुक्ति *क्रासोस्ट्रिआ माड्रासेनसिस* यूरिहालैन (eury haline) है जो खाडियों, पश्चजलों, (creek) आदि में अच्छी तरह बढता है। लेकिन यहाँ से प्राप्त इस जाति के नमूने की बढती कम दीखी। यहाँ समुद्री स्थिति हमेशा होने के कारण *सक्कोस्ट्रिआ कुक्कुलेटा* संवर्धन किया जा सकता है पर इसका वाणिज्यिक मूल्य अब कम है इसलिए यहाँ *सी. माद्रोसेनसिस* का संवर्धन करना ही उचित है।

3. बडी सीपी (Clam) का संवर्धन

ब्लड क्लाम *अनडारा ग्रानोसा* के संवर्धन के लिए वालिनोक्कम खाडी अनुकूल नहीं लगते। पर क्लाम जैसे *पाफिया मलबारिका, मेरट्रिक्स* और *एम.कास्टा* का परीक्षणात्मक खेती यहाँ किया जा सकता है।

ट्रिडाक्ना जाति के भीमाकार बडी सीपियाँ समुद्रवर्ती स्थितियों में जीनेवाले हैं इसलिए वालिनोक्कम खाडी इसके संवर्धन के लिए अनुकूल सा लगता है।

4. समुद्री ककडी का संवर्धन

सर्वेक्षण के दौरान *अक्टिनोपैगा मिलारिस* और *होलोथूरिया स्पिनिफेरा* यहाँ से मिला था। इन में *ए. मिलारिस* वाणिज्य की दृष्टि से महत्वपूर्ण है। पर समुद्री ककडियों में सब से अधिक मूल्य मिलनेवाली जाति *एच. स्काब्रा* का संवर्धन उचित तरीके से करना अच्छा होगा।

5. हरित सीपियों (ग्रीन मसल) का संवर्धन

वालिनोक्कम खाडी में रैफ्ट तरीके से हरित सीपियों के संवर्धन के लिए कोशिश किया जा सकता है। इसके लिए बीज कूड्डलूर जैसे समीपस्थ स्थानों से लिया जा सकता है।

6. सी बास (Sea bass) का संवर्धन

लाटेस कालकारिफर इस वर्ग की महत्वपूर्ण जाति है क्यों कि यह तेजी से बढता है, मांस स्वादपूर्ण है और अच्छा दाम भी मिलता है। वालिनोक्कम खाडी में इसके संवर्धन के लिए अनुकूल परिस्थिति है इसलिए नेट केज संवर्धन तरीका इसकेलिए अपनाया जा सकता है।

7. झींगा का संवर्धन

खाडी में संवर्धन करने के लिए अनुयोज्य दो तरह की झींगे माने *पेनिअस सेमिसुलकाटस* और *पी .इन्डिकस* को पहचाना गया है। वालिनोक्कस में पेन/केज तरीके से *पी. सेमिसुलकाटस* का संवर्धन करना उचित होगा।

8. समुद्री शैवाल का संवर्धन

जी. इडुलिस के संवर्धन के लिए वालिनोक्कम खाडी अनुकूल लगता है।

संवर्धन का कार्य शुरु करने से पहले विविध संवर्धन जातियों का पर्यावरण अनुयोज्यता संबंधी निरीक्षण एक वर्ष तक करना होगा। अनुकूल लगने पर चुनी गई तकनोलजियों का परिचालन किया जा सकता है।

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*सी एम एफ आर आइ के टूटिकोरिन अनुसंधान केन्द्र और मंडपम क्षेत्रीय केन्द्र के के. ए. नरसिंहम, आर. मारिचामी, डी. बी. जेम्स, पी. नम्मलवार, ए. सी. सी. विक्टर, एन. कालिय पेरुमाल, एम. ई. राजपाडियन, एस. धर्मराज, जी. महेश्वरुडु, ए. डी. गांधी, डी. सुन्दरराजन, एम. आर अर्पुतराज, एम. मुनियांडी, एस. कालिमुत्तु, जे. एक्स, रोड्रिगो, एम. शेल्वराज, ए. दासमान फेर्नान्डो, एफ. सूसै वी. रायन, एन. जेसुराज, पी. मुत्तुकृष्णन और डी. बोस्को फेर्नान्डो द्वारा तैयार किया लेख

रामेश्वरम, पाम्बान और मण्डपम में तारली *सारडिनेला लोंगिसेप्स* का मौसमी अवतरण*

रामेश्वरम और पाम्बान में 1992 जनवरी और फरवरी के दौरान तारली *सारडिनेल्ला लोंगिसेप्स* का असाधारण अवतरण देखा गया। इसका शोषण युग्म ट्रालरों (pair trawler) और मत्स्य ट्रालरों (fish trawler) के ज़रिए किया था। प्रारंभ में प्रतिदिन 30-40 युग्म ट्रालरों का परिचालन किया था। लेकिन केरल आदि राज्यों से बढती माँग देखकर युग्म ट्रलरों की संख्या बढ़ा दी। जनवरी-फरवरी, 1992 में रामेश्वरम से तारली की आकलित पकड 4561 टन थे। इसमें युग्म ट्रालरों का योगदान 4244 टन और मत्स्य ट्रालरों का 317 टन था।

युग्म ट्रालरों का प्रस्तुतीकरण शुरु में उतना सन्तोषजनक नहीं था। लेकिन बाद में तारली, मुल्लन, पॉम्फेट्स आदि मछलियों की मात्रा और गुण ने धीवरों को इसकी ओर आकृष्ट किया। आज इसका प्रचालन हर वर्ष दिसंबर के आखिरी हफ्ते से अप्रैल के पहले हफ्ते तक होता रहता है।

क्राफ्ट व गिअर

प्रचालन कार्य 9.14-9.75 मी ओ ए-एल (45-70 एच पी डीज़ल इंजिन) के यंत्रीकृत एकक के ज़रिए होता है। मत्स्यन के वक्त ट्रालरों का चाल 3.5 नोट्स (knots) है। लेकिन तारली के मत्स्यन के समय यह चाल 3.5 नोट्स रखता है। युग्म बोट हाइ स्पीड बोटम ट्राल शांकाव थैली के आकार में बनाया गया है। इसके 15.4 मी का एक पख, 3 मी का एक प्रलम्ब, 23 मी का पेट, 5 मी की गला और 7.5 मी का कोड एन्ड और 33 मि की लंबाई का हेड रोप होते है। बोट के इंजन की शक्ति के अनुसार निर्देशन (specification) में विविधता होती है। मत्स्य ट्राल के 25 मी का एक पख, 17 मी का पेट, 3 मी की गला 8 मी का कोड एन्ड, और 22 मी के हेड रोप होते है। कोड एन्ड का जालाक्षी आकार 25 मि मी-30 मि मी है। इसका प्रचालन एकमात्र एकक द्वारा 2.5-3 नोट्स की चाल में किया करता है।

प्रचालन का क्षेत्र

प्रचालन का क्षेत्र रामेश्वरम में तट से 15-20 कि. मी दूर समुद्र में उत्तर और उत्तर-पूर्वी दिशा है। मत्स्यन तल की गहराई 12-16 मी के बीच है और अधःस्तल पंकिल होता है। मत्स्यन केलिए 0400 घण्टे जाते है और 11.30 घण्टे तक वापस आते हैं।

मात्स्यिकी

युग्म-ट्रालिंग-दिन का मत्स्यन

मत्स्यन कार्यक्रम 13 जनवरी 1992 से शुरु हुआ। जनवरी 1992 के दौरान युग्म ट्रालरों के ज़रिए प्रति प्रयास में 2084 कि ग्रा और 1635.8 टन प्राप्त हुआ और फरवरी, 1992 में प्रति पकड/प्रयास में 1192 कि ग्रा और 2618 टन। पाम्बान में जनवरी और फरवरी, 1992 के दौरान पकड क्रमशः 203 टन और 538 टन थी।

मत्स्यन-ट्राल-दिन का मत्स्यन

रामेश्वरम में जनवरी, 1992 के दौरान 40-110 मत्स्य ट्रालर प्रचालन में थे। जनवरी और फरवरी में तारली पकड क्रमश : 271 टन और 45.7 टन थी जो इस अवधि में कुल मत्स्य पकड के 29.6% और 4.1% थे।

युग्म ट्रालरों के ज़रिए प्राप्त अन्य मछलियाँ लेसर सारडीन्स, *डसुमेरिया एक्युटा, टाचीसलस कालाटस, हिमानदुरा ब्लीकेरी* आदि थी। मत्स्य-ट्रालरों में मुल्लन और लेसर सारडीन्स मुख्य थे। इनके अतिरिक्त *टी.कालाटस, आलीपस काला* और एच. *ब्लीकेरी* आदि की बम्पर पकड भी कभी कभी देखी गयी थी।

चिंगट-ट्राल-निशा मत्स्यन

रामेश्वरम में चिंगट ट्रालों द्वारा अक्तूबर-दिसंबर 1991 के दौरान 147 टन तारली प्राप्त हुआ जो कुल

मत्स्यन पकड के 2.8% था। पिछले साल इस अवधि में पकड 75.3 टन था। पाम्बन में चिंगट आनायकों द्वारा पकड अक्तूबर-दिसंबर, 1992 में 22 टन थी जो पिछले साल की तुलना में 10 टन कम थी।

तट ट्राल

मण्डपम के मान्नार खाडी में हर साल अक्तूबर-नवंबर से मार्च-अप्रैल के दौरान तट संपाशकों का प्रचालन होता है। दिसंबर 1990 से अप्रैल 1991 तक की अवधि में 668 टन तारली का अवतरण हुआ था।

आकार मिश्रण

युग्म आनायकों का आकार 123 से 194 एम एम के बीच है और अधिकतम 130, 145 और 170 एम एम आकार के है लेकिन चिंगट आनायकों का आकार 105-191 एम एम के बीच है और आम तौर पर ये 120,135 और 175 एम एम के होते है। मात्स्यिकी आम तौर पर 165-175 एम एम आकार के बीच की थी।

लिंग अनुपात और प्रौढता

चिंगट आनायकों के ज़रिए प्राप्त तारली (निशा-मत्स्यन) अधिकतः बिगडी हुई स्थिति में थी। जाँच से ज्ञात हुआ कि ये अक्तूबर - दिसंबर के दौरान अंडरिक्त स्थिति में थी। मादा तारली अधिक थी। युग्म आनायकों और मत्स्य आनायकों की पकड ताजा था। जनवरी और फरवरी में मादा अधिक थी।

खाद्य

जनवरी और फरवरी के दौरान चलाये अध्ययन ने यह बात व्यक्त की कि सब के पेट खाली थे। शरीर शुष्क और सिर बडे थे।

पकड का निपटान

अपराह्न के पहले घण्टे में प्राप्त पकड के प्रति टन के 8000 से 6000 रुपये तक का अच्छा मूल्य मिला। संध्या होते होते मूल्य प्रति टन पर 3000 से 2000 रू तक गिर गया।

इस क्षेत्र में प्रचालन करनेवाले सभी गिअरों की मासिक पकड, मौसमी रीति, जैव लक्षण, परिस्थिति से संबन्धित प्रवासी रीति आदि पर विस्तृत रिपोर्ट की तैयारी हो रही है।

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*लेख तैयार किए है : आर. मारिचामी, ए. ए. जयप्रकाश, एन. राममूर्ति और एम. बोस सी एम एफ आर आइ के मंडपम क्षेत्रीय केंद्र, मंडपम काम्प।

वैपीन में समुद्री सीपी, *सुनेट्टा स्क्रिप्टा* की मात्स्यिकी*

सुनेट्टा स्क्रिप्टा जिसका स्थानीय नाम "कडल कक्का" है, वैपीन द्वीप की एक महत्वपूर्ण वाणिज्यक मात्स्यिकी है। यह सीपी हल्के पीले रंग की है जिसमें काले भुरे रंग के बाणाकार चिह्न है। इस सीपी को, चूने के व्यवसाय में इस्तेमाल करता है। हाल ही में झींगा स्फुटनशालओं के अंडशावकों को खिलाने के खाद्य के रूप में इसका उपयोग करने लगे है। कोचीन और अष्टीकोड के समुद्र नदी संकर मुख में भी यह दिखाया पडता है।

मुरुक्कुमपाडम की समुद्री सीपी मात्स्यिकी

मुरुक्कुमपाडम में सीपियों के मत्स्यन में नियमित रूप से लगे हुये करीब पचास मछुए हैं। मत्स्यन केलिए ये डोंगियों का इस्तेमाल करते हैं जिसकी क्षमता 2.25 टन है। सीपीयों के वासस्थान करीब 2.5 से 3 मी की गहराई में लकडी से बनाये हुये 'तुम्बा' नामक उपकरण बलपूर्वक खींचते हुये उस से लगाये गये नाइलोन नेट जाल में मछुए सीपीयों का संग्रहण करते है। नेट जाल से पकडी गयी सीपियों को डोंगी में इकट्ठा करते है। प्रतिदिन प्रत्येक डोंगी से 400-500 कि ग्राम सीपी कवचों का संग्रहण होता है जिसे मुरुक्कुमपाडम के क्लाम फिशरमेन इंडस्ट्रियल फिशरीस सोसाइटी को बेचता है। मुरुक्कमपाडम से वर्ष 1989 से 1991 तक मिली सीपियों का माहवार अवतरण का निरीक्षण, पकड में अन्य जातियों और कवचों का उपस्थिति प्रतिशत और वार्षिक उत्पादन, और मूल्य संबंधी डाटाओं का निरीक्षण किया गया।

सीपियों का माहिक और मौसमी उतार चढाव

वर्ष के पूरे महीने में *एस. स्क्रिप्टा* का अवतरण सब से उच्चतम मई में और निम्नतम दिसंबर में हुआ।

पकड में मौसमी उतार चढाव भी दिखाया पडा। सब से उच्चतम पकड पूर्वमानसून अवधि के फरवरी-मई महीनों में और निम्नतम पकड मनसूनोत्तर अवधि में मिली थी। कभी कभी पकड में मेरेट्रिक्स जातियाँ भी थी।

वार्षिक उत्पादन

यह डाटा वर्ष 1986 से लेकर 1990 तक का है जो मुरुक्कुमपाडम फिशरमेन इन्डस्ट्रियल सोसाइटी का है। वार्षिक तुलनात्मक अध्ययन में सीपियों की कुल पकड में घटती की प्रवणता देखी। वर्ष 1986 का वार्षिक उत्पादन 3691.4 टन था तो 1990 में यह 2133.81 टन हो गया। जबकि मछुओं की संख्या और मूल्य में बढती देखी।

निपटान और उपयोग

खादी बोर्ड के अधीन वर्ष 1976 में स्थापित 'क्लाम फिशरमेन इंडस्ट्रियल सोसाइटी' मछुओं से पूरी पकड खरीदकर चूना फाक्टरियों को बेचता है। इस सोसाइटी में 112 मछुए सदस्य है लेकिन अब सिर्फ 54 मछुए सीपी मत्स्यन में लगे हुये हैं। सोसाइटी अपने लाभ मछुओं के कल्पाण के लिए बिताते हैं। खाद्य के रूप में इसका मौंस अभी तक न उपयोग किये है, हाल ही में झींगा भोज्य के निर्माण में इसका उपयोग कर रहे है।

मुनम्बम की समुद्री सीपी मात्स्यिकी

यहाँ *सुनेट्टा स्क्रिप्टा* की बडी संपदा है। तट के पास 1.5 मी की गहराई में 2 कि मी क्षेत्र में यह सीपी अच्छी तरह पनपती है। निम्न ज्वार के समय पर हाथों से और स्कूप जाल के ज़रिए इसका संग्रहण करता है। 15 कि. ग्राम सीपी कवच को 4/- रु का दाम मिलता है। स्थानीय मछुए इसके मांस खाते है। अषीकोड के समुद्र नदी संकर मुख में *एस. स्क्रिप्टा, पी. मलबारिका* और मेरेट्रिक्स जातियाँ उपलब्ध है। निम्नज्वार के समय पर डोंगियों में जाकर इसका निकर्षण करता है। मत्स्यन के लिए अनुकूल मौसम जनवरी-मई के पूर्व मानसून है। पकडी गई सीपियों का निपटान कोई संघ के अभाव में स्वयं मछुए करते हैं।

सिफारिश

अध्ययन ने व्यक्त किया कि इस समुद्री सीपी का मत्स्यन विचारणीय मात्रा में हो रहा है और इस का मांस बहुत कम खाया जाता है। इसके आधार पर मात्स्यिकी के विकास केलिए निम्नलिखित बातों पर ध्यान देना अच्छा होगा। पहला इस मछली के पोषक गुण के बारे में लोगों को समझाना है दूसरा झींगा संवर्धन खेतों में भोज्य के रूप में इसका अधिकाधिक उपयोग करना है तीसरा इस मांस की निर्यात साध्यताए ढूँढ निकालना है और चौथा इसके मत्स्यन में लगे हुये मछुओं के कल्याण केलिए संघों की स्थापना होनी चाहिए।

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* वी. कृपा और मात्यू जोसफ, सी एम एफ आर आइ कोचीन द्वारा तैयार किया लेख।

आंध्रा प्रदेश के अपतट समुद्र में मत्स्यन के लिए कट्टामरन के स्थान पर फाइबर ग्लास *तेप्पा* का प्रयोग*

भारत के अपतट समुद्र में मत्स्यन केलिए उपयोग करनेवाला एक पुरातन और लोकप्रिय यान है *कटामरन*। 2-3 लट्ठों को एक साथ बाँधकर इसे बनाया जाता है। तटीय समुद्र में कास्ट नेट, गिल नेट और कभी कभी कांटा डोर का प्रयोग करके मत्स्यन करने केलिए ये यान उपयुक्त करते है। वर्षों के बाद मछली की मांग बढ़ने पर तट से 10 से 15 कि मी दूरी में भी मत्स्यन करने केलिए इन कटामरनों के निर्माण में परिवर्तन लाया गया। नवनीकृत कटामरनों में 4-5 व्यक्ति एक समय मत्स्यन के लिए जा सकते हैं और इस से ड्रिफ्ट जाल का परिचालन कर सकते हैं।

साधारणतया गरीब मछुए कटामरनों का उपयोग करते हैं क्योंकि कटामरनों का लागत 5,000/- 20,000/- रु के बीच में है और प्रचालन सिर्फ 10 वर्ष तक कर सकते है। इसके बाद इसके लट्ठे उपयोगशून्य हो जाते हैं। कटामरनों में बाहरी इंजन नहीं लगा सकते हैं। इस प्रकार के कई खूबियाँ कटामरनों का उपयोग करने वाले मछुओं के सामने है। फाइबर ग्लास से बना हुआ *तेप्पा* नामक एक यान उडीसा में अभी प्रचालित करने लगे है इन कठिनाइयों को पार करने में यह सक्षम लगता है।

रंगीन फाइबर ग्लास से बना हुआ इस यान में बाहरी इंजन लगाने की और पकड को इकट्ठा करने की सुविधा मौजूद है। ईंधन के व्यय के अलावा इसके अनुरक्षण का व्यय नहीं के बराबर है। हल्का होने के कारण इसे चलाना भी आसान है और हवा है तो इंजन के बिना ही पतवार की सहायता से चला सकते है। उड़ीसा के पुरी में इस यान का निर्माण 30,000/- - 45,000/-, रु की रेंच में हो रहा है।

ये यान उतना जल्दी नहीं टूटते इसलिए अधिक काल तक सभी वातावरण में इसका प्रयोग किया जा सकता है और मछुए इससे अधिक लाभ उठा सकते है। लट्ठे से बने हुए कटामरनों के स्थान में इन यानों का प्रयोग लागू करने की संभाव्यताओं पर अब निरीक्षण हो रहा है।

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* सी एम एफ आर आइ के काकिनाडा अनुसंधान केंद्र के पी. वेंकट रमना, एन. बुरय्या और के. धन राजु द्वारा तैयार किया लेख।

बीजाणुओं से *ग्रेसिलेरिया एडुलिस* का संवर्धन*

ग्रेसिलेरिया वाणिज्य की दृष्टि से महत्वपूर्ण एक अगारोफैट (agarophyte) है। शीतोष्ण (temperate) और उष्णकटिबंधीय (tropical) समुद्रों में यह अच्छी तरह बढती है। इस अगारोफैट की बढती मौंग और प्राकृतिक संपदाओं का युक्तिहीन शोषण, नए संवर्धन तरीकाओं से उत्पादन बढ़ाने केलिए प्रेरणा देती है। ग्रेसिलेरिया के संवर्धन केलिए दो तरीकाएं प्रचालित है, खंड संवर्धन (fragment culture) और बीजाणु संवर्धन (spore culture). भारत में वाणिज्य की दृष्टि से महत्वपूर्ण अगारोफैटों का खंड संवर्धन करने की कई कोशिश की गई है।

ग्रेसिलेरिया का बीजाणु संवर्धन का कार्यक्रम 1988-89 के दौरान बंगाल की खाडी में किया था। यद्यपि ग्रेसिलेरिया के बीजाणुओं का संवर्धन बडी मात्रा में किया जा सका तथापि बीजाणुओं को नूतनोद्भिद (germling) तक बढाने का कार्यक्रम एक पराजय था। इसका मुख्य कारण इसके जीवन चक्र और आवास स्थिति में हुआ अचानक परिवर्तन था।

ग्रेसिलेरिया का उत्पादन बडी मात्रा में बढाने केलिए फिर से कई तरह के निरीक्षण चलाए। इस परीक्षण में नर्सरी में मोचित व पालित बीजाणुओं को मान्नार की खाडी में पुनर्रोपण किया। यहाँ नूतनोद्भिदों की बढ़ती में मंदता देखी। इस से यह अनुमान लगाया जाता है कि बीजाणुओं को नूतनोद्भिदों की अवस्था पहुँचने तक नर्सरी में पालना अच्छा है। मोचन के 13-18 दिवस के बाद नर्सरी से निकालकर प्राकृतिक वातावरण में पुनर्रोपण करना बढती केलिए सब से अनुयोज्य कालावधि निरीक्षित की गयी।

नियंत्रित वातावरण में बीजाणुओं का मोचन और पालन करके प्राकृतिक वातावरण में उसका पुनर्रोपण करने पर शैवाल अच्छी तरह बढते हुये देखा। अनियंत्रित वातावरण और पौष्टिक मीडिया में बीजाणुओं का पालन करने पर भी अच्छी बढती देखी पर वर्णक मात्रा (pigment content) में कमी देखी।

अभी तक चलाए गये निरीक्षणों से यह व्यक्त हो गया है कि *ग्रेसिलेरिया* के सफल संवर्धन केलिए इसके बीजाणुओं को नूतनोद्भिदों की अवस्था तक पौष्टिक मीडिया में पालन करके पुनर्रोपण करना उचित है।

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*रीटा जयशंकर, सी एम एफ आर आइ का क्षेत्रीय केन्द्र, मंडपम काम्प।

तोण्डि के निकट पाक खाडी समुद्र तट में, धँसे पोरपोइस *निओफोसीना फोसीनोइड्स जी. कवियर* पर एक टिप्पाणी*

दिनांक 21-1-1992 को रामनाथपुरम जिला के उत्तर भाग के पाक खाडी तट में, तोण्डि के पास मल्लिमुन्नाइ नामक एक अवतरण केन्द्र में एक नर पोरपोइस *निआफोसीना फोसीनोइड्स* जिसे "मिनिकुट्टी" नाम से पुकारा जाता है, ताजे स्थिति में धँसा हुआ देखा। इसके शरीर में कोई घाव नहीं था। स्थानीय धीवरों ने कहा कि इसी आकार के और एक "मिनिकुट्टी" एक हफ्ते पहले समुद्र तट में दीख पडा था। इसके अलावा इस निरीक्षण केन्द्र से 5 कि मी दूर के एक अवतरण केन्द्र एम. वी. पट्टिणम, (सोलियाकुडि) में इस जाति के और एक स्तनी के धँस जाने के बारे में सूचना मिली

थी। कुलमिलाकर एक हफ्ते की अवधि में इसी जाति के 3 स्तनियों के धँसने की सूचना मिली और यह भी समुद्र तट के 5 कि मी दूरी में। इन कारणों से ऐसा अनुमान किया जाता है कि उपर्युक्त जातियाँ झुंडों में आयी होंगी और किसी आकस्मिक परिस्थिति में तट पर धँसे हुए होंगे।

*श्री ए. गणपति, तकनीकी सहायक, सी एम एफ आर आइ के मण्डपम क्षेत्रीय केन्द्र, मण्डपम कैंप द्वारा तैयार की गयी रिपोर्ट।

विशाखपट्टणम में एक बडे ग्रीसी ग्रूपर एपिनेफेलस तॉविना फोस्कल का अवतरण*

विशाखपट्टणम में मार्च 20, 1991 को 60 मी गहराई से, 13.1 मी लंबाई के सोना बोट नामक के ट्रालर के ज़रिए नल्लबोन्डु पुकारे जाने वाला एक बडा ग्रीसी ग्रूपर *एपिनेफेलेस तॉविना फोस्कल* का अवतरण हुआ था। इसकी कुल लंबाई 236 से मी और भार 300 कि ग्रा थे। तालवर और काकेर (कमेर्सियल सी फिशेस ऑफ इन्डिया, 1984) की रिपोर्ट के अनुसार यह जाति कम से कम 220 से मी लंबाई और 230 कि ग्रा भार प्राप्त करता है। लेकिन किशोर और वाइटहेड (एफ ए ओ स्पीशीज़ आइडेन्टफिकेशन, शीट्स, ईस्टेर्न इन्डियन ऑशियन, एरिया 57 खंड 4, 1974) के अनुसार यह जाति 150 से मी तक की लंबाई प्राप्त करती है। अभी रिकोर्ड की गयी लंबाई इस जाति की अधिकतम लंबाई लगती है।

* सी एम एफ आर आइ के विशाखपट्टणम अनुसंधान केन्द्र, विशाखपट्टणम के सी.वी. शेषगिरि राव और जे. बी. वर्मा द्वारा तैयार की गई रिपोर्ट।

मंडपम में धँस गया सी वेल *बालिनोप्टीरा बोरियालिस लेसन**

भारत के समुद्र तटों में तिमियों का धँसाव असाधारण नहीं है। पर इन दिनों तिमियों का धँसाव बहुत साधारण हो गया है विशेषकर *बालिनोप्टीरा बोरियालिस* का जिसके संबंध में यह आठवीं रिपोर्ट है।

जनवरी 20, 1992 को मंडपम क्षेत्रीय केन्द्र के कुछ वैज्ञानिकों ने पाक खाडी के पास एक सचेत तिमि को दोखा। यह तटीय समुद्र में तैरने की कोशिश कर रहा था। पर लहरों में होकर यह तट पर धँस गया और दो दिन तक सचेत रहने के बाद 23 वाँ दिसंबर को सबेरे मर गया। यह *बालिनोप्टीरा बोरियालिस* लेसन नामक तिमि था और इसकी 14 मी लंबाई और 10 टन भार था।

* रिपोर्ट किए हैं :- पी. नम्मलवार, आर. मारिचामी, ए. राजु., ए.ए.जयप्रकाश, सी. काशिनाथन, एन. राममूर्ति और वी. सेतुभास्करन, सी एम एफ आर आइ का मंडपम क्षेत्रीय केन्द्र, मंडपम।

पाक खाडी तट, तोण्डि में कौनोस रे *राइनोप्टीरा जावानिका* का असाधारण अवतरण*

जेम्स ने 1962 और 1970 में बोटम सेट "गिल जाल" तिरुक्कुवलै के ज़रिए मान्नार खाडी से *राइनोप्टीरा जावानिका* का भारी अवतरण के बारे में रिपोर्ट की है। उन्होंने पाक खाडी तट में इसकी अनुपस्थिति की सूचना भी प्रस्तुत की थी। इस रिपोर्ट में यंत्रीकृत ट्रालरों द्वारा *आर. जावानिका* के बडे पैमाने में अवतरण के बारे में संक्षिप्त वर्णन किया गया है। इस बार इसकेलिए 15 से 20 मि मी के जालाक्षिवाले ट्राल जाल का प्रचालन किया था। दिनांक 26-12-1991 को तोण्डि के निकट एम. वी. पटिनम (सोलियाकुडि) में लगभग 10 टन *आर. जावानिका* का अवतरण हुआ था। शंकुशों का आकार 350 से 880 मि मी के बीच में था। पूरी पकड प्रति कि. ग्रा 4.50 रु की दर में बेच गयी थी। स्थानीय धीवरों ने कहा कि इसी जाति का 5 टन मछली का अवतरण 2-1-92 को और 0.5 टन मछली का अवतरण 7-1-1992 को हुआ था। मत्स्यन केलिए पोतों का परिचालन दक्षिण पूर्वी दिशा में 13 से 14 मी गहराई के बीच में किया था। शंकुशों का इस तरह की भारी पकड कई वर्षों के बाद की घटना है जो इस क्षेत्र में अक्सर नहीं होती है।

* सी एम एफ आर आइ मण्डपम क्षेत्रीय केन्द्र, मण्डपम कैम्प के श्री गणपति द्वारा की गयी रिपोर्ट।

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