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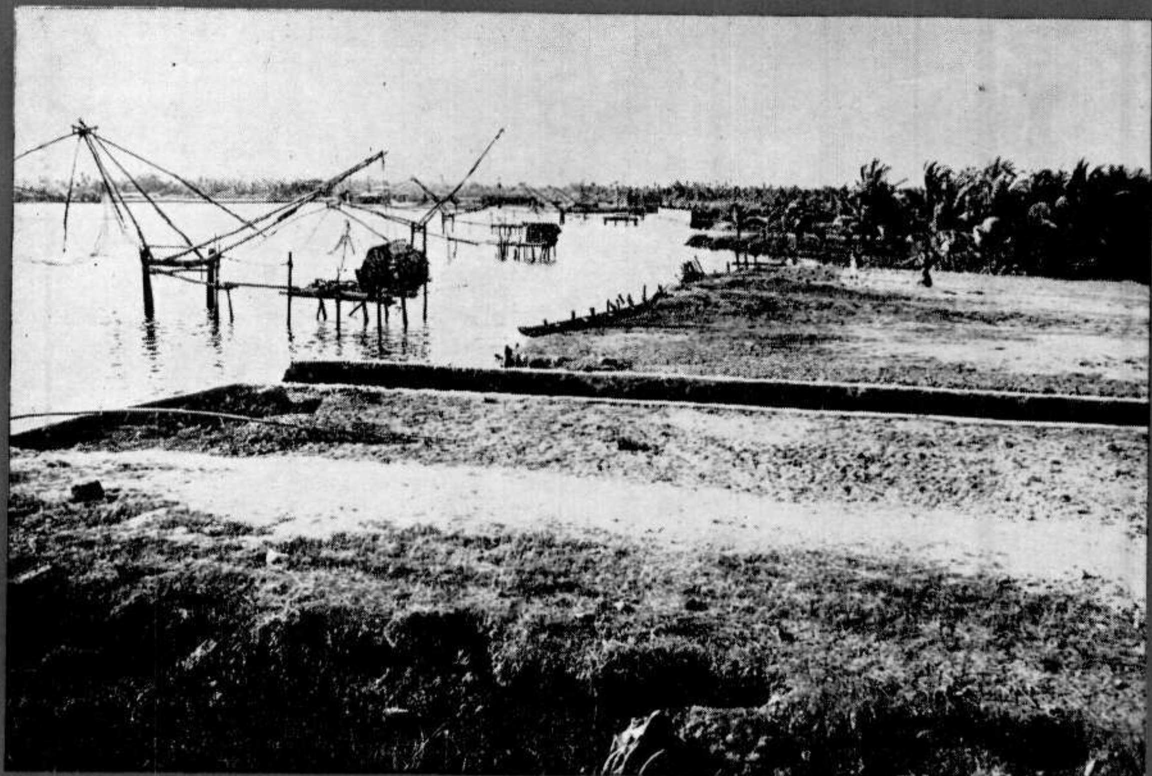

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THE MARINE FISHERIES INFORMATION SERVICE: Technical and Extension Series envisages the rapid dissemination of information on marine and brackish water fishery resources and allied data available with the National Marine Living Resources Data Centre (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.

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Front cover photo:

Reclamation of shrimp nursery areas in progress at Cochin

Back cover photo:

Another view of extensive reclamation in Cochin backwaters

IMPACT OF ENVIRONMENTAL CHANGES AND HUMAN INTERFERENCE ON THE PRAWN FISHERY RESOURCES

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Introduction

Although the marine prawn production of India has shown phenomenal increase over the past two decades, year to year fluctuations in the landings are a common feature noticed during the last few years. Many possible reasons have been attributed to this and the general conclusion is that the unsteady nature of production, in several areas, is due to fishery independent factors. Depletion of stock due to overfishing has also been suspected in some of the heavily exploited areas of the west coast. In this context it is worthwhile to examine the impact of various changes occurring in the environment and human interference (other than fishing) on the natural stock of prawns so that necessary protective measures could be taken to ensure sustainable yield.

It is a well established fact that the commercial prawn fishery of our waters is dependent on two distinct environments having different ecological features, *viz.* the sea and the estuaries. The adults of these prawns breed in the sea and the postlarvae migrate into estuaries and backwaters where they grow fast and return to the sea on reaching adulthood. The important species occurring in the marine as well as estuarine environments are *Metapenaeus dobsoni, M. affinis, M. monoceros, M. brevicornis, Penaeus indicus, P. monodon, P. semisulcatus* and *P. merguiensis.* The giant freshwater prawn *Macrobrachium rosenbergii* and a few other species of the same genus utilise the brackishwater areas for breeding purpose.

The major brackishwater systems of India include the estuaries of river Ganga, Mahanadi, Godavari, Krishna, Cauvery, Narmada and Tapti and the lakes such as Chilka Lake, Pulicat Lake, Ashtamudi Lake and Vembanad Lake with their connected backwaters. All of them are permanently connected to the sea and are subjected to strong tidal influence and mixing of freshwater influxes. Besides these, there are innumerable small estuaries also distributed all along the west and east coasts, having perennial or seasonal connection with the sea. All these areas are good nursery grounds for many species of prawns that support commercial fisheries in the adjoining seas.

As in the case of any other aquatic organisms, the biology of prawns is closely governed by the physico-chemical conditions of the environment in which they live. Due to the rapid advancement in civilisation, many kinds of changes are brought about in their habitats by natural as well as unnatural processes. The impacts of such changes on the prawn resources are enumerated below.

IMPACT OF ENVIRONMENTAL CHANGES ON THE PRAWN RESOURCES

Generally speaking, the ecological conditions of prawn's habitats in the sea are not easily affected by external influences to cause deleterious effect on these animals except in extreme cases. In the small, shallow water areas like the estuaries, on the other hand, frequent changes in the environmental parameters are quite common and they have profound influence on the life processes of the estuary-dependent species. The major factors regulating the recruitment, survival and growth of the juvenile prawns in these environments are: opening and closing of the barmouth, tidal effect, water circulation and currents, temperature, salinity and other chemical properties, turbidity, fertility, vegetation and the nature of the substratum.

Environmental changes are brought about by two different ways, *viz.* by natural causes and by human interference. The former may include physical changes in the bar openings, unpredictable weather conditions leading to heavy floods and droughts and prolific growth of undesirable aquatic weeds. The important changes brought about by the activities of man are those caused by (1) large scale reclamation, bulkheading and filling and dredging, (2) engineering works such as construction of barrages, salt-water barriers, spill-ways *etc.* and (3) water pollution caused by various factors.

Formation of sand-bars across the opening of estuaries and lakes

Formation of sand-bars across the opening of small estuaries and other coastal ecosystems is a common feature noticed along Indian coasts during the summer period. The barmouth establishes proper connection with the sea in the beginning of monsoon season as a result of the flushing of rain water into the sea and remains open till the end of that season. During the land-locked condition after the monsoon period it is natural that the movement of penaeid prawns between the two environments is totally arrested, and this could ultimately result in low production of prawns in the fishing grounds. The closure of bar mouth also brings about adverse conditions to the impounded prawns, due to stagnation of water, low oxygen, high temperature and excessive increase in the salt contents beyond the tolerance limit, on account of extreme evaporation.

Floods and droughts

Occurrence of heavy floods in the estuaries and riverfed backwaters during the monsoon period gradually reduces the distributional range of juvenile prawns in those areas. Field studies conducted by the author on the seasonal distribution of penaeid prawns in Vembanad Lake in Kerala have shown that juveniles of *Penaeus indicus* disappear from the upper reaches along with the discharge of monsoon flood and recolonise these areas again after the rainy season is over. The prawns recruited into this environment during the monsoon period fail to penetrate the interior areas due to the strong flow of freshwater and also possibly due to the very low salinity conditions brought about by this physical change.

Extreme cases of drought pose serious problems to the prawns that live in salt-water pools and shallow impoundments. Here, due to the high rate of evaporation the temperature and salinity of the water increase considerably and the prawns become exposed to conditions beyond their tolerance limit.

Prolific growth of aquatic weeds

Presence of moderate amount of vegetation is an essential factor in any aquatic environment as it increases the productivity and provides food as well as shelter for many organisms including prawns. However, excessive growth and accumulation of undesirable weeds in the water can have harmful effects as well, since they reduce the tidal effect, light penetration and photosynthetic oxygen production in the ecosystem. A typical example of this phenomenon is the infestation of the African weed *Salvenia auriculata* in the fresh and brackishwater areas of Kerala. This exotic weed multiplies enormously in the freshwater systems and are transported to the backwaters and lagoons during the monsoon season. In the postmonsoon period when the river flow is low, tidal water carries large quantities of the weed upstream, building up stagnant blankets over the backwaters where they undergo decay due to salinity and get deposited at the bottom. Besides being a hindrance to various aquatic activities, this plant is a biological menace as it depletes the oxygen and nitrates in the water column and changes the nature of the bottom by depositing decayed parts. The depletion of oxygen occurs by different ways such as (1) formation of the thick mat-like covering on the water surface preventing mixing of atmospheric oxygen with water and light penetration thereby affecting photosynthesis of algae and diatoms and (2) decaying of the dead plants at the bottom. This can make the affected areas unsuitable for the growth of young prawns.

Land reclamation, bulkheading and filling and dredging activities

One of the major changes now taking place in many parts of the brackishwater systems of our country is the large-scale reclamation of water areas for agriculture, aquaculture and other purposes. While some of these activities are in connection with the various developmental schemes of the Government, like the few that could be seen progressing in Cochin backwaters at present, many are undertaken by private parties, either legally or illegally, without any control. These activities not only reduce the total acreage of the shrimp nursery grounds but also considerably alter the physical features like tidal flow, water circulation and current, which in normal cases together act and make the environment congenial for the prawns. Similarly, bulkheading and filling of shorelines and shallow salt-water areas undertaken as part of the water front development programmes in urban coastal areas also have their bad effects if carried out in an unplanned manner. This is particularly a problem which has relevance to the postlarval and early juvenile prawns that inhabit mostly the surf-beaten submerged sea-shores and shallow marginal areas of the backwaters.

Various dredging activities associated with clearing of navigational channels, mining of mineral resources like fossil shell deposits, and filling process are quite common in the marine and estuarine areas inhabited by prawns. Dredging in shorelines is most destructive of marine habitats. Prawns being bottom dwellers, feeding on the rich organic substances available at the bottom, are affected by the depletion of biological productivity due to increased silt load and turbidity in the areas disturbed by dredging.

Construction of barrages, salt-water barriers and spillways

The most important among the various activities of man which cause changes in the natural habitat of prawns are the construction of engineering structures on river basins and estuaries, such as barrages, saltwater barriers, stream diversion spillways and tide control structures. These projects may alter the entire physico-chemical conditions of the ecosystems, particularly of estuaries and backwaters, and reduce the nursery areas of prawns by restricting the influx of sea water. This results in impeded exchanges of fresh and saltwater, loss of tidal exchange benefits, change in water circulation pattern affecting the distribution of salinity, temperature, *etc.* and lessening of average depth. Salinity being the most affected parameter in these cases, the pattern and extent of its variation modify the distribution of juvenile penaeid prawns as well as the estuary-dependent breeding population of palaemonids.

The Thanneermukkom Bund Project of Vembanad Lake in Kerala is an ideal example for such barriers put in the natural brackishwater environments, which have considerably influenced the prawn resources. This bund was constructed in 1976 to prevent saline water from the sea entering the extensive paddy fields of Kuttanad area in Central Kerala. While this has considerably helped to augment the paddy production of the State, it has also brought in a number of problems concerning the natural resources of the lake and the socio-economic condition of the people inhabiting that area. Since the tidal flow was completely arrested by the bund and the salinity reduced to almost zero level, the penaeid prawns became very scarce in the lake beyond Thanneermukkom. Experimental try-net fishing conducted by the author on either side of the bund during the peak summer period (February–April) of 1977–'79 yielded only less than 5 prawns/haul in the freshwater side as against an average of 110/haul recorded from the saltwater side. Because of the drastic reduction in the abundance of penaeid prawns beyond the bund, all the stake nets and dip nets used for catching the prawns in that area had to be removed after closure of the shutters in 1976. In the saltwater side also the prawn production in the areas nearer to the bund has considerably declined due to the reduced tidal effect and therefore most of the fishermen engaged in prawn fishing there have now taken up other avocations.

Water pollution

Aquatic pollution is a serious and growing threat to the living resources of our waters and also to human health. Although the extent of biological effects of pollution on the animals living in large water-bodies like the ocean are not fully understood, there is increasing evidence to believe that it can cause havoc to those occurring in estuaries and other nursery areas which are more prone to pollution than the sea. Some of the possible effects of aquatic pollution on animals including prawns are: (1) large-scale mortality, (2) reduced rate of growth and survival, (3) retarded maturation and inhibition of spawning, (4) reduced rate of egg production, (5) uptake and accumulation of toxic substances and other pollutants making the animal unfit for human consumption and (6) reduced quality and export value of the product.

The marine and brackishwater environments constantly receive several kinds of pollutants, directly or indirectly. While some of the pollutants are leached out from the land and carried by rivers to the estuaries and coastal waters, others are deliberately introduced by man. Some are also transported by the atmosphere and ultimately washed down by rain. The important pollutants that reach these environments are: pesticides, various types of industrial effluents containing heavy metals and toxic chemicals, municipal and domestic sewages, oils and oil dispersants, heated water and radio-active wastes. To some extent pollution of water also occurs as a result of large-scale retting of coconut husks and other materials in stagnant backwater areas.

Large quantities of pesticides like DDT and its derivatives used for agricultural and public health purposes find their way into the estuaries and coastal waters. While the concentration of these pesticides in the open waters are lowered by dilution, in areas with reduced circulation, mortality of animals occur at all levels. Crustaceans are particularly sensitive to these chemicals which in concentration as low as 0.003 ppm have often been found to be lethal to shrimps. Fishes and shellfishes containing high concentration of DDT (above 5 ppm) are considered to be unfit for human consumption.

Industrial effluents containing a number of inorganic wastes such as acids, alkalies, ammonia, mercury, chromium, copper, lead, arsenic *etc.* and several synthetic organic compounds, detergents and organic wastes are periodically discharged into the water, which are potentially harmful to aquatic life. Although fish and crustaceans can detect concentration of acids and alkalies much below the toxic level and thus avoid areas of contamination, higher doses can corrode their gills affecting respiration and eventually leading to death. Consumption of fish and shellfish having high concentration of mercury (methyl mercury) has been reported to have caused dangerous diseases among people in Japan and other countries. In Sweden, fishes with more than 1 ppm mercury are considered to be unfit for human use. Many synthetic organic compounds like polychlorinated biphenyls (PCB), chlorinated hydrocarbons and organophosphorus are highly toxic to fishes, prawns and various planktonic organisms and therefore leaching of these compounds into estuaries and inshore waters is detrimental to the ecosystem. Contamination with organic wastes discharged from the paper factories, seafood processing units *etc.* can interfere at various trophic levels in the food chain by increasing the Biological Oxygen Demand and consequent depletion of oxygen in the water, which ultimately lead to reduction in the fishery resources.

Dissolved and suspended organic constituents of the municipal and domestic sewage could increase the productivity of the environment, but when accumulated excessively they cause oxygen depletion and other unfavourable conditions to aquatic life. They are also known to harbour many pathogenic bacteria and viruses, and human life may be endangered by eating the prawns contaminated with them. There have been several reports of outbreak of hepatitis, polio, cholera and other enteric diseases by eating shellfish contaminated with these pathogens.

Oil pollution of marine and estuarine environments can occur from various sources such as accidental spills from tankers and offshore wells, nearshore ship operations, urban and industrial sewage effluents and also through the atmosphere. When oil is released into the water, the lighter fractions evaporate and with the residues a water-in-oil emulsion is formed over the surface. In the sea, this spreads to extensive areas by wind, waves and tides and gradually reaches the beach. A film of oil on the water surface acts as a barrier to exchange between water and atmosphere. This reduces the dissolved oxygen content in the water which affects the planktonic larvae. Direct contact of oil with the respiratory organs weakens or kills the animals. The oil, polluting the shores may damage the small juvenile prawns by smothering them and cutting off respiratory exchange and by interfering with their movement and ability to withstand wave action. Oil is also known to affect the hormone system responsible for the reproduction and behaviour of larger crustaceans like lobsters and crayfishes. The oil spill in the Lakshadweep Sea from the American oil tanker 'TRANSHURON' is reported to have caused serious damages to living organisms in the polluted zone. Due to the formation of thick layers of oil in the lagoon and the wide spread deposit of tar-like paste along the beaches and intertidal areas of Kiltan Atoll, mass mortality occurred among planktonic organisms and benthic animals including lobsters and crabs. Considerable depletion in the population of planktonic decapods has also been reported from the Madras coast as a result of oil spills occurring during transport of oils and from ocean liners, tugs and mechanised fishing vessels.

Thermal effluents discharged from power plants and other shore-based industries may cause serious environmental stress in shallow estuaries and backwaters. The added temperature brings about local increase in salinity which in turn reduces the oxygen content in the ecosystem. Rise in temperature can also intensify the toxicity of other pollutants and increase the susceptibility of prawns to diseases.

Radioactive wastes dumped into the ocean are potentially very dangerous to the marine organisms. Prawns being bottom dwellers feeding on suspended detritus, are likely to ingest radioactive substances also along with the food, and they may get concentrated in the body tissue. These substances are highly mutagenic and carcinogenic and can also affect human beings indirectly.

The various types of pollution discussed above will have far reaching effect on the prawn fishery resources of our waters. Due to the rapid technological advancement and urbanisation most of the nursery areas of commercially important prawns get badly polluted. The Hooghly Estuary down stream from Calcutta receives the wastes from about a hundred industries. Other polluted coastal areas are near Bombay, Trivandrum and the outlets of the rivers Krishna, Godavari, Cooum and Chaliyar. The effluents from the industrial complex at Alwaye and nearby areas poured into the Periyar River flow through the backwaters enroute to the Arabian Sea and pose serious threat to the fish and prawn population of the estuary and inshore waters of the Kerala coast. Large scale mortality of fishes and other organisms due to the contamination of industrial effluents has been reported from Cochin backwaters, Chaliyar river and other estuarine systems.

IMPACT OF LARGE-SCALE CAPTURE OF PRAWN FRY FOR FARMING

In recent years prawn culture has been receiving increasing importance all over the country for augmenting production for export purpose. One of the major requirements for undertaking large-scale farming is the availability of the seed of desired species. Presently this problem is solved by capturing the post-larvae and small juveniles from the surf, estuarine and backwater regions. These small fry (measuring upto about 40 mm) are collected by using velon screen drag nets and a number of other devices from the shallow nearshore areas where they mostly concentrate. In these areas the young ones of several species of prawns contributing to our commercial fisheries occur in different compositions. Since the prawn farming is mainly aimed at culturing large growing species like *P. indicus* and *P. monodon*, millions of young ones of smaller species belonging to the genus *Metapenaeus* obtained in the seed collections are often discarded. Apart from the fact that uncontrolled exploitation of the young ones from their natural nursery areas itself is a destructive process, as it can adversely affect the fishery of adult prawns, the heavy damage caused to the smaller species incidental to the procurement of larger ones is a problem that deserves more concern in the context of conservation of the resource. Since large scale exploitation of prawn fry from the wild for farming purpose is only of recent origin, the extent of its impact on the capture fisheries is yet to be evaluated.

Conclusion

It is evident from the foregoing account that apart from the usual changes associated with the commercial fishing activities, the prawn resources of our coastal waters are faced with several problems which deserve due consideration in the context of conservation of the resource. As the prawn fishery of the marine region is largely dependent on the emigrating sub-adults of the adjacent brackishwater areas, the reduction in the juvenile stock brought about by the various environmental and external influences will have serious impact on the coastal fishery. When compared with the sea, the estuaries play a more prominent role in the life and survival of the prawns, but at the same time such areas are vulnerable to human alterations which ultimately lead to the deterioration of the resource.

The problem of aquatic pollution is becoming more and more acute everyday in most of the major nursery grounds and large-scale mortality of fishes and other organisms due to environmental contamination are increasingly reported. Although specific instances of mass mortality of prawns due to these changes are not reported from any of the natural environs, probably because the dead prawns remain at the bottom and do not float up like fish, the increasing tendency of many productive areas like the Cochin backwaters getting polluted by industrial effluents and other harmful substances is alarming. Oil pollution in Indian seas has reached to such an extent that the northern region of the west coast has now become one of the world's most highly contaminated parts, with petroleum hydrocarbons. The Maharashtra coast which comes under the spell of this serious situation is one of the richer prawn producing areas of the country and how far this rate of oil contamination will affect the productivity of this coast deserves attention.

AN ACCOUNT ON THE SUB-FOSSIL SHELL DEPOSITS OF KOVALAM BACKWATER*

Vast stretches of sub-fossil deposits of molluscan shells have been found excavated by the people of Padur village around the Kovalam backwater area. The shell deposit *stratum* extends over an area of about 2.0 x 0.5 km on the western bank of the backwater from the Kovalam bridge to Muttukadu bridge (Fig. 1), and the shell deposits are rarely found on the eastern side of the backwater.

*Prepared by R. Thangavelu, K. Rangarajan and P. Poovannan, Madras Research Centre of CMFRI, Madras.

The detection of shell deposits is done by piercing a probe (iron rod or wooden pole) pointed at one end,

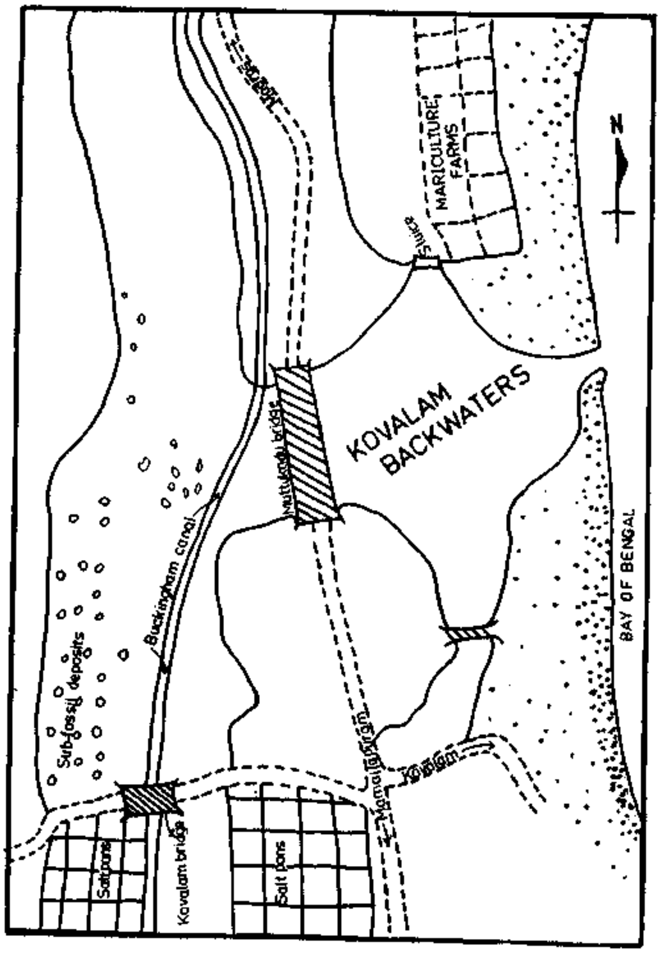

Fig. 1. Sub-fossil shell deposits of Kovalam backwater.

with a handle at the other. The dislodging of shells is usually done during the low tide. Excavation of shells is more intensive on the western side of the backwater from the bank to about 300 m width towards the water spread area than on the eastern side. Men and boys are engaged in excavation. Usually 4 or 5 persons group together and start to excavate the shells by means of spade and crow-bar (Fig. 2). The size of each pit is 2–3 m in length and 1.5–2 m in width (Fig. 3) depending upon occurrence of shells. Water percolates into the pit. After reaching the shell-strata cane baskets are used to scoop out the shells along with mud and sand. A basket lifted from the pit may contain about 50% of shells and 50% of mud. The shells in the basket are sieved to remove the sand and mud, and put in heaps (Fig. 4) within easy reach of the boat. After cleaning again in the water, the baskets full of shell are carried by head-loads to the bank of the estuary by women.

From each pit about 1,000 to 1,500 kg of sub-fossil shells are obtained. Each basket of 20 kg shells is sold at Rs. 4.50 and thus each tonne of shells realises a price of about Rs. 225 in the site. One lorry load of shells costs about Rs. 700/- at Kovalam and Rs. 1,000/- at Madras including transportation costs. After baking into lime, one tonne of lime is sold for Rs. 600/- in the local market of Kovalam. The sub-fossil shells baked

Fig. 2. Method of excavation of shells.

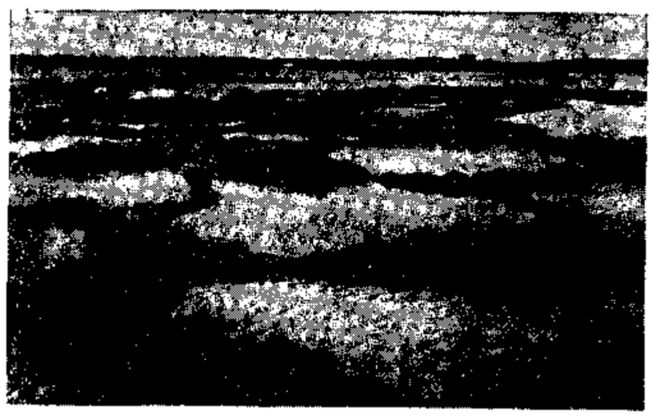

Fig. 3. Shell pits of Kovalam backwater area.

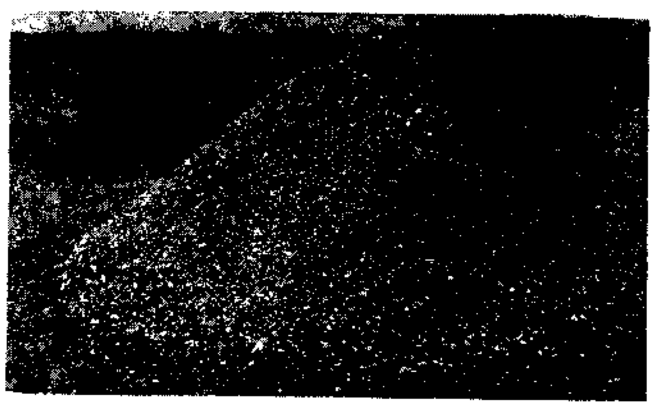

Fig. 4. Heaps of shells excavated from the pits.

into lime are used for white washing or building construction. Shells are also used for preparing poultry grit to a certain extent.

Shell deposit composition estimated from random samples of sub-fossils collected from different areas of the Kovalam backwater is given as follows:

Genera	Percentage
Cerithidium	64.24
Meretrix	15.33
Crassostrea	8.03
Umbonium	4.38
Arca	2.19
Window-pane oyster	1.46
Other gastropods	1.46
Cardium	0.72
Tellina	0.72
Miscellaneous	1.46

In almost all places of the backwater of Kovalam, the gastropod shell *Cerithidium* ranks first in the sub-fossils, whereas in a few places the oyster shells constitute to about 25 to 35%.

The regular season of exploitation starts during January and extend till the end of July, with seasonal fluctuations in the trend of exploitation. About 200 people from Padur village are engaged in this profession, excavating about 40 to 50 tonnes/day during the peak season March–May, and they are unemployed for most of the days during the offseason.

We are thankful to Dr. P. S. B. R. James, Director and Dr. K. Alagarswami, Joint Director, C. M. F. R. Institute for their encouragement. Thanks are due to Dr. S. Ramamurthy, Officer-in-Charge, Madras Research Centre of C. M. F. R. I., Madras for extending all facilities in preparing this report.

ON AN UNUSUAL CATCH OF BIGEYE SCAD *SELAR CRUMENOPHTHALMUS* (BLOCH) IN SHORE SEINE AT VIZHINJAM*

An unusually heavy catch of the carangid *Selar crumenophthalmus* (Bloch) was obtained close to the shore at Vizhinjam on 3rd December, 1985. The bumper catch was landed by shore seines operated on the southern side of the Inspection Bungalow of the Vizhinjam Harbour Project. This area is a short stretch of sandy beach caved into the rocky shore (Fig.1). Here fishing activities are normally scarce and one or two shore seines may be operated in a day, that too occasionally.

On 3rd December, 1985, this beach became very active and continuous operation of shore seines was noticed. In the morning of that day, some fishermen who started shore seine fishing, sighted a huge fish shoal close to the shore. The first haul itself was quite encouraging and the news immediately spread around. All the shore seine units available in the village were brought to the centre and were soon put into operation. Even before one net was completely hauled up, another was cast around the first one. Likewise 2-3 nets, one encircling the other, were in the sea at the same time. The fishing activities started at about 0800 hrs and continued till around 1900 hrs and 10 units were operated during this period at the same area.

*Prepared by P. N. Radhakrishnan Nair and N. Gopalakrishna Pillai, Vizhinjam Research Centre of CMFRI, Vizhinjam.

The catch

The shore seines were operated within one kilometre from the shore (Fig. 1). The total catch was estimated to be around 33.4 tonnes caught by 10 units. The catch per effort was thus 3.34 tonnes. The catch in individual units ranged from over half a tonne to say 11 tonnes. The number of fish in each effort ranged from 3,500 to 57,100; totalling to 1,75,650 fish. The total catch by weight, number of fish in each effort, *etc.* are presented in Table 1.

The catch was exclusively of the single species of carangid *Selar crumenophthalmus* (Bloch) commonly known as Bigeye scad and locally called 'Kannan kozhiyala' (Fig. 2). Such a huge catch of bigeye scad has never been observed in this area during the past years. Also, the shoals were present in the coastal waters only for one day.

Fig. 1. A view of the landing centre and the fishing activities.

Table 1. *Total catch of* Selar crumenophthalmus *by weight* (kg) *and by number caught on 3rd December,* 1985 *at Vizhinjam in each unit of shore seine along with total income and price rate. (The serial number of units is not in sequence of operation)*

Gear unit	Catch by wt (kg)	Number of fish	Total income (Rs.)	Average cost per fish (Rs.)
1	4,351	22,900	22,500	0.98
2	1,414	7,440	12,100	1.63
3	1,049	5,520	5,000	0.91
4	718	3,780	5,200	1.38
5	2,048	10,780	16,000	1.48
6	994	5,230	5,000	0.96
7	665	3,500	4,700	1.34
8	6,536	34,400	34,000	0.99
9	4,750	25,000	25,000	1.00
10	10,849	57,100	55,000	0.96
Total	33,374	1,75,650	1,84,500	1.05

Biological observations

Length measurements of random samples revealed that the size of fish ranged from 210 to 300 mm in total length with an average size at 252 mm. Nearly 70% of the fish ranged between 240 and 269 mm. The major mode was located at 255 mm. Two minor modes, at 230 and 280 mm were also noticed (Fig. 3).

The fish collected for biological studies showed that the weight of individual fish ranged from 110 g for a fish measuring 210 mm to 259 g for a fish of 283 mm total length. The average weight of fish was 190 g. The length-weight relationship of the fish was analysed based on 50 fish. The length-weight formula was derived as–

$$\log W = -5.1550 + 3.0954 \log L \quad \text{or}$$

$$\overline{W} = 0.000006998\ L^{3.0954}.$$

The correlation coefficient ('r' value) was found to be r = 0.9692. The length-weight plot is given in Fig. 4.

Stomach content analysis of the samples showed that the percentage occurrence of stomachs in different degrees of fullness was 38% $\frac{1}{2}$ full, 30% $\frac{1}{4}$ full and 32% empty. This shows that majority of the fish (62%) was in poorly fed condition. The food items were mainly pteropods (8%) and semidigested and digested matter (91%) with a few fish scales (1%).

Fig. 2. A portion of the bumper catch.

In the analysis of the maturity stages of the fish examined, 6% immature, 38% resting, 52% maturing and 4% mature gonads were noticed. The sex-ratio between males and females was 46:54.

Disposal of catch

From the landing centre the fish was loaded in canoes and brought for auctioning to the main fish landing and marketing centres situated inside the Vizhinjam bay. The fish from a single unit was auctioned in different lots. The price of a single fish in a lot was fixed through open bidding and later raised to the total number of the fish in that lot. By this method of auctioning the actual count of the fish per effort could be conveniently available from the owners of the gear.

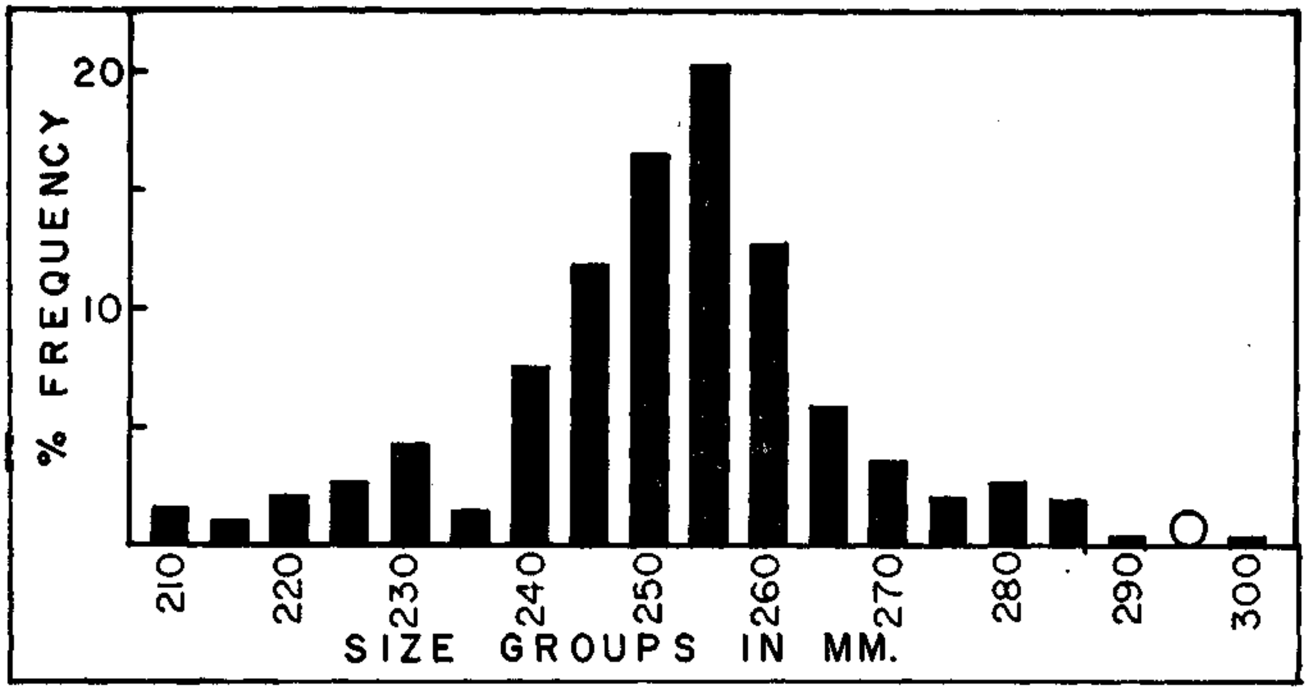

Fig. 3. The percentage size-frequency distribution of *Selar crumenophthalmus* from shore seine at Vizhinjam on 3-12-1985.

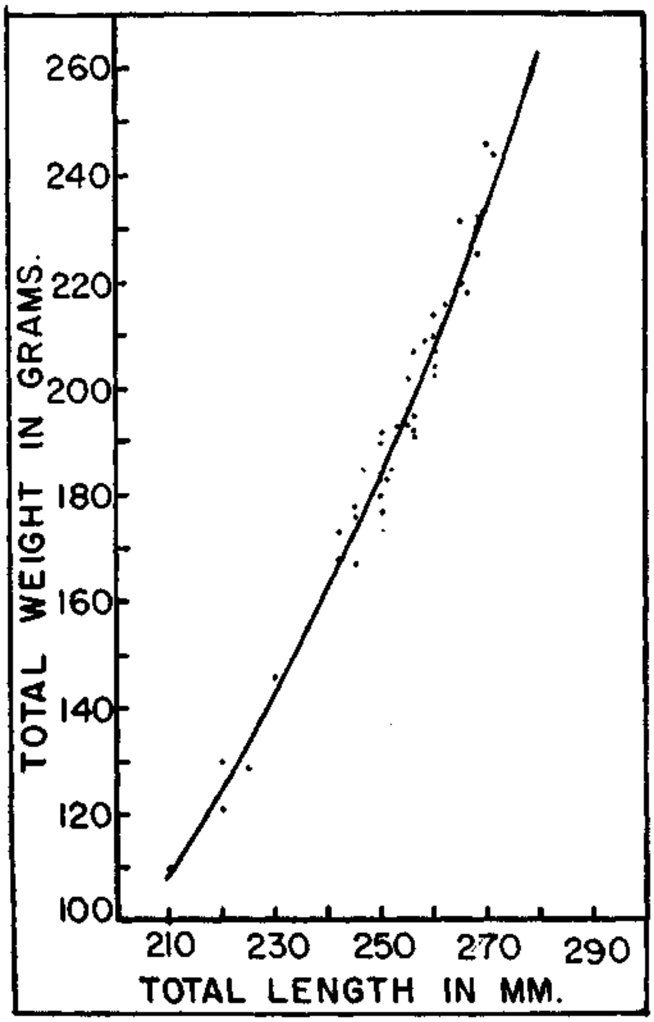

Fig. 4. Length-weight plot of *Selar crumenophthalmus* from shore seine at Vizhinjam on 3-12-1985.

From this the catch by weight was computed later. The price of a fish varied from Rs. 1.60 in the morning to Rs. 0.50 in the evening when more and more catch came ashore. The sale figures obtained later from the owners showed that the day's income from this bumper catch was around Rs. 1,84,500. From this the average price of a fish could be calculated as around Rs. 1.05 (Table 1). The fish in fresh condition was moved to the local markets by small traders, but bulk of the catch was iced and transported to the major fish markets at Trivandrum, Balaramapuram, Neyyattinkara *etc.*

Remarks

S. crumenophthalmus forms a fishery at Vizhinjam during August to March with a peak period from November to March. In some gears it has been observed in very small quantities in April to May also. In 1985–'86 the season started in June and was continuing with gaps in July and October, and the estimated catch, excluding the present bumper catch, during June to December, 1985 was 53.7 tonnes. On an average the annual contribution of this species to the total carangid catch was estimated as 5.3%.

The Bigeye scad generally does not come so close to the shore, but occasionally it reaches the inshore area in small schools and is caught in shore seines. This fish is normally caught in drift net, boat seine and hooks and line. The studies conducted at Vizhinjam since 1980, on the resources of carangids, have shown that the percentage of catch of Bigeye scad by these gears is 52.2 by drift net, 20.4 by hooks and line and 20.2

by boat seine. All these gears are normally operated at 20–30 fathom depth zone, 4–5 km away from the shore. In shore seine its percentage of catch is only 7.2. Neither the condition of the gonads nor the food of the fish sampled gave any clue for possible migration of the fish in such huge shoals into the shallow waters. Similarly, the hydrographic studies also showed that the water properties such as surface temperature (30.9°C), dissolved oxygen (4.5 ml/l), salinity (34.7‰) and pH (8.2) were only normal for the season and thus do not indicate any special circumstance for the present bumper catch.

The authors are thankful to Shri C. Mukundan, (Head of Demersal Resources Division), Vizhinjam Research Centre of Central Marine Fisheries Research Institute for critically going through the manuscript and suggesting suitable modifications.

BOMBAY DUCK LANDINGS BY TRAWLERS AT SASSOON DOCK, BOMBAY DURING 1983-'84*

The 'Bombay duck' *Harpodon nehereus* Hamilton constitutes an important fishery in the state of Maharashtra. The fishery and biology of this species have been studied. This resource is exploited mainly by 'dol', a kind of bagnet. The trawlnets are not very effective in the fishery of Bombay duck. In 1983-'84 three trawlers belonging to Fishery Survey of India namely *Meenatharangini, Meenapradata* and *Meenayojak* landed good quantities of Bombay duck during almost every month of their fishing operations. *Meenayojak*, however, landed the species only during September, 1983. The details of the landings are presented in Table below.

Name of the vessel	Fishing area	Depth range (m)	Catch (kg)	Percentage in total fish
Meenatharangini (200 H.P.)	18-72, 19-71, 19-72 & 17-72	27-64	2,597	14.60
Meenapradata (200 H.P.)	18-72, 19-72 & 19-71	28-68	2,307	5.07
Meenayojak (200 H.P.)	18-72	25-50	390	12.90

*Prepared by M. Aravindakshan and J. P. Karbhari, Bombay Research Centre of CMFRI, Bombay.

The gear employed in these operations was the 24 m fish trawl. The size range of Bombay duck caught in trawl net operated beyond 30 m depth was 68-380 mm. Very few mature specimens were noticed.

The appearance of Bombay duck regularly in the trawl landings is significant. It is indicative of the existence of Bombay duck populations outside the traditional operational limits of 'dol' (28 m). Larger size groups may exist in deeper regions as fully mature size groups are rarely landed by 'dol'. Absence of eggs and newly hatched larvae in the inshore plankton suggests that this species breeds in deeper waters. Presence of Bombay duck in the inshore regions and creeks such as Arnala and Marve during monsoon months may be attributed to the fact that they follow the penaeid and non-penaeid prawn population to the inshore regions, as crustaceans form a major percentage in the food of Bombay duck during the initial stages of its growth.

The authors are deeply thankful to Dr. E. G. Silas, former Director, CMFRI, Cochin for his interest in the preparation of this note.

AN UNUSUAL FISHERY FOR INDIAN SCAD *DECAPTERUS RUSSELLI* AND OCCURRENCE OF INDIAN RUFF *PSENOPSIS CYANEA* AT CALICUT WITH NOTES ON BIOLOGY OF FORMER SPECIES*

Introduction

Though scads (locally known as '*chamban*') used to appear in the catches at Calicut generally after the south-west monsoon, it has not supported a sizable fishery here in the near past. But, from 19th August to 10th September, 1986, there were unusually heavy landings of scads (Fig. 1) all along the Calicut coast by boat seines, operated at depths varying from 35 to 50 metres. When the operations were at a depth of 45 metres or above, appreciable numbers of *Psenopsis cyanea* were also caught for the first time at Calicut. Detailed data collected on this fishery from Vellayil (Calicut) from 23rd August to 10th September, 1986, along with notes on some aspects of the biology of *Decapterus russelli,* the most important component of the fishery, are presented in this report.

Fig. 1. A view of scads landed at Calicut.

The fishery

The gear employed in this fishery at Vellayil was a boat seine namely *Pattenkolli.* Country crafts employed were all fitted with Yamaha out board engines. The operations were at a depth of 45–50 m till 2nd September and subsequently the operations were at a depth of 36-40 m in the night hours. The units used to leave for fishing at 1830 hrs and return between 0300 and 0900 hrs.

There was hectic fishing activity (Fig. 2) and 1,589 *Pattenkolli* units were operated during this period and most of the boats landed good catches of scads (Fig. 3). Normally, this is the peak period for mackerel catches by *Pattenkolli.* But, with a staggering total catch of 1,170 tonnes of scads during this period it eclipsed the mackerel fishery which yielded only 220 tonnes. The first peak in the scad catches was observed on 24th August (Fig. 4). From 28th August to 2nd September, when operations were at greater depths, say beyond 45 m, there were good catches of *Psenopsis cyanea.* The highest peak in the scad catches was observed on 2nd September, when 178 tonnes of scads were caught with a CPUE of 1,156 kg. The total catch (in kg) of different components are given below.

Fig. 2. Hectic activity – *Pattenkolli* units landing scads.

Species	Catch	CPUE	%
D. russelli	11,16,370	702.56	68.49
D. macrosoma	54,075	34.03	3.32
P. cyanea	12,153	7.65	0.75
R. kanagurta	2,20,464	138.74	13.53
Others	2,26,803	142.73	13.91
Total	16,29,865	1,025.72	100.00

*Prepared by T. M. Yohannan and K. K. Balasubramanian, Calicut Research Centre of CMFRI, Calicut.

D. russelli (locally known as *'kannan chamban')* constituted 95.38% of the scad catch and *D. macrosoma* (locally known as *'kol chamban')* 4.62%.

Fig. 3. A boat-full of scads.

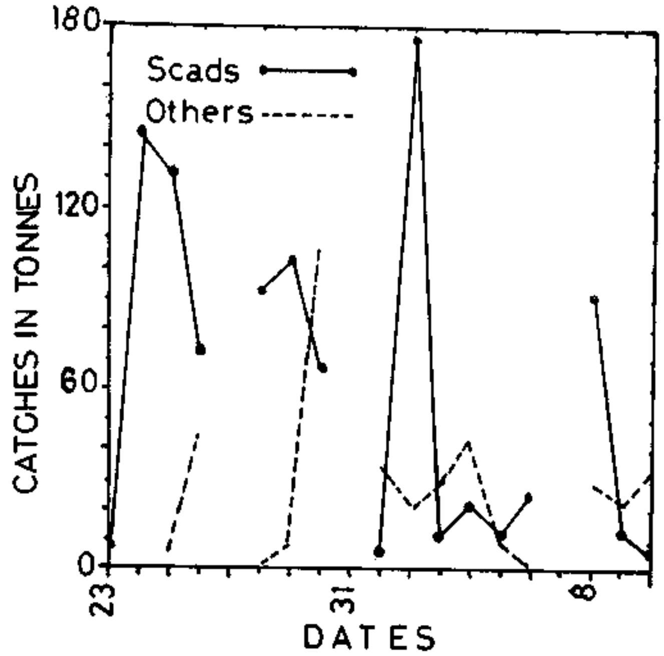

Fig. 4. Daily catches from 23rd August to 10th September, 1986.

STUDIES ON THE RESOURCES OF *D. RUSSELLI*

Size distribution

A random sample of 262 number of *D. russelli* was collected and studied in detail. The length of *D. russelli* ranged from 105 to 224 mm. The major mode was at 197 mm. There was a secondary mode at 167 mm. The smaller size groups had a mode at 122 mm (Fig. 5). Sreenivasan *(Indian J. Fish.,* **29:** 144-150, 1982) while studying the growth of *D. dayi* which is synonymous with *D. russelli* (Fischer and Bianchi, *FAO species identification sheets for fishery purposes, Western Indian Ocean* (Caron Deca 8 FAO, Rome, 1984) has observed that *D. dayi* reached a size of 150 mm (fork-length) in one year and 184 mm (fork-length) in 19 months. The present lengths are total lengths and the fork lengths measured by Srinivasan when converted to total lengths it would be 166 mm for one year and 204 mm for 19 months. Hence, it can be assumed that the modal length 122 mm represents 'O' year-class, the modal length 167 mm one-year-olds and modal length 197 mm 6 months older. 62.98% of the fishes were in size between 180 mm and 224 mm (one and a half year or older fishes), 23.66% between 150 and 179 mm (one-year-olds) and 13.36% between 105 and 139 mm ('O' year-class).

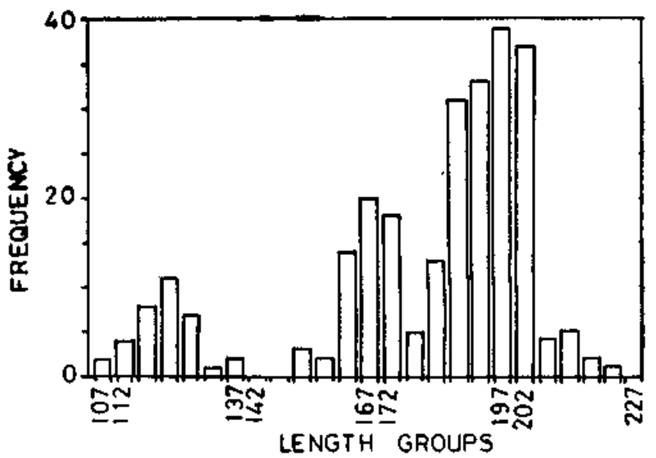

Fig. 5. Frequency of length groups in the sample (mid-points given).

Maturity

Males dominated the catches contributing about 60.71%. 70.91% of the fishes in the size range of 180–224 mm was mature and many were in running stage exuding ova or milt with a slight pressure on the abdomen. 27.59% of the fishes in the size range of 150–179 mm also were mature. Those in the size range of 105–139 mm were all indeterminates. The percentages of mature individuals in different size groups of 10 mm interval are shown in Fig. 6 (mid-points 165 indicates a size range of 160-169 mm and so on). It can be seen that more than 50% of the individuals above 180 mm in length were mature. The oozing ova of the mature females measured between 0.63 and 0.79 mm in diameter with an oil globule measuring between 0.09 and 0.12 mm in diameter.

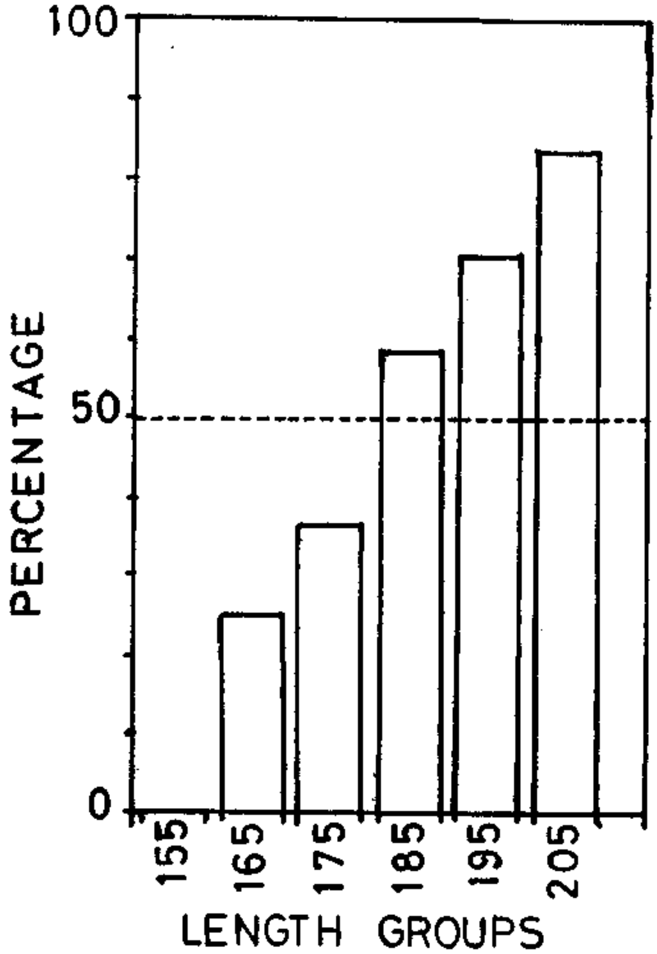

Fig. 6. Percentage of mature individuals in the 10 mm length group.


Fig. 8. Scads being loaded into trucks to be sent to distant places.

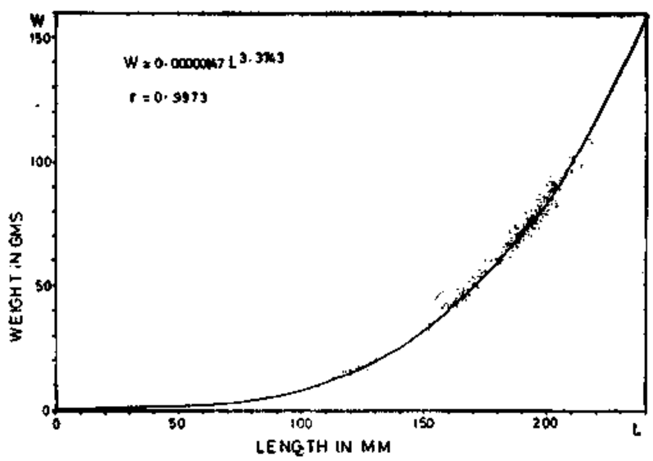

Fig. 7. Observed lengths and weights plotted against estimated relationship.

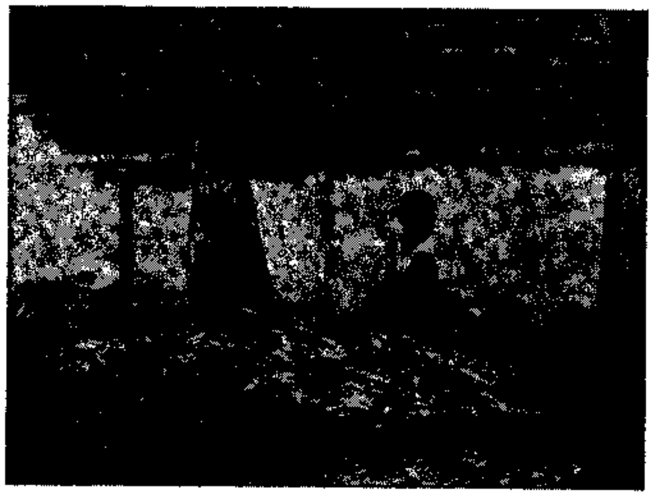
Fig. 9. Scads being gutted for beach-drying.

Length-weight relationship

The weight of *D. russelli* had the following relation with length:

$$W = 0.00000147\ L^{3.3743}$$

The correlation coefficient had a value of 0.9973 (Fig. 7).

Price structure and utilisation

At Vellayil the wholesale price of scads was Rs. 150/- per basket (about 70 kg or 1000 fishes) in the beginning of this period. The price came down to Rs. 80/- by the end of the period. In the market the wholesale price ranged from Rs. 15 to Rs. 25 per 100 fishes and the retail price from Rs. 20 to Rs. 35 per 100 fishes.

Due to poor local demand truck-loads of scads were sent to other places where there was scarcity of fish (Fig. 8). On the days when catches were extremely high, about 25% of the scad catch was gutted, salted and dried on the beach (Fig. 9). *P. cyanea* being new to the area the customers were reluctant to buy it and most of the catch was dried whole on the beach. However, some people who tasted it reported that the fish was fine tasting.

BUMPER CATCH OF CAT FISH AT PONDICHERRY*

On 25-8-1986 shoals of Giant cat fish (*Arius thalasinus* Day) (Fig. 1) moving northward in the Bay of Bengal at a distance of 1 km from the Pondicherry port were noticed by the fishermen at Vembakeerapalayam at 1330 hrs. Immediately 23 fishermen headed by Shri Allimuthu, rushed their traditional fishing gears, *Edavalai* (Bagnet) to the spot with catamarans. The shoals were encircled quickly, and about 80 per cent of the shoals entered into the nets. The captive shoals drifted the nets further one km to the north. In the meanwhile, the fishermen sent signals to the villagers for assistance. Immediately two mechanised trawlers went to the spot and arrested the movements of the shoals. Simultaneously the remaining part (1,250 Nos.) of the shoals was also captured by the Vaithikuppam fishermen who operated their *Edavalai* nearby.

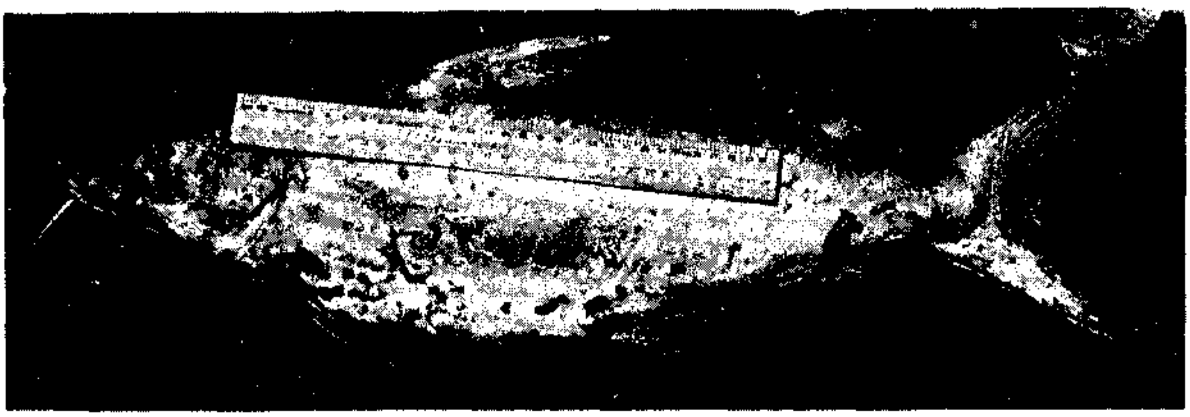

Fig. 1. *Arius thalasinus* the giant cat fish.

Fig. 2. Part of catch brought to the shore.

The Vembakeerapalayam fishermen brought the catch in several trips to the shore with the help of two mechanised trawlers from 1600 to 0330 hrs (Fig. 2). Nearly 4,300 fishes were sold to the merchants at the rate of Rs. 14/- per fish. The cat fishes were of uniform size and weight (75 cm length and 5 kg weight).

*Reported by L. Chidambaram, Pondicherry Field Centre of CMFRI, Pondicherry.

ON THE OCCURRENCE OF SEEDS OF THREADFIN AND INDIAN SAND WHITING ALONG THE CALICUT COAST*

Occurrence of seeds of Threadfin *(Polynemus tetradactylus)* and Whiting *(Sillago sihama)* was noticed for the first time along the Calicut coast during the last week of November, 1985. The seeds were found in fairly good numbers in the surf of Konnad beach extending about 500 m length in the West Hill area. The Threadfin seed was available only during November, 1985; whereas the availability of Whiting seed extended upto the end of January, 1986. The Threadfin seed was available at an average of 36 numbers per haul (179 numbers per hour). During the months of November and December the Whiting was available at a rate of 0.5 number per haul (2.2 per hour); whereas in January it was available at the rate of 39 per haul (196 per hour). A total of 1,250 numbers of Threadfin seed ranging in size from 15 to 23 mm and 1,193 numbers of Whiting seed ranging in size from 30 to 50 mm were collected and utilised for culture experiments.

The seeds were collected by using an ordinary mosquito netting from the shallow waters upto 5 m distance from the shore line having a maximum depth of 1m. The early morning hours and high tide periods seemed to be the best time for the collection of seeds. The salinity and temperature of the water ranged between 32.8 and 33.5‰ and 28 and 30°C respectively in the area where the seeds were collected. The bottom of the ground was sandy and a good concentration of yellow-green algae was noticed in the area. Young ones of *Ambassis* sp., *Therapon* sp. and carangids were also found along with the above seeds.

*Reported by S. Lazarus and K. Nandakumaran, Calicut Research Centre of CMFRI, Calicut.

ON AN UNUSUAL LANDING OF CAT FISH *ARIUS CAELATUS* (CUVIER AND VALENCIENNES) AT RAMESWARAM VERKOTTIL, TAMILNADU*

Pillai and Sathiadas (*Mar. Fish. Infor. Serv., T & E Ser.*, No. **39**: 1982) described the two boat, high opening trawl for pair trawling operations recently introduced at Rameswaram and Mandapam area under the Bay of Bengal Programme. They reported good fishery for rainbow sardines and white pomfrets in the Palk Bay. Accoring to them catfish contributes 9.32% forming an important subsidiary catch in the pair trawl gear. In this connection an unusual instance of the landing of cat fish *Arius caelatus* was observed on 19-1-'84 and the same is recorded in this note.

A total of five pair-trawl units were operated in fishing area, 9/79-3C in Palk Bay on 19-1-'84 from 0430 hrs to 1900 hrs. The H. P. of these boats ranged from 53.9 to 68.0, length from 9.2 to 9.8 m and the number of crew from 5 to 6 per boat. The trawling speed was about 2.5 knots.

The unusual catch of seven tonnes of cat fish was obtained in a single haul by one of the units operated by two STC boats, each with 68 H.P. diesel engine and length of 9.8 m. The catch was taken around 0630 hrs. About four tonnes of the catch were hauld on board from the net and the remaining portion of the catch was impounded in the net till bringing to the shore.

The composition and average quantity of catch of the five units in the areas were *Arius caelatus* 1,400 kg, *Dussumieria acuta* 300 kg, *Pampus argenteus* 80 kg, *Pellona* sp. 20 kg, *Caranx* spp. 15 kg, silver-bellies 8 kg and other fishes 10 kg. The total length of *Arius caelatus* in the unusual catch ranged from 275 to 300 mm and the weight from 1.2 to 1.5 kg.

*Reported by S. Subramani, Regional Centre of CMFRI, Mandapam Camp.

Four tonnes of the cat fish catch was iced and sent to markets at Madurai and Coimbatore in fresh condition. The remaining three tonnes were salted and pit-cured. The price of iced fish was Rs. 1.60 per kg and that of salted fish Rs. 2.50 per kg.

Bumper catches of 3.0 and 4.5 tonnes of cat fish were landed on 16-2-'82 and 10-3-'82 respectively at the same landing centre by pair trawl units. From second week of January, 1984 onwards trial fishing using pair trawl gear was taken up by some fishermen in anticipation of good pomfret fishery in February. However, the present unusual fishery was encountered in one such trial fishing operation. In subsequent days, trial fishing did not yield any good catch. But on 2-2-'84 a catch of one tonne of cat fish was brought by one unit.

The cause for the present unusual fishery is not known. The sky was clear and the sea calm, the wind was westward and the current northward. Instances of unusual bumper catches for catfish are locally reported to be a new feature after introduction of pair trawl in these areas.

The author is thankful to Dr. P. Bensam and Shri P. Livingston for rendering help in the preparation of this note and to Shri V.S. Rengaswamy for identification of the species.

A NOTE ON AN UNUSUAL OCCURRENCE OF HORSE MACKEREL *MEGALASPIS CORDYLA* (LINNAEUS) IN THE KOVALAM BAY, MADRAS*

On 4th February, 1986, an unusual landing of *Megalaspis cordyla* was observed in the shore-seine catches from the Kovalam bay. From the earlier reports it was observed that the fishery of Kovalam was mainly supported by the lesser sardine, silverbellies, caranx, perches, sciaenids and elasmobranchs. In the present instance a total of 980 numbers of horse mackerel with an average weight of 1,015 g were obtained. An estimated total catch of 1,107.7 kg fish fetched a revenue of Rs. 5,990/- on that day which was an all time record for this fish.

The length of the fish landed measured between 390 and 520 mm and the modal value was at 400-440 mm which contributed 66% of the landings. The weight ranged between 700 and 1,400 g with an average of 1,015 g.

Environmental parameters showed that the salinity, temperature and dissolved oxygen of the surface water were 32.02‰, 29°C and 4.32 ml/l respectively. The sea was calm and clear. The water current was moving gently from the northern side to southern side. The wind direction was towards south and its velocity was very low.

Analysis of stomach contents showed the presence of *Acetes indicus* which was also recorded in abundant quantities in the boat seine catches operated prior to the shore-seine operation.

It is likely that these shoaling fishes would have followed the prey *(Acetes indicus)* towards the shore where they were netted.

*Reported by R. Thangavelu, P. Poovannan and K. Sahul Hameed, Madras Research Centre of CMFRI, Madras.

LARGE SCALE DAMAGE DUE TO FIRE AT THE VIZHINJAM FISH LANDING CENTRE *

On 25th July, 1986 a fire broke out in the thatched sheds on the western side of the Vizhinjam fish landing centre, inside the fishing harbour area, destroying a number of sheds and fishing materials stored inside. Some of the canoes beached were also gutted.

Fig. 1. A view of the beached canoes destroyed by the fire.

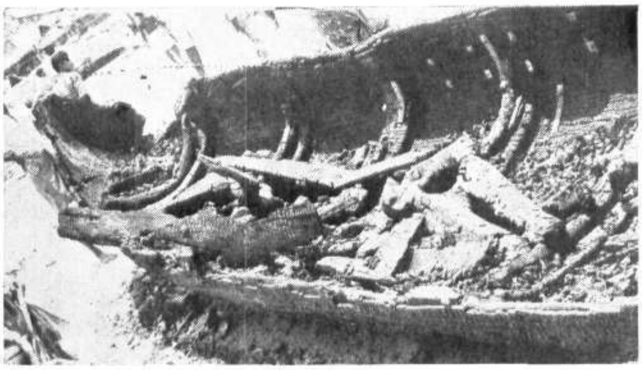

Fig. 2. A canoe turned to ashes by the fire.

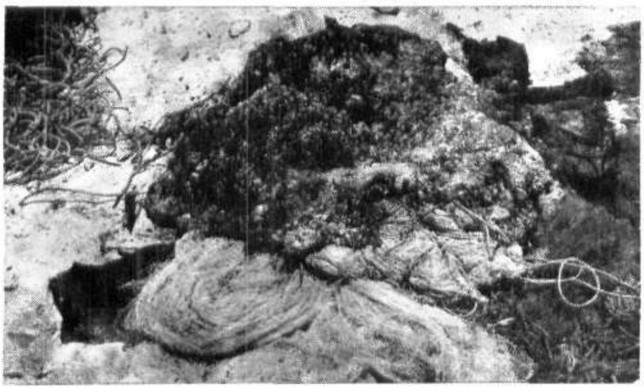

Fig. 3. Drift net unit burnt to a molten mass.

*Reported by P. N. Radhakrishnan Nair, Vizhinjam Research Centre of CMFRI, Vizhinjam.

Fig. 4. Salt bags stored inside the shed.

The fire started around 1300 hrs from a thatched shed and it immediately spread to neighbouring sheds. The fire service squads from Trivandrum and Neyyattinkara rushed to the area and with the help of the local people they could control the fire from spreading far thus avoiding still heavier loss. Fortunately there were no casualties except for a few minor burn victims who were admitted in the hospital.

Nylon and coir fishing nets, salt bags, salted fish and other fishing materials stored inside these sheds were gutted. One outboard motor and many of the beached canoes were destroyed in this fire.

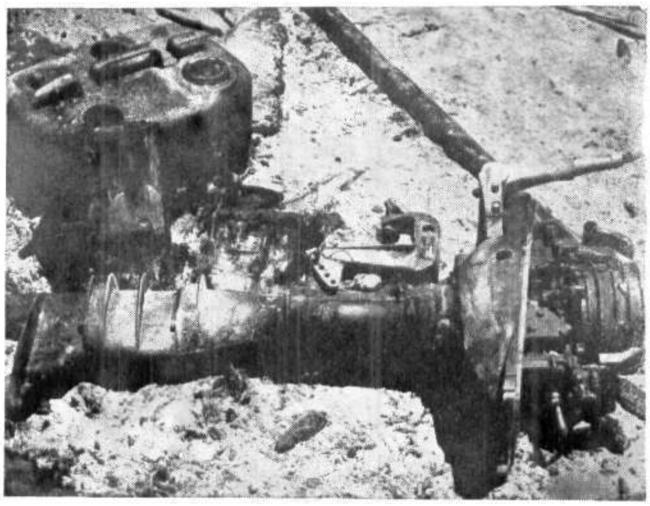

Fig. 5. An outboard motor destroyed in the fire.

According to the press nearly 40–50 sheds and 21 canoes were damaged and the total loss is estimated at more than Rs. 10 lakhs.

Edited by Dr. K. J. Mathew and Mr. I. David Raj. Published by Dr. K. J. Mathew on behalf of the Director, Central Marine Fisheries Research Institute, Cochin-682 031. Printed at PAICO, Cochin–31