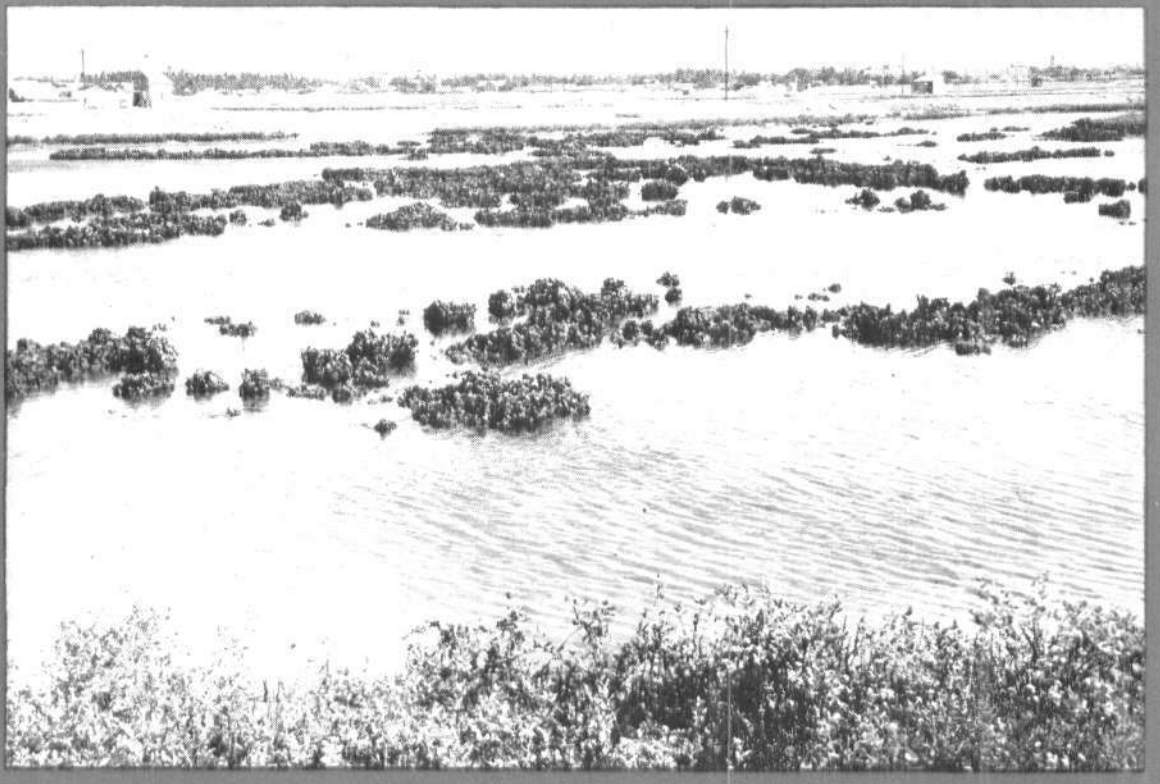
MARINE FISHERIES INFORMATION SERVICE



No. 61
JANUARY, FEBRUARY
1985

Technical and Extension Series

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
COCHIN, INDIA

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

THE MARINE FISHERIES INFORMATION SERVICE: Technical and Extension Series envisages the rapid dissemination of information on marine and brackish water fishery resources and allied data available with the National Marine Living Resources Data Centre (NMLRDC) and the Research Divisions of the Institute, results of proven researches for transfer of technology to the fish farmers and industry and of other relevant information needed for Research and Development efforts in the marine fisheries sector.

Abbreviation – *Mar. Fish. Infor. Serv. T & E Ser.*, No. 61: 1985

CONTENTS

Cover photo : A view of the natural edible oyster bed exposed during low tide at Tuticorin

MOLLUSCAN FISHERIES OF INDIA

K. Nagappan Nayar and K. Satyanarayana Rao
Tuticorin Research Centre of C.M.F.R.I., Tuticorin

Introduction

Molluscs form valuable fisheries in various parts of the coasts of India providing shellfish as food and as source of lime, pearls and decorative shells, as constituents of medicinal preparations etc. The commercially important molluscs of the country consist of oysters, mussels, clams, ark shells, pearl oysters and other bivalve molluscs, the sacred chank *(Xancus pyrum)*, *Trochus niloticus*, *Turbo marmoratus* and some other gastropods and cephalopods including squids, cuttlefishes and octopods. The available resources are exploited at numerous places all along the coasts of the country using a variety of fishing methods but the total production is not high compared to several other countries of the world. However, in recent years following an increase in the fishing effort and greater awareness of the resources, there has been a steady rise in molluscan production. The Central Marine Fisheries Research Institute has recognized the importance of molluscs as valuable fishery resource and conducted several studies on the identity, distribution and biological characteristics of the resources and the trends in production of some of the major species. Very recently researches have been carried out on the culture of oysters, mussels, and clams as well as pearl culture, and culture methods have been developed which would be useful in adopting mariculture practices. In this article, the present status of exploitation of molluscan resources in the country and the progress made in researches on the culture of bivalve molluscs are presented and the possibilities for better utilization of the resources by proper exploitation are emphasized.

Molluscan Resources and Fisheries

Oysters

Oysters are one of the most valuable among molluscs found along Indian coasts and are widely distributed in estuaries, creeks, backwaters, bays and harbours wherever rocky or other hard substratum is found. Several species of oysters have been reported from India of which four viz., *Crassostrea madrasensis*, *C. gryphoides*, *C. discoidea* and *Saccostrea cucullata* form beds and are of economic importance (Nayar, 1980). *C. madrasensis* has extensive distribution, occurring in Sonapur backwaters in Orissa, Pulicat Lake, Ennore, Killai backwaters, Karangad, Athankarai, Pinnakayal and Tuticorin (Fig. 1) on the east coast and in Vembanad Lake, Cochin, Beypore and Tellicherry in Kerala and

Fig. 1. Natural oyster bed of *Crassostrea madrasensis* at Tuticorin.

several estuaries of Karnataka on the southwest coast. The oysters at Sonapur are fished regularly for converting the shells into poultry feed (Alagarswami and Narasimham, 1973). Small sized oysters from Pulicat Lake were previously grown to marketable size in the shallow parts of the Lake and sold to meet the requirements of a few hotels in Madras city. Now oysters are occasionally collected from natural beds and supplied when there is demand. Along Cochin coast and in Mulki, Udayavara, Coondapur and villages bordering Kali river, oysters are collected for domestic consumption or sold at Rs. 3–4/- per 100 nos. thus forming a sustenance fishery. Oysters are collected by dislodging them with a strong knife or a chisel. The shells of this species are also used in the manufacture of calcium carbide.

In *Crassostrea madrasensis* of Adyar estuary a main spawning season extending from October to December and usually a second season from March–April have been observed (Rao, 1951). *C. madrasensis* spawns twice in a year during April–May and August–September at Tuticorin and grows to a size of 90 mm at the end of one year when meat forms 8–10% of total weight (Mahadevan, Nayar and Muthiah, 1980). *C. gryphoides* occurs along the Maharashtra and Goa coasts and is fished in fair quantities at a number of places such as Bombay, Alibag, Ratnagiri, Malvan, Ratnagiri Ribander, Siolim and Curca. *C. gryphoides* spawns between July and September in Kelwa waters and grows to a maximum size of only 48 mm at the end of one year (Durve and Bal, 1962). In the creeks of Gulf of Kutch, Port Okha, Dwarka and Porbunder in Gujarat the disc oyster *Crassostrea discoidea* occurring in muddy bottom is fished for its meat. In Poshetra *Crassostrea cristagalli* is exploited for meat but this species is a small sized one and fetches a price of Rs. 3/- per 100 nos. *Saccostrea cucullata* commonly known as the rock oyster due to its occurrence on rocky substratum is found on both east and west coasts but is more common on the west coast. This species grows well in marine environment and fisherfolk collect it from sandstone or granite boulders in the intertidal zone.

Mussels

Mussels are an important molluscan fishery resource in India. These are found in the coastal waters on rocky substratum up to a depth of 10 m and are fished at low tides using a knife. Of the two species (the green mussel *Perna viridis* and the brown mussel *Perna indica)*, the green mussel occurs at a number of places on Indian coasts and forms thick beds at Quilon, Alleppey, Cochin, Malabar coast, Karwar, Goa, Malvan, Ratnagiri and in Gulf of Kutch. In these areas the green mussels are regularly exploited for the meat which is relished very much. The green mussel resources are particularly abundant on the rocky coasts from Calicut to Tellicherry where there is an active fishery. On the east coast small beds of green mussels occur only at a few places viz., Visakhapatnam, Kakinada and Madras. *Perna viridis* attains a length of 92 mm at the end of one year at Kakinada and its breeding period is prolonged extending from December to July (Narasimham, 1980a). Unlike the green mussel, the brown mussel *Perna indica* has a limited distribution from Varkalai near Quilon on southwest coast to Cape Comorin with good fisheries at Varkalai, Kovalam, Vizhinjam, Poovar, Muttom and Colachel. The brown mussel grows to a size of 35–36 mm in a year on Vizhinjam coast and breeds from May to September (Appukuttan and Nair, 1980).

Fig. 2. Fishing of the brown mussel *Perna indica* on Vizhinjam coast.

Clams

In terms of total production, clams are the foremost among the molluscan resources in India. They are distributed along both coasts but the resources along the west coast are very considerable as compared to those on the east coast. Clam fishing is generally done by hand picking or with scoop nets. In several estuaries of Maharashtra, Goa, Karnataka and Kerala on the west coast there are regular fisheries for different species of clams. *Meretrix casta, Katelysia opima* and *Paphia laterisulca* are the species caught from the estuaries and backwaters in Maharashtra. Two species of clams *M. meretrix* and *Villorita cyprinoides* support clam fisheries at Tiracol, Chapora, Sal, Mandovi, and Zuari estuaries in Goa (Alagarswami and Narasimham, 1973).

In Kali river in Utthara Kannada district, Karnataka there is a very good clam fishery of *Meretrix meretrix, Paphia malabarica* and *V. cyprinoides*; the annual clam production amounting to about 2,000 t (Nayar *et al.*, MS). Clam fishing is carried out in Kali river by hand picking or with a net which has a semi-circular mouth and is operated with leg. In the estuaries of Dakshina Kannada district, in contrast to Utthara Kannada district, *Meretrix casta* is generally the dominant clam species, the other species occurring in commercial catches including *M. meretrix, Paphia malabarica, V. cyprinoides* and *K. opima*. An estimated clam production of 79 to 128 t including mostly *Villorita cyprinoides* are fished annually from Netharavathi estuary at Mangalore (Rao, K. S., MS).

In Kali river and Coondapur estuary vast subfossil clam shell deposits are present and these are exploited on a large scale using dredges. The fishermen who fish live clams in the Kali river vehemently oppose the exploitation of shell deposits using the dredging equipment and they contend that along with shells live clams present in the area are caught in large quantities and destroyed.

There are extensive sub-fossil molluscan shell deposits largely comprising of clams in Vembanad Lake, the total resource of which has been estimated as 2–4 million tonnes. The annual estimated production of shells from the lake is 1,98,809 t of which live clams form 26,859 t (Rasalam and Sebastian, 1976). Fishing is carried out using a long handled spade as in the southern portions or with a drag net. Mechanical suction type dredgers are used by M/s. Travancore Cements Ltd. and Travancore Electro-Chemical Industries Ltd., which exploit large quantities of lime shells for the manufacture of cement and calcium carbide. Lime shells are used for a number of other purposes like preparing of morter and slaked lime, for neutralising acidic soil and in rayon and paper industries. Large quantities of sub-soil lime shell deposits occur in Kodungallore and Ashtamudi lakes, and Kadalundi and Korapuzha estuaries also in Kerala. *Villorita* spp. form 90% of clam resources of Vembanad Lake and their meat is sold and consumed in a large number of surrounding villages. There is a good fishery for *Katelysia opima* in Ashtamudi lake for exporting clam meat.

On the east coast in Bahundi river in Orissa live *Meretrix* sp. occur along with oysters and subfossil shell deposits are quarried annually. From Chilka Lake good quantities of shells of *Meretrix* spp. are mined every year (Alagarswami and Narasimham, 1973). *Meretrix meretrix* is common in Kakinada Bay and about 400 t of the clams are landed annually. On the southeast coast, beds of *Meretrix casta* occur in Vellar and Vaigai estuaries. The clam beds in Vellar estuary support a fairly good fishery with yearly production of about 210 t (Natarajan *et al.*, 1979). *M. casta* is found in Chilka and Pulicat lakes and Vaigai estuary. There is a regular fishery for live *M. casta* in Pulicat lake. *Katelysia opima* occurs only sporadically in the lake. Good quantities of subfossil molluscan deposits are present in the northern part of Pulicat lake which are regularly exploited (Thangavelu, personal communication). Large subfossil molluscan deposits of *M. casta* and some other species have been located recently in Vaigai estuary at Athankarai and they are being actively exploited since 1978 (Nayar *et al.*, MS).

Ark shells

In Kakinada Bay the ark shell *Anadara granosa* is abundant and supports a fishery (Fig. 3), the annual production amounting to 130 t. The ark shells fished from the bay are mostly used in the production of lime

Fig. 3. Fisherwomen engaged in fishing *Anadara granosa* in Kakinada bay.

and only small quantities are utilized as food or for export. There is much demand in Japan for this species. An economic method of culturing this species has been developed by CMFR Institute (Narasimham, 1980b). Efforts are necessary to culture the shellfish and export them *A. granosa* occurs in Vellar estuary and Venkatpur estuary also but only in small quantities.

Window-pane oysters

These bivalves belonging to the species *Placenta placenta* the shells of which are used for glazing windows and are also sources of shell lime and pearls used in medicine, enjoy wide distribution in Indian seas occurring in Gulf of Kutch, Bombay, Malabar coast, Tuticorin, Mandapam, Nagapattinam, Madras and Kakinada Bay. Of the several places, only in Kakinada Bay and Gulf of Kutch window-pane oysters form a resource. The total biomass of this shellfish in Kakinada Bay has been estimated to be 8,945 t, the dead oyster resources forming another 43,348 t and the annual landing is 400 t (Murthy, Narasimham and Venugopalam, 1979) indicating that production could be increased several times. Till recently window-pane oysters were only converted into lime or pearls present were collected and used in preparing medicine. At present the right valves of the oysters are exported to Hong Kong, Japan

and Korea. In addition the shell valves with iridescent lustre are used in the production of chandeliers. The meat of window pane oysters is edible. Therefore the possibilities of popularizing it as food in the country have to be explored.

Pearl oysters

In India there is a continous demand for pearls for use in the making of jewellery, which is largely met through import of cultured pearls from Japan, the pearl production from pearl oyster resources in the country being erratic. Most beautiful natural pearls have been collected from pearl oysters of the species *Pinctada fucata* collected in pearl fisheries off Tuticorin coast in Gulf of Mannar and to some extent from Gulf of Kutch since very early times. The pearl banks in the Gulf of Mannar are under the control of the Government of Tamil Nadu which conducts pearl fisheries (Fig. 4) when the pearl banks known as *Paars* are populated by pearl

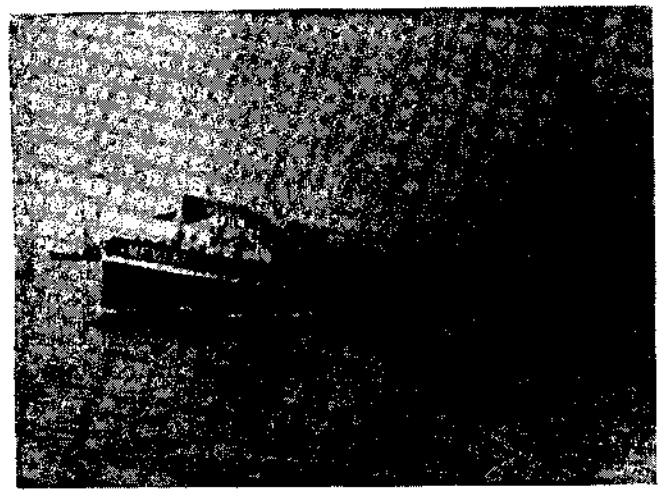


Fig. 4. Pearl oyster fishing boats being towed by mechanised vessel.

oysters in abundance. In the present century only fourteen pearl fisheries have been conducted the last being as far back as in 1961. Pearl oysters occur in Gulf of Kutch and support small fisheries, the annual production amounting to 30,000 to 77,000 pearl oysters (Mahadevan and Nayar, 1973). Settlement of *P. fucata* has been noticed in Vizhinjam coast recently. *Pinctada margaritifera* which also yields pearls of high quality occurs only sporadically in India.

The pearl oyster production in the various pearl fisheries varies very much due to wide fluctuations in the stocks of pearl oysters in the pearl banks. Natural populations of pearl oysters are influenced by a variety of factors like recruitment, presence of *Modiolus* as a pest, occurrence of predators like sea stars, sharks, rays and skates, strong currents, drifting sand and unauthorised fishing.

Maximum of 21.4 million pearl oysters which brought a revenue of Rs. 4,51,098/- to the State Government were obtained in 1958 pearl fisheries. The maximum income of Rs. 8,00,568/- was achieved in the fishery held in 1959 when 16.4 millions of oysters were fished. In the 1961 fishery the total harvest of pearl oysters fished was 15.4 millions which fetched an income of Rs. 2,88,860/-. Observations made recently on the pearl banks in the Gulf of Mannar have revealed the presence of pearl oysters in good numbers in some of the paars. The Central Marine Fisheries Research Instutute has achieved a major breakthrough by producing spherical cultured pearls in the pearl oyster *Pinctada fucata* (Alagarswami and Qasim, 1974).

Other Bivalves

There are also other bivalve molluscs of economic value like the razor shells *Solen* spp. in Ratnagiri coast (Rao *et al.*, 1962) and surf clams *Donax cuneatus, D. faba,* and *D. incarnatus* in various parts in the intertidal zone which are fished for their meat (Nayar, 1955, Alagarswami, 1966, Nayar and Mahadevan, 1974). *D. cuneatus* attains a size of 13–14 mm in one year and its spawning season extends from January to April in Palk Bay (Nayar, 1955). *D. faba* of Gulf of Mannar grows to sizes of 20 mm and 24 mm at the end of one year and two years respectively and spawns from November to June (Alagarswami, 1966). Other species like *Mesodesma glabratum* in sandy beaches, *Gafrarium* spp. in muddy habitat in Gulf of Mannar and the fan shells *Pinna bicolor* and *Atrina (Servatrina) pectinata pectinata* (Rao and Dorairaj, 1974) occurring in coastal waters of Mandapam area are bivalves which could be exploited.

Sacred chank

The sacred chank *Xancus pyrum* which occupies an important place in the lives of Hindus, being used in worship and in the manufacture of bangles worn by ladies in Bengal is distributed in the coastal waters of Tamil Nadu, Kerala and Gulf of Kutch in Gujarat. The major portion of the resources are distributed in Tamil Nadu where chanks occur in Tirunelveli, Kanyakumari, Ramanathapuram, Pudukottai, Thanjavur, South Arcot and Chingleput coasts. Chanks occur from shallow parts to depths of 20 m (Nayar and Mahadevan, 1973).

About 90% of the chank production is obtained by diving (Fig. 5) and the rest in nets or by fishermen wading in shallow waters. In Tamil Nadu chank

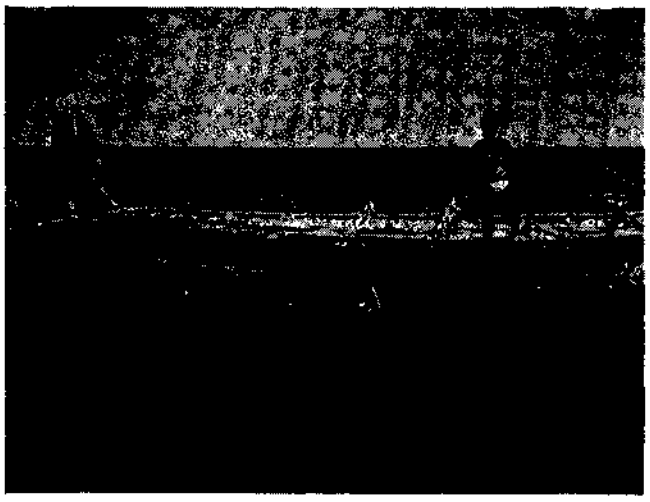


Fig. 5. Chank fishing by divers off Tuticorin coast.

fishing is controlled by the State Government which permits fishing by issuing licences to fishermen. Fishing of chanks below the size of 57 mm is prohibited, the under-size ones being returned to the sea. The chank production is highest in Tirunelveli area off Tuticorin coast. The fishing season extends in the area from November to May and over 900 divers are engaged in the fishery. During 1972–78 the number of full size chanks fished per season off Turicorin coast varied between 18,768 and 5,58,996. In the recent years 1978–83 the chank landings per season along the coast have been much higher ranging between 7,78,132 and 10,54,940 with maximum number of chanks having been obtained in 1982–83 season (Table 1). Next in importance is the

Table 1. *Number of full size chanks fished off Tuticorin coast during* 1972–83

Season	Number of chanks fished
1972–73	3,72,106
1973–74	3,58,883
1974–75	5,58,996
1975–76	12,365
1976–77	18,768
1977–78	19,171
1978–79	9,55,893
1979–80	8,01,035
1980–81	7,78,132
1981–82	7,95,645
1982–83	10,54,940

Source: Department of Fisheries, Govt. of Tamilnadu.

Kannirajapuram–Ramanathapuram fishery with a yearly production of 3,00,000 chanks.

Another 40,000 chanks are fished along the coasts of Tanjavur, South Arcot and Chingleput districts. Chank production is much less in other areas being 17,000 chanks caught in trawl nets off Quilon coast and 6,000 obtained in hooks and lines off Vizhinjam. From the Gulf of Kutch, about 12,000 chanks are fished annually. A number of varieties of chanks are recognised based on shell characteristics, the main ones being the beautiful spindle shaped *acuta* and the squat form *obtusa*. The sacred chanks with sinistral shells known as *Valampuri* (Fig. 6) which are greatly esteemed are caught in very stray numbers and these fetch a price of Rs. 10,000/- or more depending on the size and quality of the shell. The sinistral chanks are auctioned by the Government of Tamil Nadu.

Fig. 6. A sinistral chank *Xancus pyrum*.

Fig. 7. *Trochus niloticus*.

Trochus and Turbo

Trochus niloticus and *Turbo marmoratus* (Figs. 7 & 8) form important local fisheries in Andaman and Nicobar

Fig. 8. *Turbo marmoratus.*

Islands, the annual production of the former amounting to 400-600 t and that of the latter 100-500 t (Appukuttan, 1977). In recent years a decrease in the catches of *T. marmoratus* is evident. There is very good demand for the beautiful shells of the two species with opalescent lustre, as a variety of utilitarian articles are made with them. The foot of the species is boiled, dried and consumed.

Other gastropods

Apart from the above species, there are other gastropods like *Turbo intercostalis*, *Oliva* sp., *Lambis lambis* and *Babylonia spirata* which occur in intertidal zone and littoral waters and could be utilized as food. Shells of *Tonna* spp., *Hemifusus* sp, *Cymbium melo*, *Umbonium vestiarium* and *Cyprea tigris* are collected and sold as such or made into handicraft articles. The cowries *Cypraea moneta* gathered from shallow coastal waters are used as dice. The early development of a number of prosobranch molluscs of Mandapam area has been studied by Natarajan (1957). Studies have been taken up by CMFR Institute at Mandapam camp to make some of the gastropods of economic importance breed in laboratory.

Cephalopods

In India squids and cuttlefishes are mostly obtained as by-catch in trawl nets, shore sienes, boat seines, hooks and lines and stake nets operated for fish and prawns, trawl nets accounting for 59% of total cephalopod production. The country's cephalopod production was meagre till 1973 after which there has been a remarkable increase in the landings to meet the demand for exports (Silas *et al*, 1982). In recent years, the annual cephalopod production varied between 9,548 t (1981) and 15,931 t (1978) (Silas *et al*, 1982, FRAD, CMFRI, 1982). 41.94% of the total landings are caught on the west coast and the rest on the east coast. Kerala, Maharashtra and Gujarat are the states with high cephalopod production, the three states accounting together for 79% of the production during 1978–81 while Tamil Nadu ranks fourth in importance. The commercially imporatnt species of cephalopods of India are the squids *Loligo duvaucelli*, *Sepioteuthis lessoniana*, *Doryteuthis* sp., *Loliolus investigatoris* and the cuttlefishes *Sepia pharaonis*, *S. aculeata*, *S. breviamana*, *S. elliptica*, *S. prashadi* and *S. inermis*. There is an important local fishery for the squid *Sepioteuthis lessoniana* in Ramanathapuram district on southeast coast of India, which is exploited with a special type of shore seine *ola valai* (Rao, 1954). Octopods occur in sheltered crevices amidst rocks and coral stones at a number of places on the mainland and Lakshadweep and Andaman Islands. In Lakshadweep Islands they are fished by spearing, the annual production amounting to 13–20 t. A number of species of oceanic squids are known to be distributed in Indian ocean (Flippova, 1968) but their catch potential is to be assessed. Silas (1969) has pointed out that the oceanic squid *Symplectoteuthis oulaniensis* is common at high depths beyond 180 m off southwest coast of India. By carrying out exploratory fishing extensively on the continental shelf and oceanic parts and use of special gear like jigs, there is much scope for considerably increasing the country's cephalopod production. Squids and cuttlefishes are being exported in good quantities annually to several countries. The total cephalopod exports from India amounted to 3,028 t worth Rs. 75 millions in 1981.

General Considerations

Molluscan resources exist at innumerable places along the coasts of India and are exploited in varying degree of intensity forming valuable fisheries. The fisheries and biological aspects of the major species of molluscs of economic importance have been studied only at a few areas in the last few years. It is quite essential that these studies are intensified and extended to other areas which will help in taking steps to develop the fisheries. A big lacuna in the study of molluscan fisheries in India is the lack of detailed data on the production of the shellfishes such as oysters, clams, mussels, ark shells etc. At present such data is available only for pearl oysters, chanks and cephalopods. The

CMFR Institute has drawn up a programme to monitor the landings of the different groups of molluscs other than cephalopods. When this programme is implemented, we will have a clear idea of the status of the various molluscan fisheries of the country.

In the case of bivalve and gastropod resources, systematic resources surveys have to be conducted along the east and west coasts as well as the Andaman and Lakshadweep islands for assessing the standing stocks. A beginning has been made in this field and CMFRI has surveyed the molluscan resources of a number of estuaries and other brackish water systems in Kerala and Karnataka.

Bivalve molluscs such as oysters, mussels, clams, cockles and scallops are cultivated in shallow coastal waters on scientific lines in several advanced as well as developing countries of the world such as U.K., U.S.A., Canada, France, Spain, Holland, Germany, Australia, Japan, Philippines, Korea, and Taiwan to supplement production from exploitation of natural stocks. But unfortunately until recently no serious attempt has been made to adopt culture practices for bivalve molluscs in our country. In India where malnutrition is widespread, aquaculture of oysters, mussels, and clams can very much augment production from fishing natural beds and provide protein-rich sea food. Silas (1980) has stressed the importance of culture of edible molluscs as the production of biomass is high. The Central Marine Fisheries Research Institute has developed economic methods of oyster culture (Nayar and Mahadevan, 1980), mussel culture (Kuriakose, 1980) pearl culture (Alagarswami, 1980) and culture of *Anadara granosa* (Narasimham, 1980b). The culture of the bivalves could be carried out profitably in suitable littoral areas with the available technology as the materials required could be easily procured and farming conducted. During the last few years a very good demand has developed for the export of bivalve molluscs especially clams. Clams like *Katelysia opima, Meretrix* and *Villorita* have been collected from Ashtamudi and Vembanad lakes and over 510 t of clam meat worth Rs. 97,37,000 exported in 1982-83. Thus by improving the fishing methods and proper exploitation of the available molluscan resources it is possible for India to increase production substantially from the present level which will provide greater quantities of wholesome sea-food to meet internal demand and requirements of export industry. Besides the meat, the molluscan shells which are used in various ways bring substantial additional income.

References

ALAGARSWAMI, K. 1966. *J. mar. biol. Ass. India,* 8 (1): 56-75.

ALAGARSWAMI, K. AND K. A. NARASIMHAM, 1973. *Proc. Symp. Living Resources of the Seas around India,* CMFR Institute, Cochin, 648-658.

ALAGARSWAMI, K. AND S. Z. QASIM, 1974. *Indian J. Fish.,* 20 (2): 533-550.

APPUKUTTAN, K. K. 1977. *Seafood Export Jour.* 9 (12): 21-25.

APPUKUTTAN, K. K. AND T. PRABHAKARAN NAIR, 1980. Ch. II. In *Bull. Cent. Mar. Fish. Res. Inst.,* 29: 5-9.

DURVE, V. S. AND D. V. BAL, 1962. *J. mar. biol. Ass. India,* 4: 206-213.

FILIPPOVA, J. A. 1968. *Proc. Symp. Mollusca,* Mar. biol. Ass. India, 1: 257-264.

FRA DIVISION' CMFR INSTITUTE, COCHIN, 1982. *Mar. Fish' Infor. Serv. T & E Ser.,* 41: 1-33.

KURIAKOSE, P. S. 1980. Ch. VIII. In *Bull. Cent. Mar. Fish. Res. Inst.,* 29: 33-38.

MAHADEVAN, S. AND K. N. NAYAR, 1973. In *Proc. Symp. Living Resources of the Seas around India,* CMFR Institute, Cochin, 659-671.

MAHADEVAN, S., K. N. NAYAR AND P. MUTHIAH. 1980. *Mar. Fish. Infor. Ser. T & E Ser.,* 26, 1-3.

MURTHY, V. K. S., K. A. NARASIMHAM AND M. VENUGOPALAM. 1979. *Indian J. Fish.,* 26 (1 & 2): 125-132.

NARASIMHAM, K. A. 1980a. Ch. III. In *Bull. Cent. Mar. Fish. Res. Inst.* 29: 10-16.

NARASIMHAM, K. A. 1980b. *Mar. Fish. Infor. Ser. T & E Ser.,* 23: 7-9.

NATARAJAN, A. V. 1957. *Proc. Indian Acad. Sci.,* 46B: 170-228.

NATARAJAN, P., P. DEVADOSS AND K. MUNIYANDI, 1979. *Indian J. Fish.,* 26 (1 & 2): 201-206.

Nayar, K. N. 1955. *Indian J. Fish.,* 2: 325-348.

NAYAR, K. N. 1980. *Proc. Summer Inst. in Culture of Edible Molluscs 26th May-24 June* 1980, CMFR Institute, Cochin, 31-39.

NAYAR, K. N. AND S. MAHADEVAN, 1973. *In Proc. Symp. Living Resources of the Seas around India,* CMFR Institute, Cochin, 672-686.

NAYAR, K. N. AND S. MAHADEVAN. 1974. Ch. III In. *Bull. Cent. Mar. Fish. Res. Inst.,* 25: 40-53.

NAYAR, K. N. AND S. MAHADEVAN, 1980. In *Proc. Symp. Coastal Aquaculture, II, Mar. biol. Ass. India,* in press.

RAO, K. S. AND K. DORAIRAJ, 1974. *J. mar. biol. Ass. India,* 13 (1): 139-142.

RAO, K. V. 1951. *Proc. Indian Acad. Sci.,* 33B: 231-256.

RAO, K. V. 1954. *Indian J. Fish.,* 1: 37-66.

RAO, K. V., K. A. NARASIMHAM AND K. ALAGARSWAMI, 1962. *Indian J. Fish.,* 9 (2) : 542-579.

RASALAM, E. J. AND M. J. SEBASTIAN, 1976. *J. mar. biol. Ass. India,* 18 (2) : 323-355.

SILAS, E. G. 1969. *Bull. Cent. Mar. Fish. Res. Inst.,* 12: 86 pp.

SILAS, E. G. 1980. Ch. XIV In *Bull Cent. Mar. Fish. Res. Inst.'* 29: 51-56.

SILAS, E. G., K. S. RAO, R. SARVESAN, K. PRABHAKARAN NAIR AND M. M. MEIYAPPAN, 1982. *Mar. Fish. Infor. Ser. T & E Ser.* 34: 1-17.

AN INSTANCE OF MASS MORTALITY IN THE MUTTUKADU FARM NEAR MADRAS DURING APRIL 1983*

Introduction

The Mariculture Centre at Muttukadu is situated in the Kovalam backwater and is about 36 km south of Madras City. The northern wing of backwater which ends abruptly near Karikattukuppam village has an area of 93 ha running parallel to the coast and is being converted into a fin fish and prawn culture farm (Fig.1). An earthern bund with steel sluice gates runs across

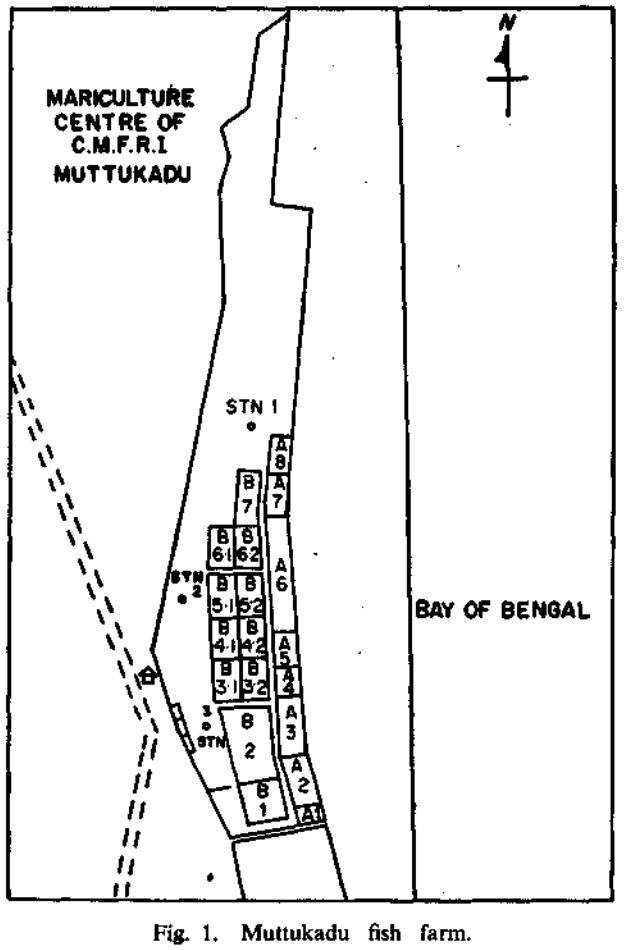


Fig. 1. Muttukadu fish farm.

the backwater separating the farm area from the main body of backwater.

The Kovalam backwater is connected to the sea only during part of the year, the bar mouth usually remains open in October/November. Free water exchange is thus rather limited. This is particularly true of the farm area; as such it is a separate wing of the backwater and the sluice gates further limit water exchange. This pattern of periods of no exchange alternating with periods of limited exchange is repeated every year. Over the past one year due to drought conditions even this limited water movement has been considerably curtailed. There had been very little rain during the monsoon of 1982, it not having rained after November, 1982. The bar mouth closed, by early January, 1983, much earlier than normal. Thus a closed system with no water exchange has been existing in the farm area.

During the period after July, 1981, construction of ponds and their deepening have been carried out on a large scale. A sizeable quantity of water was drained from the farm area for deepening and constructing new ponds in June, 1982 and January, 1983. The total body of water in the farm thus decreased considerably. Mariculture activities in the farm have been intensified particularly after October, 1982. All these activities have been changing the environmental conditions in the farm and adjacent waters. Regular environmental monitoring of these waters has been going on since July, 1981.

While carrying out routine environmental monitoring of the farm site, an unusual mortality of fishes and other organisms was observed in the open site surrounding the farm at Mariculture Centre of CMFRI, Muttukadu between 10-4-'83 to 22-4-'83 (Figs 2-4). The phenomenon was particularly extensive on 19-4-'83. The following is a brief account of this unfortunate incident, giving an analysis of the relevant parameters and discussing the probable causes.

Fish mortality

A few eels of the species *Thyrsoidea macrura*, cat fishes *Tachysurus jella* and *Plotossus anguilaris* were found dead and washed ashore in the early morning

*Prepared by M. Rajagopalan, K. G. Girijavallabhan, Geeta Bharathan, M. Kathirvel, P. Nammalwar and T. Dhandapani. *Madras Research Centre of C.M.F.R.I., Madras.*

Fig. 2. Dead fishes strewn over the farm edges — a general view.

Fig. 3. The dead fishes included several varieties.

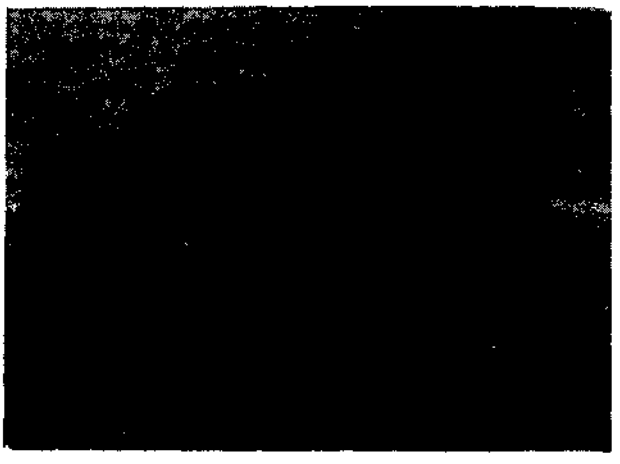


Fig. 4. Another view of the dead fishes.

hours at the northern sector of the farm area on 10 and 11–4–'83 and again from 14 to 18–4–'83. On the 18th and 19th the mortality was particularly heavy and along the western side of the farm area dead cat fishes, eels, *Etroplus surratensis, E. maculatus, Scatophagus argus, Pomodasys* sp. were noticed near the edge of the water. On 20th also heavy mortality of nearly 200 eels and other fishes was noticed. On the same day in the morning *Chanos* and mullets were observed coming to surface gasping for breath in B2 pond. The details of dead fishes together with size range are given in Table 1.

Table 1. *List of dead fishes observed during the mortality*

Species	Size range (mm)
Liza macrolepis	150–342
Mugil parsia	299–315
Valamugil seheli	301–399
Chanos chanos	238–392
Etroplus maculatus	42–62
	(9 fish per m^2)
Etroplus suratensis	144–178
Plotosus angularis	241–771
Tachysurus jella	100–484
Scatophagus argus	170–244
Therapon jarbua	38–148
Pomadasys sp.	306–394
Gobius sp.	39–52
	(467 fish per m^2)
Cynolgossus cynolgossus	90–210
Thyrsoidea macrura	350–1840
Epinephelus aereolatus	160–630

Mortality of prawns

On 19th afternoon, while examining the pen in which a brood stock of *P. monodon* (200 mm) was being maintained, it was found that all the prawns were dead. From the condition of dead specimens, they appeared to have died during the early hours of 19–4–'83. A total of 73 numbers were found dead in the brood-stock pen.

Observation on the bloom

High density of phytoplankton was noticed in the first week of April '84 which later developed into a dense bloom of *Peridinium* sp. and *Ceratium furca*.

The bloom, colouring the water yellow-brown, extended throughout the farm in the open area as well as in the pond B2. Ponds A2 and A3 were predominated by *Oscillatoria.* The densities are indicated by Chlorophyll 'a' value (Table 3). The phytoplankton of the Kovalam backwater area analysed at the same time also contained the Dinophytes but in much smaller density. Continuous bright sunshine, high salinity and low level of nutrients favoured the growth of Dinophytes. Coinciding with the mass mortality of fishes on 19–4–'83 the bloom died out in the area around station 2 continuous with Pond B2. Plankton on that day contained no live *Peridinium,* very few *Ceratium* some *Navicula* and *Nitzschia* sp. and resting spores of *Peridinium.* A similar condition prevailed in Pond B2, the bloom, however, continued near Station 1 and in the canal between A & B Pond series. Thus there was a heterogeneity in the plankton composition and distribution.

The degeneration of phytoplankton extended throughout the farm area by the 23rd. On 24th the water was deep brown in colour and on examination proved to contain a bloom of *Thalassiosira* and *Synechocystis.* Subsequent detailed examination on 26–4–'83 again revealed a difference between the northern body of the farm area and the southern part. The former was found to contain mostly *Ceratium* with a few *Navicula* and *Nitzschia.* The southern part (Station 2) contained dense populations of *Chaetoceros* with numerous *Ceratium* too. Thus it appears that the bloom of *Peridinium* died successively, first in the area near the ponds, then in the ponds and then in the northern end. The bulk of the *Peridinium* appears to have formed resting spores which may again germinate and develop into bloom.

Zooplankton collections made on 12 and 19–4–'83 (night collection) and 26–4–'83 did not reveal any appreciable zooplankton populations. Only amphipods were noticed in the collections. Huge dead masses of amphipods were washed ashore on 19th morning to the extent that they formed thick beds at the water edge on the western side.

Environmental parameters

Chlorophyll: Chlorophyll 'a' values reflected the phytoplankton populations, being very high in the first fortnight, falling during the period of mass mortality and rising again in the reviving period; plankton population consisted mainly of diatoms (Tables 3& 4).

Gross productivity: From an average gross productivity of 200.11 mg C/m³/day in January, the productivity rose to 2210.46 mg C/m³/day in March and remained high during April (Tables 3 and 4).

Nutrients: During the peak of the bloom on 12–4–'83, of the nutrients studied only phosphate-P and nitrite-N were detected in low concentrations both in the open areas and in the ponds. One week later, at the time of mass mortality, phosphate-P showed a slight increase while nitrite-N remained at the same level. Ammonia-N concentration, however, increased tremendously, from nil to 28/ug-at/l (Table 3). These altered conditions led to bloom predominated by daitoms and the nutrients levels dropped significantly.

Temperature: General level of temperature was high, varying between 31.1 to 34.0 °C in the open area. In the ponds temperature varied from 31.5 to 36.0°C.

Salinity: The prevailing high temperature and lack of rain fall since December 1982 led to hypersaline conditions. This ranged from 45.1 to 48.8 ppt in the open area and 48.8 to 54.0 ppt in the ponds.

Table 2. *Environmental parameters: Estimated values as observed during the period of mortality*

	Atmosphere Temp (°C)			Water			Water transparency (cm)			pH			Salinity (ppt)			Dissolved oxygen (ml/l)		
Date	13/4	19/4	26/4	13/4	19/4	26/4	13/4	19/4	26/4	13/4	19/4	26/4	13/4	19/4	26/4	13/4	19/4	26/4
Stn. 1	29.5	28.8	29.2	31.1	33.8	32.4	56	54	78	8.1	7.8	8.4	45.1	48.8	43.9	4.08	0.65	3.76
Stn. 2	29.8	29.0	29.2	32.0	34.0	32.6	32	28	28	8.2	8.0	8.7	46.0	45.0	44.5	4.45	0.40	6.36
Pond A2	29.8	28.0	29.4	32.5	36.0	32.5	15	14	23	8.3	8.0	8.3	48.8	49.2	51.1	5.29	3.76	4.55
Pond B2	30.0	30.2	29.4	31.5	35.2	33.0	22	28	26	8.2	8.0	7.9	51.3	54.0	55.0	3.48	2.16	3.16

Dissolved oxygen: From the normal levels (3.58 to 5.29 ml/1) during the first fortnight, the dissolved oxygen concentration fell drastically (0.40 to 3.76 ml/l) on 19–4–'83 (Table 2). This may be the result of accumulated effect of oxygen depletion during, the early hours of the morning, during the first fortnight. This is evident from the occasional mortality of fishes observed during the early hours of that fortnight. This is strengthened by diurnal monitoring done on 19th and 20th (Table 4). Two areas were monitored, on 12–4–'84; Station 2 which was already depleted in oxygen and in which the bloom had died, and Canal A/B which had higher level of oxygen and contained bloom of similar composition as obtained in Station 2. Table 4 reveals the extent of depletion, upto 0.41 ml/l at 0200 hrs in the canal containing the bloom. The diurnal monitoring of environmental parameters including dissolved oxygen carried out on 19/20–4–'84 substantiated this phenomenon (Table 4). It can be confidently inferred from this, that similar oxygen depletion had occurrred in Station 2 during the fortnight prior to mass mortality.

The continuous low oxygen levels observed during the day time on 19th April may be due to decomposition of the dead fish in the water. The deterioration in water quality also led to the death and decay of marcophytes especially *Halophilla ovalis*. This would have further added to oxygen depletion of the water.

Thus when under normal circumstances the oxygen depletion in the early hours would be made up by photosynthesis during the day, recovery was not possible here due to reduction in bloom and death and decay of different organisms (Table 4).

Table 3. *Environmental parameters: Estimated values as observed during the period of mortality*

	Gross productivity (mg C/m³/day)			Chlorophyll *a* (mg/m³)			Phosphate (µg-at/l)			Nitrite (µg-at/l)			Nitrate (µg-at/l)			Ammonia (µg-at/l)		
Date	13/4	19/4	26/4	13/4	19/4	26/4	13/4	19/4	26/4	13/4	19/4	26/4	13/4	19/4	26/4	13/4	19/4	26/4
Stn. 1	111.4	—	896.2	24.1	35.5	32.4	0.52	—	N.D.	0.25	—	N.D.	N.D.	—	0.74	N.D.	—	N.D.
Stn. 2	—	—	1569.4	43.9	8.6	—	0.52	1.56	N.D.	0.6	0.62	0.07	N.D.	N.D.	1.4	N.D.	29.4	N.D.
Pond A2	1710.9	—	2701.4	55.2	23.9	19.6	N.D.	—	N.D.	1.0	—	0.2	N.D.	—	N.D.	N.D.	—	N.D.
Pond B2	1312.1	—	—	18.9	14.1	28.6	Tr.	—	1.3	0.65	—	0.07	N.D.	—	Tr.	N.D.	—	5.22

Table 4. *Diurnal variation in Dissolved Oxygen (Period of observation* 19–4–'83 *(1400 hrs) to* 20–4–'83 *(1100 hrs)*

Time	Station 2			Canal between A and B series		
	Temperature (°C)		Dissolved	Temperature (°C)		Dissolved
	Atmos.	Water	oxygen (ml/l)	Atmos.	Water	oxygen (ml/l)
1400	31.6	33.8	0.38	—	—	—
1700	27.6	34.0	0.78	27.6	35.1	4.45
2000	26.8	32.8	0.79	26.8	32.6	3.90
2300	26.8	31.7	0.57	26.8	31.0	2.39
0200	27.2	32.2	0.19	27.0	29.8	1.52
0500	25.8	30.8	0.19	25.6	28.8	0.41
0800	26.8	31.0	0.09	26.8	29.2	1.50
1100	27.8	33.2	1.50	27.8	33.4	3.62

Conclusion

During this season the prevailing high temperature and salinity and the enclosed nature of the water body, all resulted in an intense bloom of dinophytes. This led to oxygen depletion of the waters and then, very likely, of the mud. The environment of the closed system must have been strained to a fine degree of balance.

Another reason may be that large groups of fishermen belonging to Kovalam and Karikattukuppam villages, in view of poor fishing in the sea, started unauthorised fishing in the farm area at Muttukadu. The regular operation of drag nets and gill nets has stirred up the mud and created large scale disturbance which, combined with the oxygen depletion, must have precipitated the crisis and led to the mortality of prawns and fishes.

ON THE CAPTURE OF JUVENILES OF *LUTJANUS RUSSELLI* (BLEEKER) AND *SCATOPHAGUS ARGUS* VAR. *TETRACANTHUS* (LACEPEDE) FROM BOMBAY WATERS*

Bhokshi nets are operated regularly at Manori creek at Marve for prawns and fishes of the creek. Two *Bhokshi* nets of mesh size 4–12 cm at the mouth and 1 cm at the cod end that were operated in the creek on 14-9-'83 landed 200 kg of fishes which contained 20 kg of juveniles of two species of quality fishes as incidental catches. They were identified as *Lutjanus russelli* (Bleeker) and *Scatophagus argus* var. *tetracanthus* (Lacepede) (Figs. 1 & 2).

Fig. 1. Juveniles of *Lutjanus russelli* (Bleeker).

Based on this catch the number of juveniles in the fishery was estimated at 7,00,000 in the case of *L. russelli* and were observed to have a size range of 28–31 mm weighing 13.4 g on an average. The size range in case of *S. argus* was still smaller, from 12–16 mm with an average weight of 2 g. The juveniles of *S. argus* are quite different from adults as they do possess armature in the head region which disappear as they grow into adults. The length frequency histograms are presented in figs. 3 & 4.

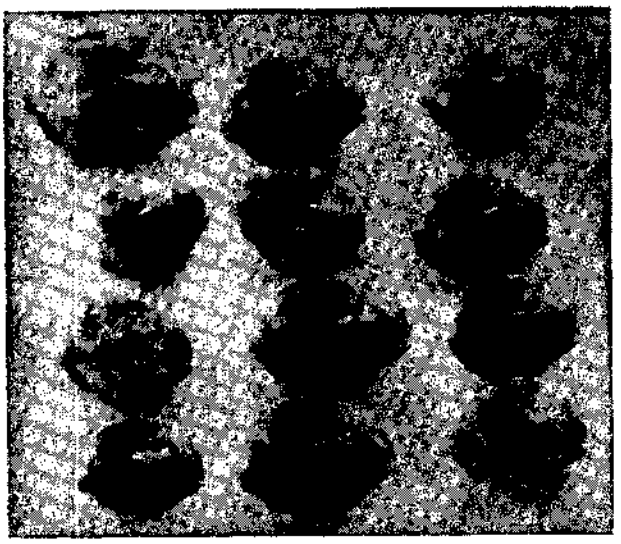


Fig. 2. Juveniles of *Scatophagus argus* var. *tetracanthus* (Lacepede)

It is quite probable that this unusual landings of juveniles in bag nets in good numbers was due to the

*Prepared by M. Aravindakshan and S. K. Chakraborty, Bombay Research Centre of C.M.F.R.I., Bombay.

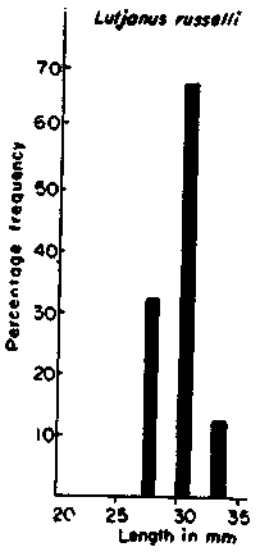


Fig. 3. Length-frequency of juveniles of *Lutjanus russelli* (Bleeker).

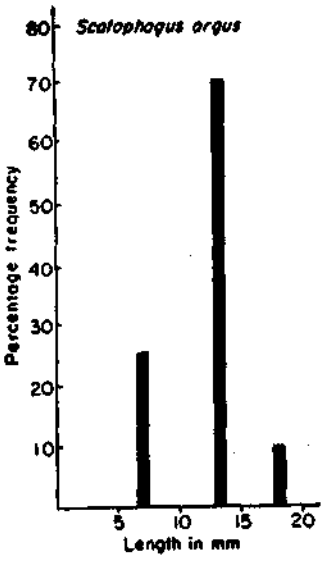


Fig. 4. Length-frequency of juveniles of *Scatophagus argus* var. *tetracanthus* (Lacepede).

young ones coming into the creek owing to the availability of food in the creeks during monsoon period and also to escape strong currents in the foreshore areas. During this period *Bhokshi* net operations are harmful for juvenile fishes and therefore it is advisable that these nets be operated with larger mesh size at the cod end. The adults of both the above cited species grow to a size of 30 cm in length and fetch a price of Rs. 2–3 in the market when sold in fresh condition. *S. argus* is however, less esteemed as food fish than *L. russelli*.

The authors are grateful to Shri A.A. Jayaprakash, Scientist S-1 for the help rendered in identifying one species as *Scatophagus argus* var. *tetracanthus* (Lacepede).

SPAWNING OF *NEMATALOSA NASUS* BLOCH IN PILLAIMADAM LAGOON AT MANDAPAM*

Marine fishes are usually not known to spawn in the coastal lagoons though such habitats constitute one of the preferred nurseries for the growth of migrating fry and fingerlings of some of the culturable species like mullets and milk fish.

During the course of the routine observations on the fishing activities of the Pillaimadam lagoon at Mandapam, large numbers of *Nematalosa nasus*, locally known as 'Koi' measuring 195–235 mm and weighing 80–140 g were caught from the lagoon (Fig. 1 c). The gonads of the fish were in ripe condition, weighing 10 to 20 g. The lagoon bar mouth which remains closed during the pre-northeast monsoon months opens with the onset of the northeast wind and the high tidal amplitude in the Palk Bay, carrying the sea water into the lagoon. Along with this tidal flow many species of fishes migrate into the lagoon, of which *N. nasus* forms a considerable percentage.

On 23–11–'83, when a trial netting was conducted by the author, using a 1 mm mesh synthetic fibre net, large numbers of transparent fry of *N. nasus* measuring 10 to 25 mm were collected (Fig. 1a). These hyaline fry were very delicate to netting operations resulting in heavy mortality. These fry were characterised by large eyes, pointed mouth, 17–19 dorsal rays and 18 to 22 anal fin rays. Fingerling of size 30 to 40 mm were collected subsequently on 17–12–'83 and 18–12–'83 (Fig. 1b). These withstood netting operations well. It was possible to transport them alive to 'hapas' erected in the shallow regions of the lagoon. Fingerlings were observed to have large eyes and terminal mouth. They were silvery in colour. Most of the adult of *N. nasus* collected from the lagoon after 10–12–'83 found

*Prepared by R. S. Lal Mohan, Mandapam Regional Centre of C.M.F.R.I., Mandapam Camp.

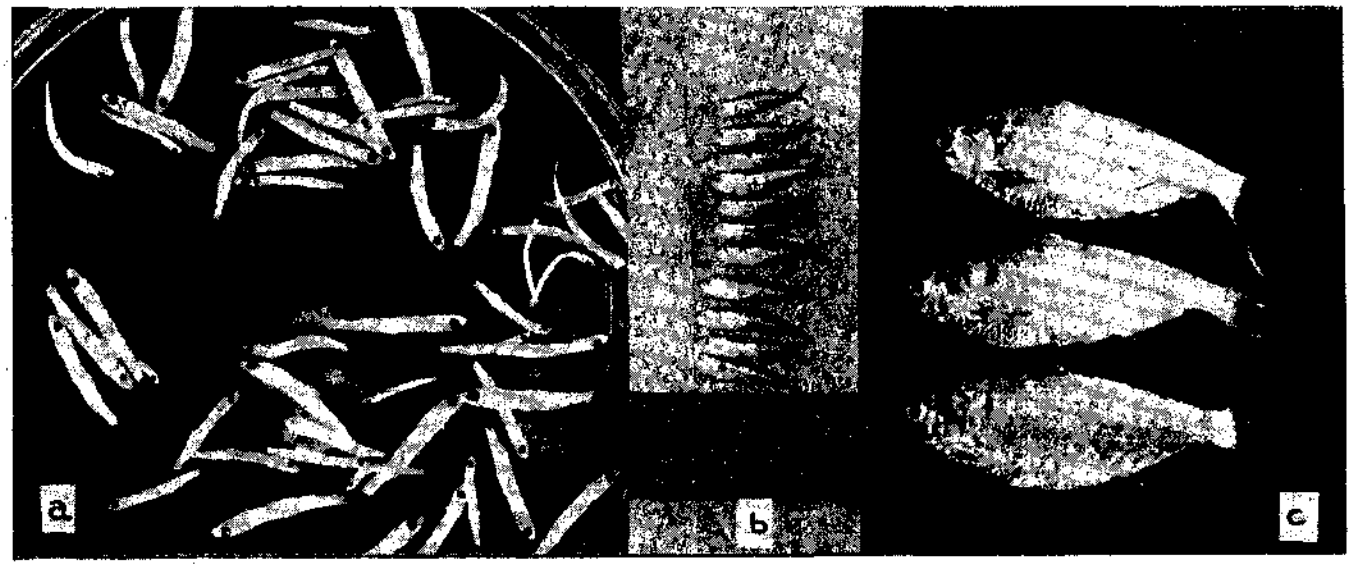


Fig. 1. *Nematalosa nasus*. a. Fry, b. Fingerlings c. adults.

to have gonads in 'spent' stage. The gonads were invariably shrivelled and weighed 2.5 to 4.0 g. However, some ovaries were vascular containing a few residual ripe ova indicating a very recent spawning. The above observations point to the probability of *N. nasus* entering the lagoon with mature gonadial condition and spawning in the water mass there. The salinity of the lagoon which was 35.2 ‰ during the first week of November came down to 28.8 ‰ during the last week of November due to the admixure of fresh water from the land on account of monsoon rain. The water temperature had dropped from 30°C to 23°C during the early hours of the morning.

Earlier observations show the possibility of *N. nasus* spawning in confined saline ponds in a salinity range of 28.0 to 32.0‰. The present observatoin of the fish spawning in coastal lagoons and ponds makes it extremely viable for culture. The observations suggest the immense possibilities of utilising the fingerling resources of *N. nasus* in the area to meet the seed requirements of this species for successful farming.

OCCURRENCE OF *TACHYSURUS DUSSUMIERI* (VALENCIENNES) WITH INCUBATING YOUNG ONES OFF MANGALORE*

During the course of routine observations on the purse-seine landings at Mangalore, a catch of about 21 t of catfish *(Tachysurus dussumieri)* was noticed on 23-3-'82. They were netted in a single haul by a purse seiner off the New Mangalore harbour at a depth of about 10 m. On a random examination of the catch it was found that all were males with fully developed young ones in their mouths. Their sizes ranged from 510 to 670 mm (average length 573.6 mm) with a mode at 589 mm and their weight varied from 1.7 to 4.0 kg with an average weight of 3.038 kg. In a sample of 30 fishes examined, the number of young ones varied from 2 to 101, with an average of 22 per fish. This indicates that the species could hold in their oro-buccal cavities as high as 100 or even more developing eggs ensuring perhaps a high hatching and survival rate. They ranged from 58 to 78 mm in total length with a mode at 67 mm (Fig. 1) and weighed between 2.7 to 4.3 g. Majority of them were fully developed, while in a few, the yolk-sac was not fully absorbed and appeared like long slits on the ventral side through which the yellow coloured unabsorbed yolk-sacs could be seen (Fig. 2).

Majority of the catfish landed had spewed out most of their young ones consequent upon their encirclement and subsequent struggle when thrown on the deck. Based on an average of 22 young ones per fish, a rough estimate of young ones destroyed amounted to 1.65 lakh in a single seining operation.

* Prepared by C. Muthiah and G. Syda Rao, Mangalore Research Centre of C. M. F. R. I.

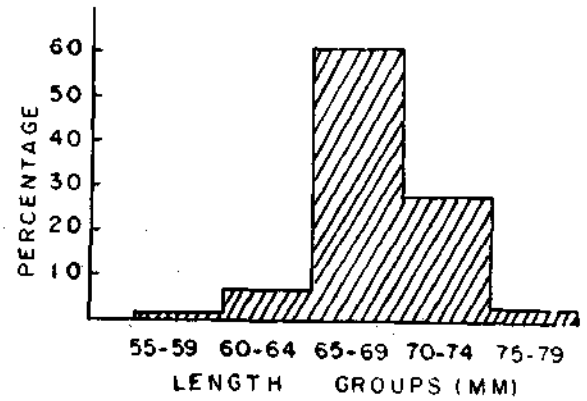


Fig. 1. Length-frequency of young ones of *T. dussumieri.*

Fig. 2. Unabsorbed yolk-sac on the ventral side of young ones of *T. dussumieri.*

Since majority (79%) of the young ones were in the 65–70 mm size group, it appears that all belong to the same spawning batch. The ova-diameter studies of ovaries in stage V maturity condition (Fig. 3), made during January, 1982 and the bimodal nature of development of eggs lend confirmatory evidence to such a view. The mode *a* at 4 mm representing immature group is clearly separated from the maturing group *b* with a mode at 14 mm destined to spawn in February.

Earlier observations along the Mangalore coast show that this species spawns only once a year during the period from December to March with peak in February. Juveniles measuring from 56 to 68 mm in total length in the oro-buccal cavities of *T. dussumieri* caught in a bag net operated in 15 to 40 m depths off Malpe and Gangulli have been recorded. Experiments conducted by the authors on the rearing of eggs of a much smaller catfish, *T. tenuispinis* (the ripe eggs of both the species have more or less the same dimensions) have shown that the embryos (8 mm in length) attained 30 mm in a period of 17 days at the time of hatching. Under natural conditions this period would be still shorter. As such it could be assumed that the young ones (58–78 mm) of *T. dussumieri* might be the product of spawning of February.

Fecundity studies of eight ovaries in maturity stages IV and V carried out in January, 1982, revealed the number of eggs varying from 176 to 207 with an average of

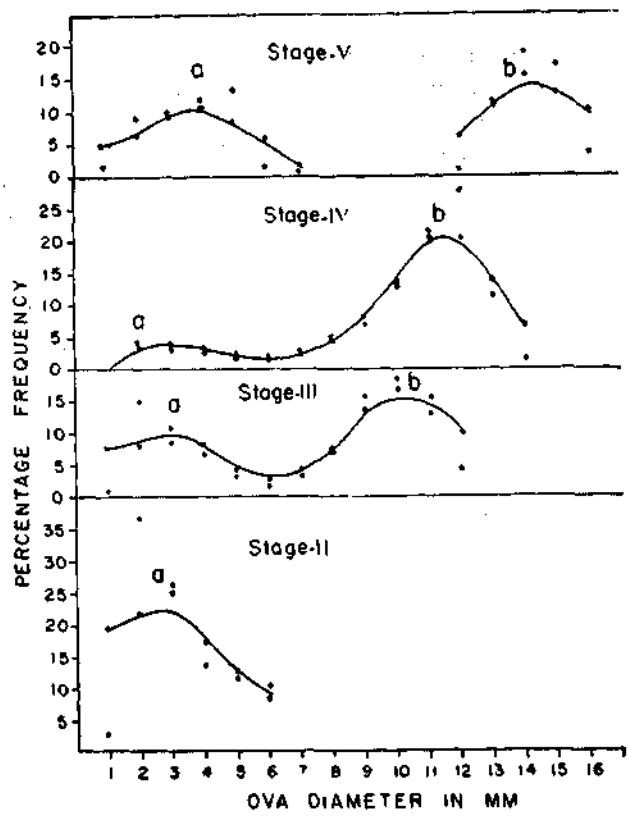


Fig. 3. Ova diameter-frequency of *T. dussumieri.*

190. In the light of the fact that a fish can hold 101 young ones in its buccal chamber as stated earlier, the survival rate for an average of 190 eggs works out to about 53%.

Mojumder *(Indian J. Fish;* **25**: 109-121, 1978) collected larvae measuring 20–30 mm of *T. thalassinus* with yolk-sac attached, from inshore waters of Lawson's Bay, Waltair. This indicates that *T. thalassinus* releases the young ones from its mouth when they are smaller in size as compared to *T. dussumieri* which retains the young ones measuring upto 78 mm in their mouth as evidenced from the present observations.

We are thankful to Dr. E. G Silas, Director, Central Marine Fisheries Research Institute, Cochin for his interest and encouragements. Thanks are due to Dr. B. Krishnamoorthy, Head, Demersal Fishery Division for critically going through the manuscript and to Shri. M. H. Dhulkhed for his valuable suggestions.

AN UNUSUAL OCCURRENCE OF OIL SARDINE IN PONDICHERRY ON EAST COAST OF INDIA*

Introduction

The Indian oil sardine, *Sardinella longiceps* Valenciennes which forms 10 to 18% of the total fish landings in India, usually occurs in shoals along the west coast of India. Only stray catches of oil sardine have been reported from the east coast. But there has been no report of its occurrence along the Pondicherry coast on the east coast except for one report in 1847 by Valenciennes from the collection of Dr. Bellenger. The only specimen measuring 15 cm collected at Pondicherry was discoloured and in bad state.

During October–December, 1983 unusual landing of oil sardine in good quantities were noticed in Pondicherry state and the present report gives a brief account of the fishery.

Catch details

Altogether 57 t of oil sardine were landed during this period. The details of catch landed in three zones in the state are given in Table 1.

It is seen from the above table that the maximum landings of oil sardine was observed in November '83, the catches of this fish in October '83 being negligible. The Zone-P_1 contributed more to the total landings than Zone P_2. The landings of oil sardines in December was poor since the fishermen preferred prawn fishing.

Table 1. *Catch details of oil sardine along the Pondicherry coast (in kg)*

Zone	Oct. '83	Nov. '83	Dec. '83
P_1	—	28,353	5,625
P_2	200	14,010	9,850
Total	200	42,363	15,475

The shoals were caught in the gill nets in depths of 6 to 8 meters just one kilometer from the shore. On 25–11–'83 the shoals were sighted very near to the shore at Pillaichavadi (Zone-P_1) which tempted the fishermen to operate the shore seine net. However, only small quantities of oil sardine were caught as the operation of shore-seine was not quick enough to encircle the shoals. Another important feature noticed was that the shoals which remained in 6 to 8 meters depth did not move to deeper areas. This was evidenced by the non-occurrence of oil sardine in the gill net that operated in deeper areas of 20 to 25 meters depth. This enabled the fishermen to choose one of the following two, either fish for oil sardines close to the coast or for other fishes in deeper areas depending upon the price available for them in the market.

The oil sardines were caught by *catamarans* using *kavala valai* and *thattakavala valai*, with the mesh size ranging from 2.5 to 4 cm. However, the fishermen preferred only *kavala valai* which has a mesh size of 3 cm for it was more efficient in catching oil sardines. From the observations made, it was found that the catches from *thattakavala valai* were bigger in size.

Biological Observations

The fishes caught in the *kavalavalai* ranged between 140 and 164 mm with the dominant size around 150 mm. The size range of fishes caught in the *thattakavala valai* was between 154 and 202 mm with majority around 170 mm.

The size range in November was from 144 to 202 mm, while in December the range observed was from 142 to 162 mm. It is presumed that the shoals belonged to the 1st, 2nd and 3rd year groups. Females outnumbered the males and were immature being in first and second stages of maturity.

General observations

The sea around Pondicherry is usually rough and in tubrid condition during the northeast monsoon

* Prepared by S. Srinivasarengan, MRC of C. M. F. R. I., Madras and L. Chidambaram, Field Centre of C.M.F.R.I., Pondicherry.

period, especially in the month of November. Further, during this period, under water drift locally called *vannivellam* flowing towards south used to be observed. However, during the period of present observations *sonivellam* alias *thentivellam* (drift flowing towards north) was strong instead of the usual southward drift *(vannivellam)*. This was an unusual feature at this coast during monsoon months especially in November. This feature might have been a cause for the abundance of oil sardine in large quantities along the Pondicherry coast.

We are grateful to Dr. E. G. Silas, Director for encouragement and Shri G. Venkataraman and Shri D. S. Rao for critically going through the manuscript and giving suggestions for the improvement of the report.

Compiled and prepared by Dr. M. J. George, Dr. K. J. Mathew, Mr. G. Nandakumar &Miss Jancy Jacob
Published by Dr. M. J. George, Senior Scientist on behalf of the Director, Central Marine Fisheries Research Institute, Cochin-682 018 and printed at PAICO, Cochin-31