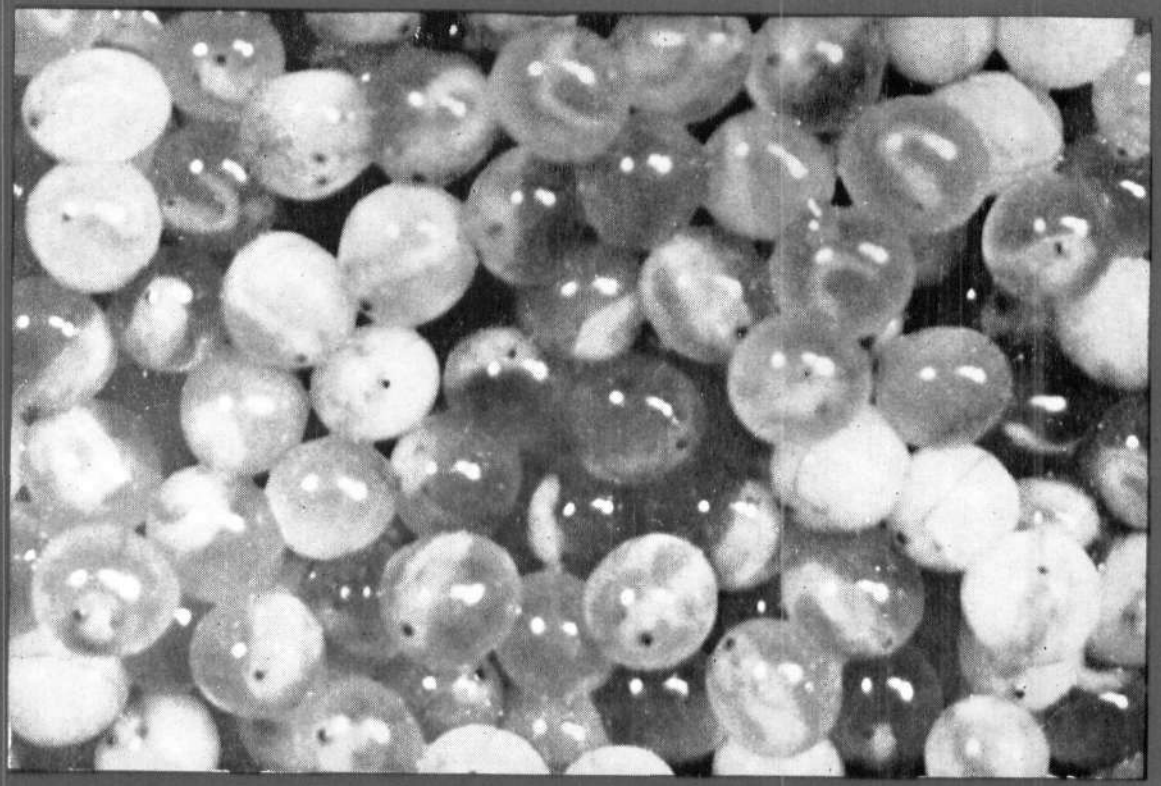
MARINE FISHERIES INFORMATION SERVICE



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No. 24

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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 Fishery Data Centre 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.* 24: 1980

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Cover photo: Catfish eggs

PURSE SEINE FISHERY – IMPERATIVE NEED FOR REGULATION*

Introduction

Purse seiners have been operating in the waters off Goa during the past few decades. Increase in their numbers, coupled with the introduction of more mechanised boats for trawling has created a considerable imbalance between the traditional small scale fisheries—the 'Rampani' operators and the mechanised boat operators. The sudden introduction of a large number of purse seiners in the Karnataka State was first viewed with jubilation on account of the market spurt in the landings of pelagic fish such as sardine and mackerel, and also in the manner in which a good number of 'Rampani' operators were involved in the new method of fishing. Despite the calamitous fire which resulted in the destruction of 41 purse seine boats in Malpe in July, 1979, (as reported in the *"Mar. Fish. Infor. Serv. T & E Ser."*, No.9, 1979) the number of purse seiners in the Karnataka State today numbers over 200. During the last two seasons, due mainly to the non-availability of the pelagic fishes during part of the year along Karnataka Coast, two major shifts in the pattern of the fishery were evident. First was the conversion of some of the purse seiners into trawlers for fishing demersal or ground fishes and the second was the deployment of about 60 purse seiners along the Kerala Coast during the fishing season.

One of the disquieting aspects of purse seining noted along the Karnataka Coast in 1979 was the unusually large catch of oil sardine in ripe running condition during the first week of June. Further, due to the heavy landing of the mackerel its price ruling at Rs. 3,500/ tonne during the last week of May, declined to Rs. 1,500/ tonne in the first week of June. The Central Marine Fisheries Research Institute (CMFRI) which has been monitoring the exploited resources along the coasts of India had given a timely warning to the State of Karnataka about the heavy incidence of spawners in the purse seine catch and projected the need for imposing restrictions in the operation of purse seiners. Subsequently, the Hon'ble Minister of Fisheries of the Govt. of Karnataka made an appeal to the purse seine fishermen to abstain from fishing from the first week of June to last week of September, 1979, in view of the fact that the spawning of oil sardine and mackerel occurs from May to August. Again, on the 2nd June he earnestly sought the co-operation of the fishermen to refrain from catching oil sardine in ripe running condition (spawning fish) in the interest of conservation of the fishery. This was followed by a statement by the Deputy Director (Fisheries), Mangalore, in which he cautioned the purse seine fishermen that the Government would step in and take suitable measures in this matter if the fishing is continued during the spawning period of the fish. However, the fishing went on unabated largely due to the lack of proper implementation.

In 1980, the fishing season started along the Karnataka Coast with a reasonably good catch of pelagic fish by the purse seiners. However, during the last week of September and first week of October, another detrimental feature in the purse seine fishery was evident. This involved the large scale capture of the marine catfish *Tachysurus maculatus*. This is one of those fishes in which the males play an active role in parental care by carrying the eggs inside their buccal cavity. Sexual seggregation at the time of incubating the eggs in the buccal cavity by the males, a peculiar behaviour in this species as in other members of the genus *Tachysurus*, resulted in an almost selective fishing by the purse seines on this potentially vulnerable component of the species and also the millions of incubating eggs. This is yet another case which calls for exercising strict control and regulation on purse seine fishery. The following is an account of the magnitude of the destruction caused by the indiscriminate fishing by the purse seiners on a single resource—*T. maculatus*.

Catfish catches by purse seines

First hand information at the purse seine fishing centres at Mangalore, Malpe and Gangoli (Fig. 1) was obtained by the personal visits to these centres during the last week of September and first week of October to specially investigate the problem of such destructive fishery of an inshore fish stock by the purse seine gear. The magnitude of the problem might be evident from Table 1 which indicates that about 37 tonnes of cat-

*Prepared by E. G. Silas, P. Parameswaran Pillai, M. H. Dhulked, C. Muthiah and G. Syda Rao.

fish eggs were destroyed during the purse seine fishery with no possible estimation of the quantity of eggs that would have fallen through the meshes of the purse seine during the operational phase and the brailing of fishes and eggs to the deck of the carrier boats and to the purse seine boats.

Table 1. *Total landings (estimated) of the catfish* (T. maculatus) *and their eggs (tonnes) at three centres in Dakshina Kannada Coast.*

Period	Centre	No. of operations (from purse seine boats)	*T. maculatus* Adults	*maculatus* Eggs	Total fish catch
29 Sept.– 30 Oct.	Mangalore	1139	204.9	16.0	1776.1
26 Sept.– 31 Oct.	Malpe	1833	241.5	14.0	3530.8
1–31 Oct.	Gangoli	1228	82.0	7.6	3282.0

All specimens of *T. maculatus* landed were males. They were found in the size range 210–396 mm with two modes at 285 and 346 mm (Fig. 2). The weight of the fish ranged between 220–580 g. (Fig. 3). When captured they were in the non-feeding condition as their oro-buccal cavity was filled with the developing eggs which are quite big in size compared to the eggs of other fishes. Maximum number of eggs found in the oro-buccal cavity was 56 and eggs had a mean diameter of 14.6 mm and average weight of 1.195 g (Fig. 4). On an average, 614 eggs made up one Kg. No relation was observed between the number of eggs carried by the male fish and fish size (Fig. 5). Besides the bulk of fish had spewed some of the eggs at the time of capture and consequent struggle in the net and on deck. The percentage of oval, opaque ova with no signs of development were extremely few: but eggs in different stages of development were undergoing incubation in the oro-buccal cavity of the male fish. The estimated total number of eggs landed during the period based on the total weight of eggs has been found to be 23 million.

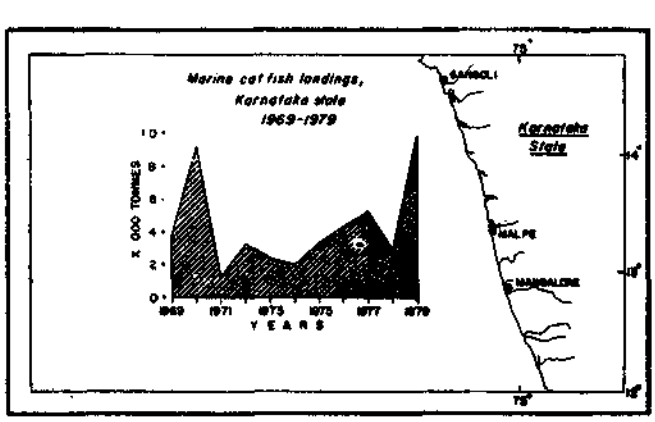


Fig. 1. Map showing the purse seine landing centres along the Karnataka Coast visited during the period September–October, 1980. Marine catfish landings along the Karnataka Coast during 1969–1979 is also shown.

At present, no information on the percentage of survival at the time of hatching or on the recruitment into the fishery, is available. The fact that almost all incubating eggs were found to be fertilised and in various stages of development is suggestive that the hatching rate with such parental care would be high. This is also equally significant and should ultimately reflect in the recruitment of different year classes.

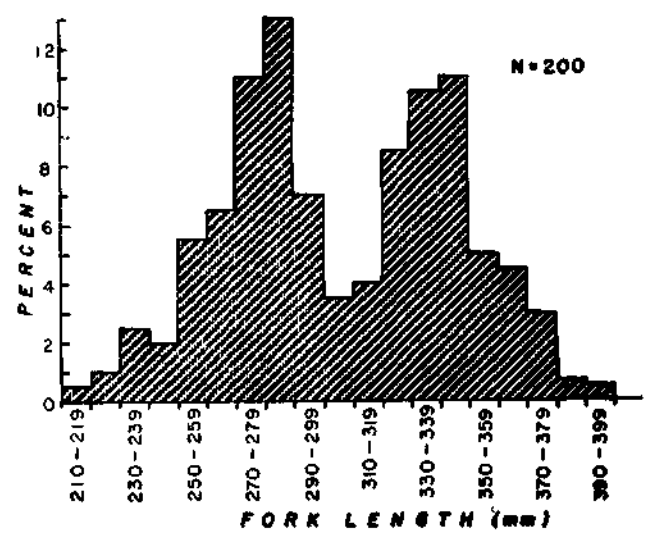


Fig. 2. Length frequency distribution of *T. maculatus* (males, incubating eggs) collected during September-October, 1980 from Mangalore.

Marine cat fish landings along the Karnataka Coast during 1969–1979 is presented in Fig. 1. A detailed analysis of the catch data of *T. maculatus* taken by the purse seine during the period September–October, 1980, at different centres is presented below:

Mangalore (Table 2)

A total of 204.9 tonnes of *T. maculatus* (males, with incubating eggs in the oro-buccal cavity) and 16.0 tonnes of eggs were landed during the period 29 September to 30 October 1980 in 1139 purse seine operations. The area of operation was off Mangalore-Suratkal

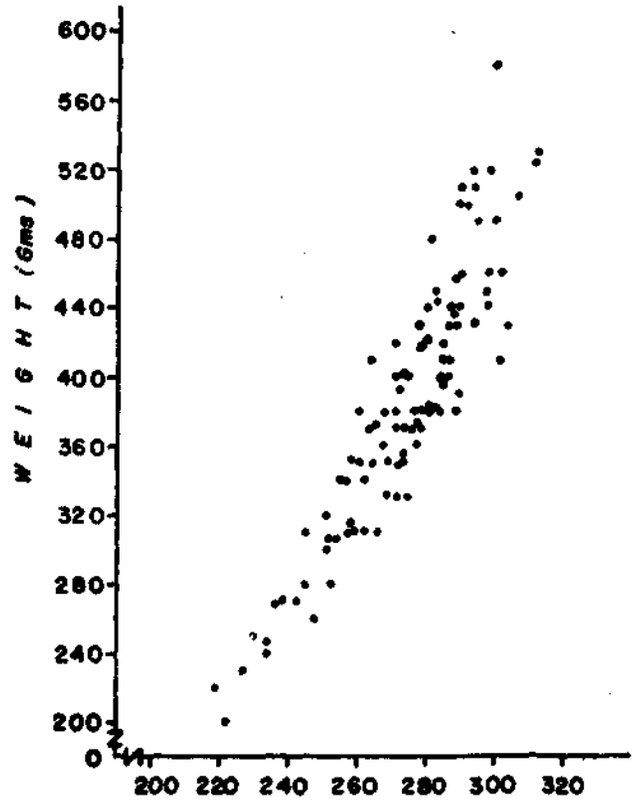


Fig. 3. Length-weight relation of *T. maculatus* (males, incubating eggs) collected during September–October, 1980 at Mangalore.

Coast at a depth range of 25–35 m. Fresh fish has been sold at the rate of Rs. 500 to Rs. 600 per tonne. Very small quantity of the eggs (a few kg. from the first few carrier boats) were disposed at the rate of Rs. 0.50/ kg. and the rest were distributed free or discarded. Fish in fresh condition were transported to places such as Chikmangalore and Hazzan where the plantation workers relish it.

Malpe (Table 3)

241 tonnes of adults and 14.0 tonnes of eggs of *T. maculatus* respectively were landed at Malpe in more than 1800 purse seine operations during 26 September to 31 October, 1980. Purse seiners operated at the depth range of 32–37 m off Malpe. 75% of the fishes landed were dried and the rest were sold in fresh condition at the rates of Rs. 1,750/- and Rs. 1,500/- per tonne respectively. Eggs landed were discarded due to the lack of demand.

Gangoli (Table 4)

Total landings of *T. maculatus* adults and eggs amounted to 82.0 and 7.6 tonnes respectively during the period 1st to 30 October, 1980. 1228 purse seine operations were conducted in the depth range of 25–35 m,

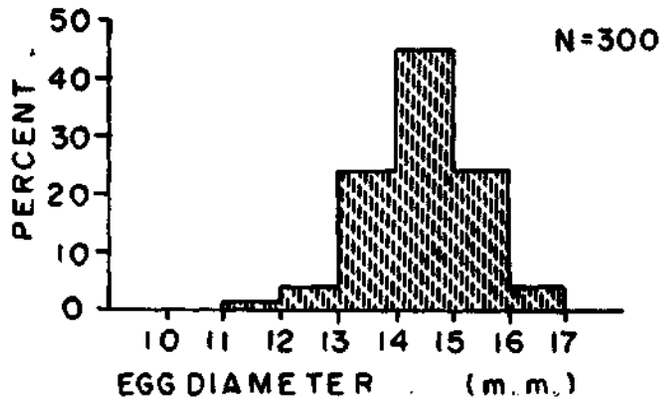


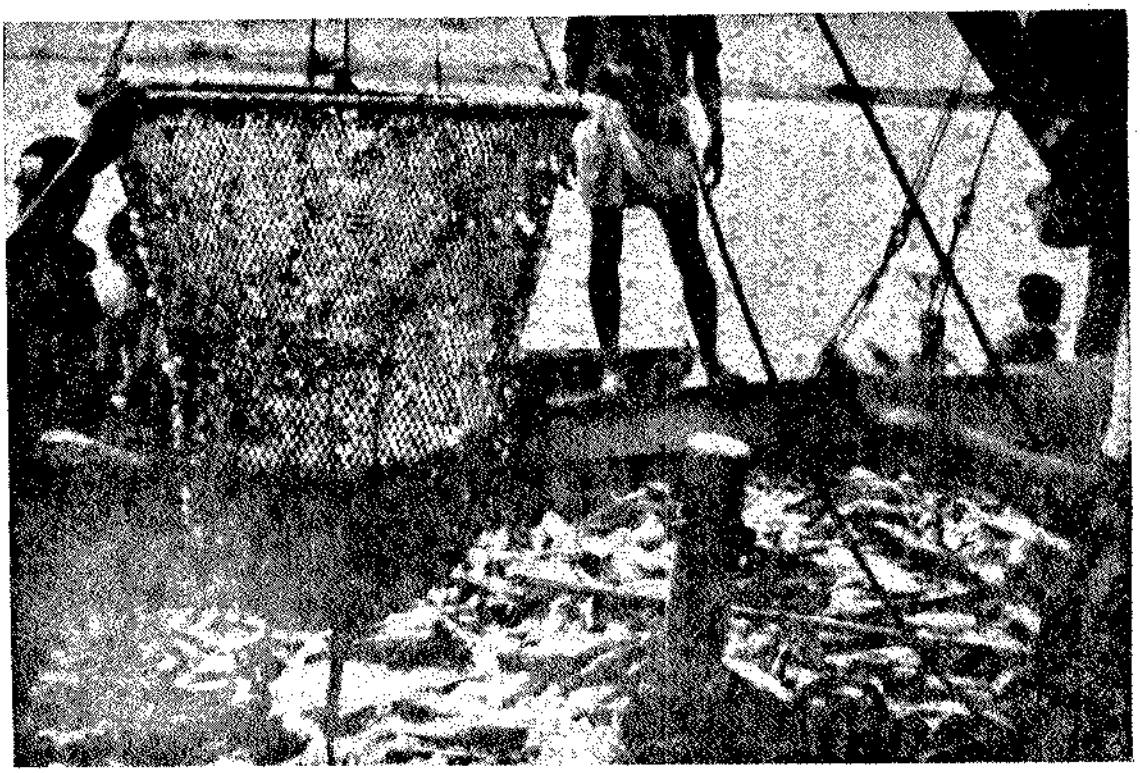
Fig.4. Size (Diameter) distribution of the eggs collected at Mangalore during September-October, 1980

SW, W and NW off Gangoli. 95% of the landings were dried and the rest sold as fresh fish. Dried fishes were disposed at the rate of Rs. 1,346 per tonne and fresh fish Rs. 830 per tonne. As at Malpe, the eggs landed were discarded.

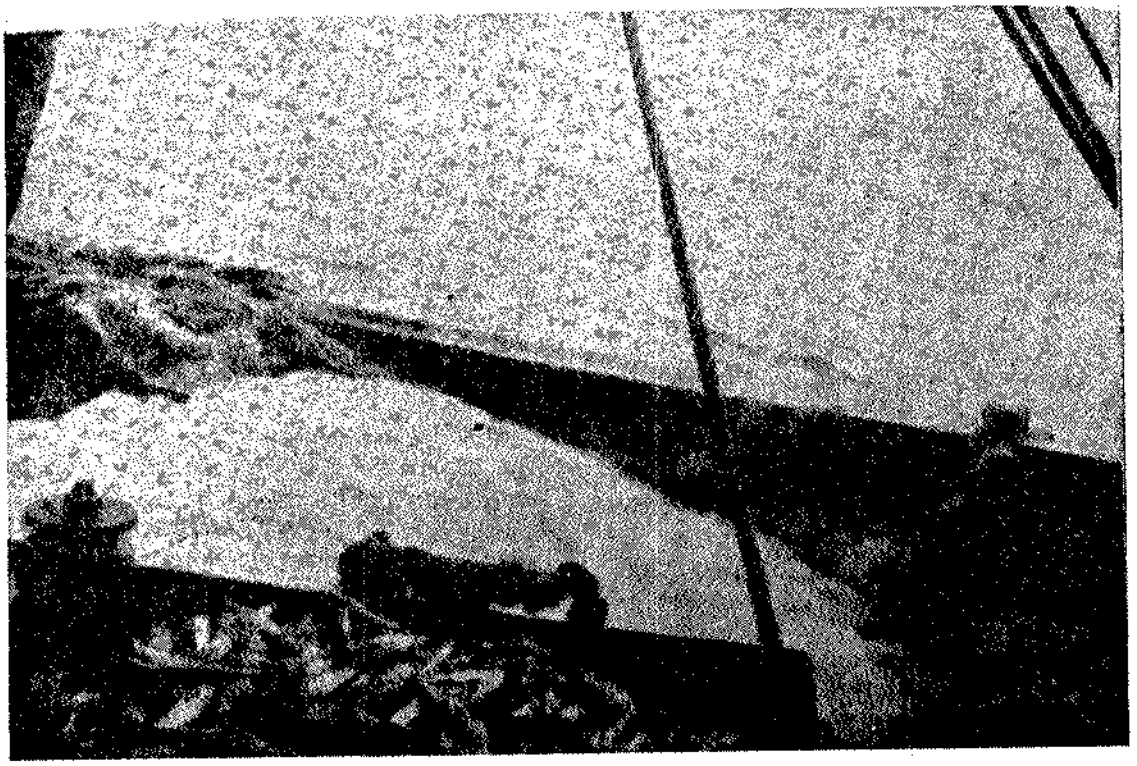
The Need for Regulation in Purse Seine Fishery

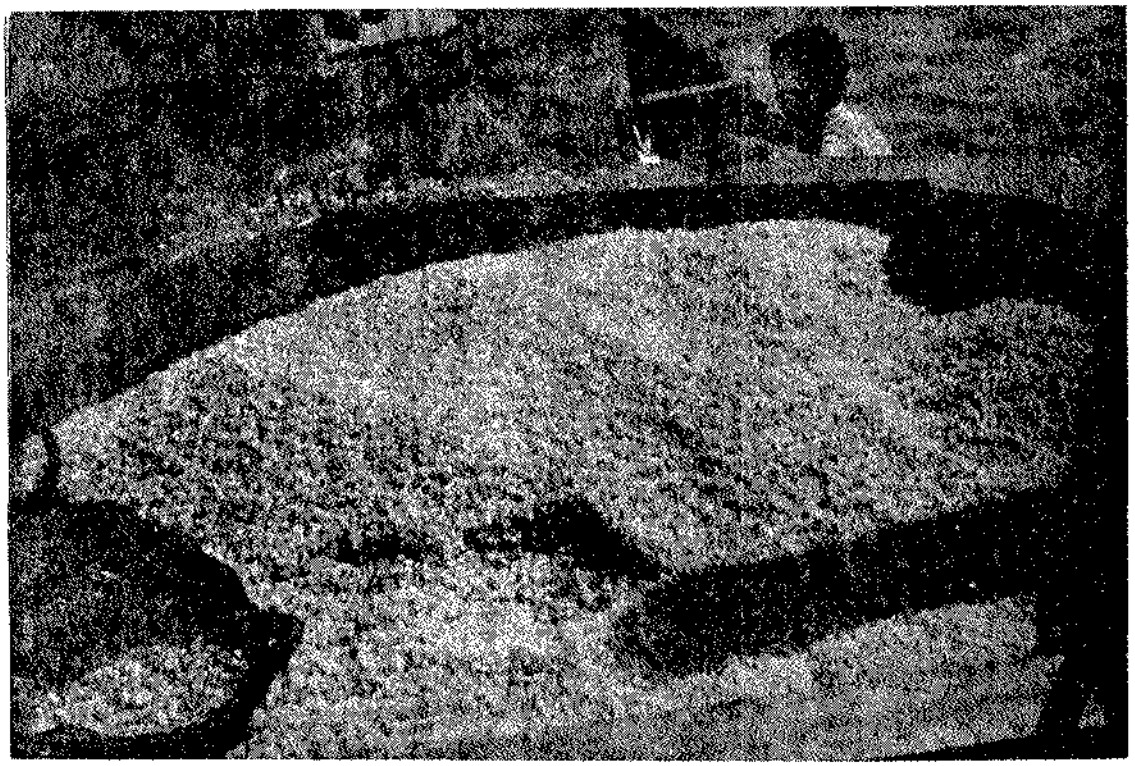
The fact that such huge quantities of incubating fish *(T. maculatus)* were caught and the consequent heavy destruction of eggs should be a matter of grave concern. Such wasteful and destructive fishing could irreparably damage the resources. There is imperative need for having an effective machinery to see to it that recurrence of such destructive fishing, which would affect the fishes are not permitted by proper regulation in limiting not only the number of boats operating purse seines but also the type of resource they could tap by fixing proper quotas. Enquiries with the purse seine fishermen indicated that they could clearly identify catfish shoals from other shoaling fishes before encircling operation is carried out. Hence it would not be difficult to avoid fishing catfishes with incubating eggs, or oil sardine and mackerel in ripe running condition.

Thus in the recent past, these two instances of destructive fishing using purse seine gear has come to our notice. The problem has to be viewed in the proper perspective in view of the heavy catches by this gear. In this context, we are reminded of the intensive and indiscriminate purse seine fishery of the pelagic fish stocks in other parts of the world which have resulted in the partial or complete depletion of some of the major pelagic fish resources.Good examples are the Californian sardine fishery, the herring fishery of the North Sea and the mackerel fishery of the North Sea and the British waters. It is suspected that intensive fishing pressure combined with an environmental



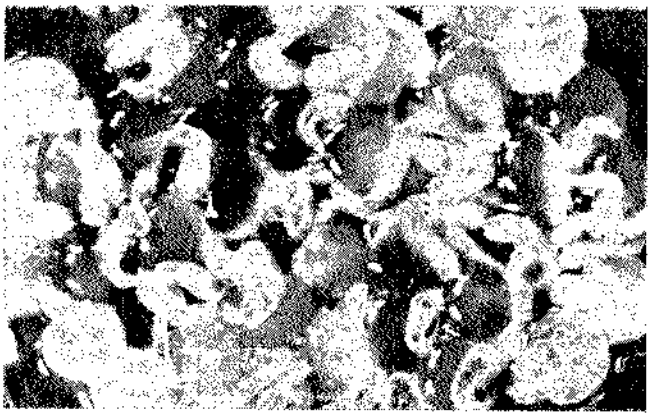
Handling of catfish eggs



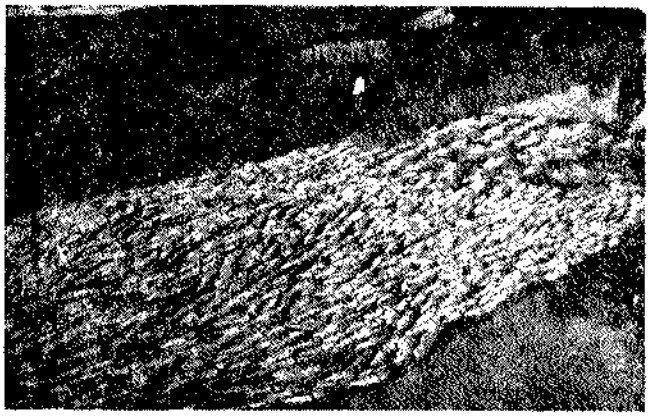


on board the vessel

Eggs inside the buccal cavity



Hatching of catfish eggs



Sundrying of catfish

Dried catfish

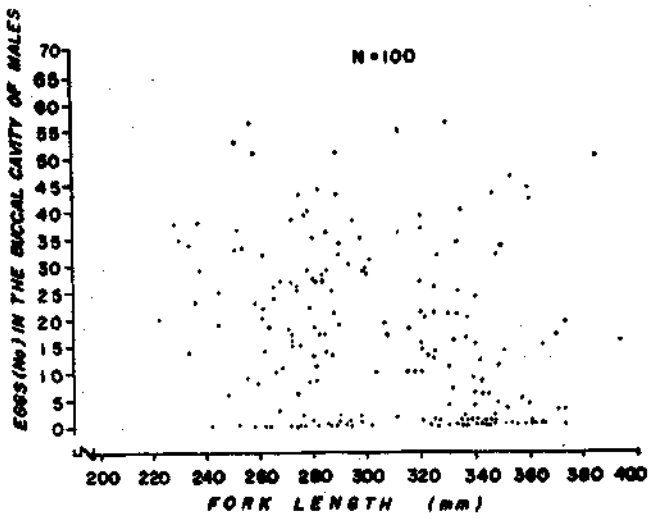


Fig. 5. Relation between the number of incubating eggs in the oro-buccal cavity of the male of *T. maculatus* and the size of the fish.

aberration in the form of *El Nino* current has been responsible for the catastrophic destruction of the Peruvian anchovetta stocks in the early seventies. At present, strict voluntary closed seasons and restrictions in purse seine fishery for tunas such as the young ones of yellowfin, albacore and skipjack tuna in the Pacific have helped the rational exploitation of the stocks. Regulation of the purse seine fishery for the Barrent Sea capelin is yet another example worthy of mention here. Landings of capelin has been prohibited during the summer months, and during the subsequent months a 'minimum legal size' has been imposed on the purse seine fishery by the Norwegian Government. Another example of the depletion of the stocks by the intensive purse seining is that of Japanese sardine fishery the catch of which failed because of the recruitment failure under pressure of fishing.

While every effort should be made to maximize production bearing in mind judicious exploitation to attain stability of production, it is not wise to be complacent when at selected centres excessive or wasteful effort is exerted, threatening the natural resources. It is imperative that there is a strict National Regulatory Policy on the introduction and use of purse seines in our coastal waters. The matters which require attention are:

(i) Identification and determination of the magnitude of specific resources (single–/eg. mackerel/or multiple–/eg. anchovies/species fishery) for which purse seine could be used and the number of purse seiners to be operated from a particular base for the exploitation of the said resource(s);

(ii) To prevent frequent shifting of the base of operation of purse seine boats which may be aimed at violating other regulatory control measures and strict control on licensing of purse seine boats from specified bases only;

(iii) Mesh regulation of the gear and restriction on the size of the species in the fishery and the introduction of 'minimum legal size';

(iv) Delimitation of the areas and periods for operation of purse seine for a specific resource;

(v) Control on the basis of annual or seasonal catch quota to be fixed for the fishery at specified bases;

(vi) Closed seasons for purse seine fishery during periods of spawning of pelagic fishes; and,

(vii) Prompt filing of duly filled-in fishing log indicating details of effort, fishing operations, (catch–both quality and quantity) and transport by carrier boats and purse seine boats.

Since purse seining with the type of boats in existence (43–48 foot and larger size boats) could be carried out either within or outside the territorial limits from the continental shelf waters, the agency to implement the regulatory measures either at national level or state level should be clearly specified. This may also be viewed in the context of the decision that may result from the law of the sea conference and extended national jurisdiction of Exclusive Economic Zone governing use of coastal water fishery resources.

At present information on the magnitude of the stocks of sardines, mackerels and anchovies in areas of purse seine operations is available. Intensive exploitation of these resources by traditional gear has shown that the fluctuation in the standing stock available in the inshore fishery are due to the fishery independent factors. However, in the present context of the purse seine fishery operating in areas of most of the distributional range of different species in the shelf waters, the whole question of fishing effort in relation to standing stock assumes a new dimension.

In this connection it may be relevant to point out that proper data acquisition on a day-to-day basis from all the purse seine boats for continuous monitoring of the catch and effort becomes essential. The Fishery Data Centre of the Central Marine Fisheries

Table 2. *Catch data of* T. maculatus *at Mangalore*

Date	No. of units (Purse seine operations)	*T. maculatus* (*tonnes*) Adults	Eggs	Total fish landings	% of *T. maculatus* (adults)
29- 9-1980	75	72.4	5.0	88.5	81.8
30- 9-1980	75	18.5	0.3	101.9	18.2
1-10-1980	75	—	—	186.7	—
3-10-1980	75	—	—	108.9	—
4-10-1980	75	0.3	—	105.3	0.3
6-10-1980	75	—	—	176.5	—
7-10-1980	75	50.0	1.5	216.7	20.1
9-10-1980	75	—	—	216.7	—
10-10-1980	75	27.1	1.0	215.3	12.6
13-10-1980	75	0.8	—	43.4	1.7
14-10-1980	75	11.3	0.01	23.1	48.7
16-10-1980	80	—	—	141.3	—
24-10-1980	84	11.0	—	34.0	32.3
29-10-1980	75	4.5	0.1	64.0	6.3
30-10-1980	75	9.5	—	53.8	17.7
TOTAL:	1,139	204.9	7.91	1,776.1	—

Table 3. *Catch data of* T. maculatus *at Malpe*

Date	No. of units (Purse seine operations)	*T. maculatus* (*tonnes*) Adults	Eggs	Total fish landings	% of *T. maculatus* (adults)
26- 9-1980	936	241.5	14.0	1,375.6	17.6
15-10-1980					
16-10-1980	66	—	—	202.0	—
17-10-1980	59	—	—	51.6	—
18-10-1980	54	—	—	71.0	—
19-10-1980	56	—	—	97.5	—
20-10-1980	64	—	—	93.5	—
21-10-1980	54	—	—	67.2	—
22-10-1980	59	—	—	77.5	—
23-10-1980	62	—	—	73.0	—
24-10-1980	48	—	—	59.9	—
25-10-1980	52	—	—	212.0	—
26-10-1980	60	—	—	195.0	—
27-10-1980	49	—	—	162.0	—
28-10-1980	52	—	—	55.0	—
29-10-1980	49	—	—	70.0	—
30-10-1980	52	—	—	310.0	—
31-10-1980	61	—	—	358.0	—
TOTAL	1,833	241.5	14.0	3,530.8	—

Table 4. *Catch data of* T. maculatus *at Gangoli*

Date	No. of units (Purse seine operations)	*T. maculatus (tonnes)* Adults	Eggs	Total fish landings	*% of T. maculatus* (adults)
1-10-1980	46	—	—	85.6	—
2-10-1980	46	—	—	237.0	—
3-10-1980	48	0.6	—	252.8	0.2
4-10-1980	48	—	—	288.6	—
5-10-1980	48	26.6	—	132.5	20.0
6-10-1980	52	18.8	—	271.6	6.9
7-10-1980	51	—	—	318.4	—
8-10-1980	46	—	—	54.4	—
9-10-1980	48	20.9	—	20.9	100.0
13-10-1980	46	6.9	—	6.9	100.0
16-10-1980	50	—	—	161.9	—
17-10-1980	40	—	—	44.8	—
18-10-1980	40	—	—	85.8	—
19-10-1980	45	—	—	246.5	—
20-10-1980	45	—	—	75.0	—
21-10-1980	52	5.1	0.4	30.5	16.6
22-10-1980	52	—	—	65.8	—
23-10-1980	45	—	—	30.4	—
24-10-1980	45	—	—	85.6	—
25-10-1980	45	—	—	75.4	—
26-10-1980	50	—	—	58.5	—
27-10-1980	45	—	—	54.0	—
28-10-1980	45	—	—	73.3	—
29-10-1980	50	3.1	—	167.4	1.9
30-10-1980	50	—	—	247.1	—
31-10-1980	50	—	—	111.3	—
TOTAL	1,228	82.0	0.4	3,282.0	—

Research Institute is being strengthened. The department of fisheries of all the maritime states should take proper view of the immediate and long term implications for developing purse seine fishery for specific resources and play an effective role in not only formulating suitable regulatory measures but also in implementing the same for the judicious exploitation of our fish stocks. Implementation of progressive mechanisation and diversification in the fishery without such measures may not be conducive for the development of our marine fisheries. Added to this, the possibilities of heavy pressure on critical stages such as spawning stocks would certainly affect subsequent recruitment into the fishery.*

* Since going to press, the Government of Kerala has promulgated an Ordinance—the Kerala Fisheries Regulation Ordinance, on November 29, 1980.

CHANK FISHING OF KERALA WITH SPECIAL REFERENCE TO LONG LINE FISHERY*

Introduction

In India the important chank beds are located in the Gulf of Kutch and Trivandrum in the west coast and in Palk Bay and Gulf of Mannar in the east coast. In recent years chank landings have been reported from Ratnagiri, Cochin, Portonovo and Orissa coasts also. Chank fishery along a stretch of 65 km of Trivandrum coast is known from very early times. The heraldic designs of royal houses as well as the emblems of both Travancore and Cochin States had the sinistral chank as a prominent motif. These states also used chank designs on coins and early stamps, thus giving a high status for chank in Kerala tradition.

The sacred chank *Xancus pyrum* with five distinct sub-species is widely distributed along Indian coast. Skin diving is the main method of chank fishing in India. Occasional catches from gill nets and trawl nets have also been reported. At Vizhinjam near Trivandrum fishing of chanks by employing longlines is being practised. This being a unique method for chank fishing a detailed account of this method is given here along with other fishing methods. The important chank landing centres and various methods of fishing are shown in Figure 1.

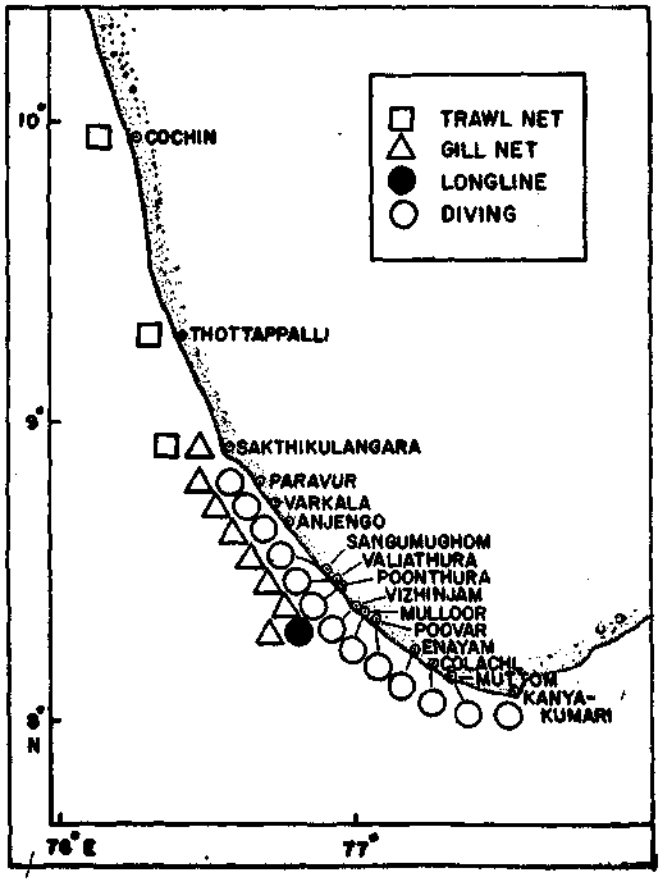


Fig. 1. Map showing the various methods of chank fishing at different centres from Cape Comorin to Cochin.

Methods of Fishing

i) Skin diving

Skin diving for chank is an age old practice carried out in the southern part of the coast of Kerala. Active divers varying in numbers from 20 to 30 drawn from Poovar, Vizhinjam, Kovalam, Valiathura and Poonthura commence diving operations from January of each year, when the sea is calm and clear. They reach the chank beds around these areas in catamarans during early morning and dive at depths ranging from 10 to 20 m. using locally made mask for good vision under water. Two divers going for fishing in each catamaran dive in turn to collect chanks. If the water is clear with very little underwater drift, each diver can collect an average of 10 chanks per day. The important chank landing centres for chank diving along Kerala Coast are Poovar, Mulloor, Vizhinjam, Kovalam, Valiathura, Poonthura, Sangumugham, Anchengo, Varkala and Paravoor. Mostly the divers from Vizhinjam and surrounding areas (Muslim divers) migrate for chank diving to other nearby chank landing centres during fishing season (January to April). During 1978–79 and 1979–80 period most of the chank divers from Kerala Coast migrated to Tuticorin area during chank fishing season as the price offered for chank fished was high at Tuticorin.

ii) Gill net and trawl net catches

Chanks get entangled in the meshes of gill net, mostly in bottom set gill nets. Though these nets are not operated exclusively for chank, stray numbers are caught throughout the year, especially from Poovar to Quilon. The length of the shell caught in gill nets varies from 70 to 200 mm. Occasionally catches are also noticed in drag nets from these areas. Considerable number of chanks are collected from trawl

* Prepared by K. K. Appukuttan, Mathew Joseph, K. T. Thomas and T. Prabhakaran Nair, Vizhinjam Research Centre of CMFRI.

Fig. 2. Longline hooks arranged in between reapers.

catches every year from Sakthikulangara to Cochin area. The main landing centres are Sakthikulangara, Thottappally and Cochin. During July-August 1976, shrimp trawlers operated off Cochin are reported to have netted an estimated 12,000 sacred chank, *Xancus pyrum* var. *acuta* from a depth of 70 m. (CMFRI Newsletter, 1977–78). The shells ranged from 85 to 227 mm. in length and 37-105 mm in breadth. These chanks were sold for Rs. 3 to Rs. 13 per shell. The peak landing season observed at Sakthikulangara, an important trawl landing centre is from August to December. Regular observations and enquiry with shell merchants at Sakthikulangara reveal that good quantity of shells are landed every year in shrimp trawlers from a depth ranging from 40 to 50 fathoms. The length of shells caught from this area ranges from 100 to 220 mm in length and 71-100 mm in breadth. Chanks are caught in gill nets and trawl nets throughout the year in Kerala Coast, the peak period for trawl landing observed being July to December.

iii) Longline fishing at Vizhinjam

The traditional catamarans and a modified version of longline (Ayiramthundi) are used for the specific method of chank fishing. The main line of the unit is of twisted nylon rope (10-15 mm thick) ranging from 250 to 500 m. long. The gangions, or hook thread is 1 m. long attached to the main line at an interval of half m. distance. Gangion thread is plastic monofilament known locally as 'kangoose'. To the free end of each gangion one hook is attached firmly and the hook number is 6 or 8. The number of hooks for each unit varies from 500 to 1000 according to the length of the main line. Other essential components of the unit are single large plastic/aluminium float, number of sinkers and two granite anchors weighing 8-10 kg. The length of anchor rope tied to main line varies according to the length of gangion thread and the length of rope attached to the float from the main line depends on the depth at which the unit is operated, usually 20-30 m.

Longline operation starts at Vizhinjam by December and lasts till March with peak landings during December to January period, when water is clear. Before starting the fishing operation every day, the hooks are arranged in between bamboo splits or two wooden reapers to avoid twisting and entangling of gangion (Fig. 2). The fishermen during peak season leave the shore by early morning, reach the bed within an hour and start operating the unit. The end with float and anchor is laid out first, keeping in mind, the depth of the area and as the catamaran is towed forward, the main line with gangion, hooks and sinkers are released one after the other till all hooks are released in the water. The anchor in the opposite end is now fixed and a long rope from main line is tied to the catamaran. As the hooks are also dragged along with the underwater drift over the chank beds, the foot of the chank gets hooked firmly (Fig.3). If the catch is good, the oper-

Fig. 3. Hooks attached to foot of chank.

ation is repeated twice or thrice a day in the same area; and returning in the evening. The chanks caught are removed by cutting gangion thread (Figs. 4 & 5). Longline operation for chank commenced in this area in 1976. Observations have shown that 30-60 numbers of chanks with an average of 45 numbers are caught in a single unit during a day in the peak season. Units operated varies from 15 to 30 numbers and total number of active fishing days varies from 20 to 25 days. The maximum number of chanks landed was 12,000 numbers

Fig. 7. *Xancus pyrum* var. *globosa*

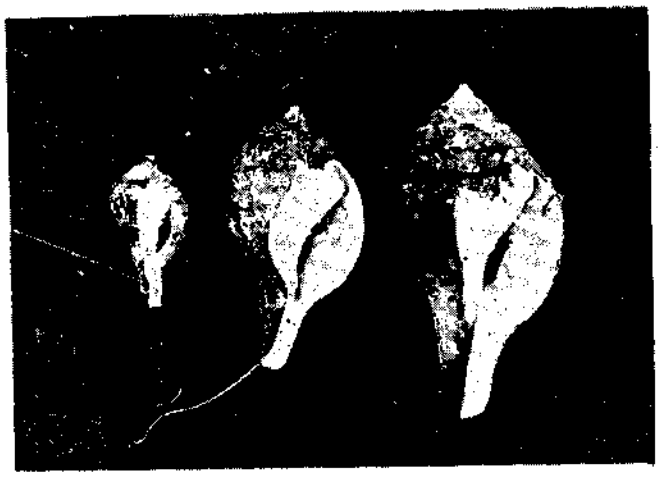


Fig. 4 & 5. Chanks removed from the longline

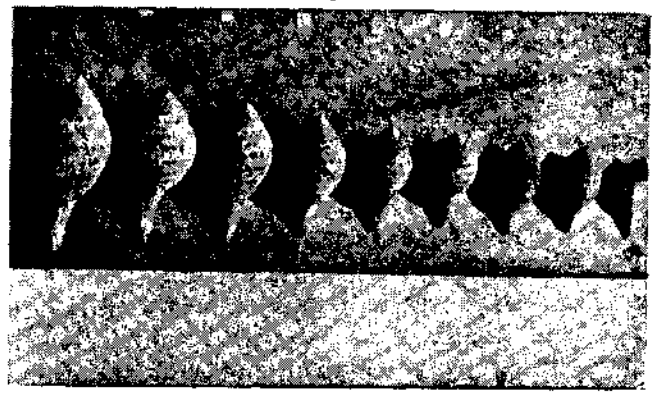


Fig. 8. 9 Commercial grades of chanks

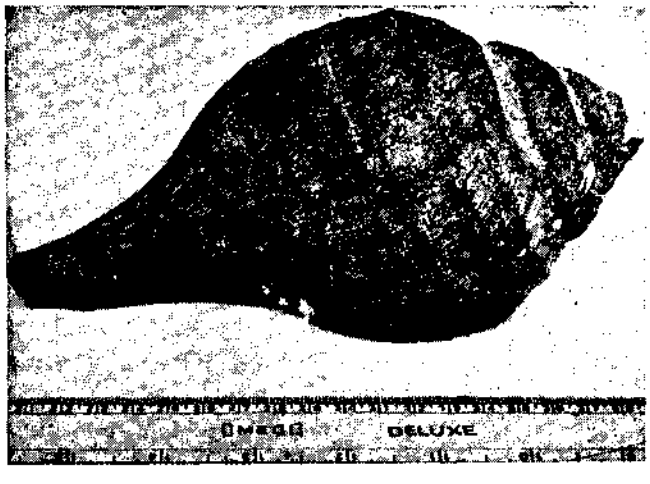


Fig. 6. *Xancus pyrum* var. *acuta*

Fig. 9. Wormed chanks

during 1976–77 period forming 80% of the total catch. The size of chank ranged from 80 to 235 mm. in length. In 1977–78, 70% (710 numbers) in 1978–79, 86% (5395 numbers) and in 1979–80, 73% (1273 numbers) were landed in longline and the rest by diving and gill nets.

Varieties of chank fished from Kerala Coast

Examination of specimens collected from Trivandrum Coast reveals the occurrence of at least three of the five sub-species namely *X. pyrum* var. *globosa*, *X. pyrum* var. *comorinensis* and *X. pyrum* var. *acuta*. Of these the bulk of the catches belong to *X. Pyrum* var. *acuta*, which exhibits narrow and moderately elongate body with a well balanced spire of the whorls, the profile of which is more or less convex (Fig. 6). Majority of the shells fished from the shallow and deeper waters beyond Vizhinjam belong to var. *acuta*. A few which exhibit inflated body portion with thick shell and red tinge in the labrum and labial region, particularly the inner lip, show similarity to the descriptions of Hornell's var. *globosa*. Some shells collected from the bottom set gill nets operated near Vizhinjam possess these characters (Fig. 7). A few shells landed by skin diving from this region far south of Trivandrum appears to show similarity of characters of *X. pyrum* var. *comorinensis*.

Processing and marketing of chanks

The right of collection of chanks along Kerala Coast is leased out to Co-operative Societies or private parties every year by Government of Kerala. According to the term of lease the lessee can collect chanks from the territorial waters of Kerala from Kollenkode to Manjeswar using nets, motor boats, catamarans or by using ordinary fishing tackles. Those who clandestinely indulge in chank fishing will be proceeded against the Travancore Cochin Fisheries Act, 1950.

The chanks are collected by the shell merchants who have taken lease and are dumped in godowns for allowing the flesh to get decayed. The shells are covered with saw dust to avoid rotting. The main chank godowns are located at Vizhinjam, Chakkai near Trivandrum, Sakthikulangara and Cochin. Once the flesh is decayed the shells are graded into 9 commercial grades based on its length and girth (Fig. 8) and packed in gunny bags for sending to shell dealers at Culcutta. No chank processing industry exists now in Kerala.

There is good demand for chank flesh as an item of food for some section of the people and the operculum is in great demand for making incense stick. Bangles sawn from chank are carved and polished before marketing. There is good market for chank bangles in Bengal. Thus chank fishery has got good scope for improvement in Kerala Coast.

Analysis of data on landings of chanks from 1964–1980 (Table 1) shows that there had been steady increase in landings in recent years, the average annual landings being 22,000 as against 10,000 prior to 1960. The lessee purchased the chanks from fishermen through authorised agents at Rs. 1.00 to Rs. 5.00 depending on the size and quality. A good diver earns anywhere between Rs. 30/– to 40/– per day during season. The longline fishing fetches Rs. 70/– to 90/– per day during peak season.

Table 1. *The total landing and amount received by Govt. of Kerala from* 1964–65 *to* 1979–80.*

Year	No. of chanks	Royalty collected by Govt. Rs. Ps.
1964–65	8296	10032.50
1965–66	11918	6666.66
1966–67	11500	9001.00
1967–68	9997	13003.00
1968–69	14538	8167.86
1969–70	17814	17201.77
1970–71	34025	20001.00
1971–72	41179	22001.00
1972–73	27850	23000.00
1973–74	8339**	24000.00
1974–75	17004	18274.00
1975–76	4750**	26100.00
1976–77	15075	26100.00
1977–78	Not leased out	.....
1978–79	35117	12345.67
1979–80	44670	27000.00

* Details obtained from Administrative Report of the Department of Fisheries, Kerala.

** Data incomplete.

Diseases and destruction

Among the exploited chanks from Kerala Coast, 5-10 per cent are found to be wormed by *Lithophaga* spp. (bivalve) and by *Cliona* spp. (sponges) (Fig. 9). These

wormed shells are discarded while grading for marketing. Study of wormed shells collected from various centres reveals that the bivalves mostly damage thick part of the shell especially the spire, central portion of the body and anterior part, whereas sponges do not show any preference to the area of attack. The magnitude of destruction varies considerably and shells collected from shallow waters by diving and from gill nets show more percentage of damage than that from trawl catches and longline catches. About 5-10 per cent of chanks landed by trawl catches and longline are undersized ranging from 50 to 70 mm.

Prospects

The chank fishery in the west coast of India is quite insignificant compared to the east coast. But in recent years a spurt in the landings has been witnessed with catches being brought in by different fishing tackles. Once believed to be restricted to Trivandrum Coast only, the landings from places like Quilon and Cochin in recent times reveal potentialities of these areas for greater exploitation by following suitable methods. Though conventional diving was considered as the most important method of fishing, the major component of chanks landed in Kerala at present is constituted by trawl and longline catches.

In this context it is worthwhile to mention that the longline fishing method shows great potential for fishing out chanks from deeper waters which remained untapped due to limitations in skin diving exploitation. The introduction of 'SCUBA' diving might help to exploit the beds lying within 15 fathoms limit. Trawling and longline can be successfully employed in deeper waters.

A proper assessment of the chank resources of the different areas is very essential. From the available data, it would appear that there is ample scope for large scale development of this fishery. Longline fishing can also be done at other centres along the Kerala Coast for increased production of chanks, as being observed at Vizhinjam in recent years. With a proper survey of the chank resources of our waters and increase in the tempo of the exploitation by adopting various fishing methods there is every possibility of the chank industry expanding further.

UNDER WATER EXPLORATION*

Introduction

The sea-bed is considered as a major source of energy, minerals and food. One of the greatest attractions to the scientist in the sea, is the life in it. Invertebrates, fish, mammals and plants of many kinds and sizes fill the waters. Whether a person chooses to hunt them with spears or photograph them with cameras, collect them by other means or spend the time in animal watching they offer the most fascinating experience. The prehistoric man groping his hard way through existence exploited the resources of the sea even before he knew the way to use the soil. He depended for food as much on fishes as on the beasts of the forests. But there was something which prevented him from getting into the water and swim like fishes and breathe. No wonder history is replete with stories of trials and errors made by him in overcoming the barrier of water using reeds, tubes, cauldrons, swimbells etc. The post-World War II period ushered in a new era of underwater exploration. By this time considerable data and materials had been collected from the sea bottom by the various world famous expeditions with the help of mechanical contrivances, submarine vehicles, photography, echo-sounding etc., which were in the infant stage of development and perfection. Over the 35 years that followed World War II, progress in underwater technology,engineering, biomedicines, saturation-diving and automation had developed tremendously. William Beebe, Otis Barton,

* Prepared by S. Mahadevan and K. Nagappan Nair, Tuticorin Research Centre of CMFRI.

Auguste Piccard, Max Cosyns, Houot and Willm have become legendary figures by their descents in 'Operation deep' with various gadgets like Bathysphere, Bentho-scope, Bathyscaph and submersibles like *Trieste, Archi-mede* and *FNRS* 3. With the coming of 70's nations everywhere have reawakened to the importance and potential the world's oceans hold for them. Scientists are not only experimenting to probe deep into the abyssal depths of the ocean but also trying to live on the sea floor for extensive periods of time. The interest in the underwater science is growing to rival the in-terest in interplanetary excursions. Publication media

Fig. 1. Scientist exploring the sea bottom.

like 'Hydrospace', 'Underwater Science and Technology Journal', and 'Underwater Association Reports', only to mention a few, are all doing great service to the cause of developing the underwater exploration by the valuable information they give. Sea city plans, offshore living space, experimental sea bottom habitats etc., have caught the imagination of scientists as a result of automation, developments in saturation diving and hyperbaric environmental living for extensive periods while completing protracted tasks on the sea bed.

While thinking of the underwater exploration now-a-days, the first thing that strikes our mind is the picture of submersibles and other advanced equipments that are used in western countries like the U.S.A., France, U.S.S.R., Italy, U.K. and Germany. This is the image projected by films and television. The truth is that the bulk of the scientific, military and commercial exploratory diving has to be carried out in places in which conditions are difficult and necessarily different types of equipments have to be used. In practice there are many tasks that are best performed with instruments, wires, dredgers, televisions, cameras, echosounders and the like and other tasks that are best done by man only. In this connection diving skill by man becomes a vital factor in the armoury of tech-niques which are being used to explore and exploit the sea. A scientist diver can intelligently search for the specific details of features, take photographs, take measurements and write down notes on the spot of what he sees, based on hand to eye co-ordination. Man's presence is needed badly because of the benefits like decision making, ability, dexterity, compactness, mano-euvrability, agility and flexibility. The fact that these advantages constitute the real assets in our explo-rations and developments of the oceans, accounts, in part, for the increased activities of man's diving with aqualung. There is a lot to be done in the shallow limits of the ocean base with the help of the aqualung and the very nature of the cheap cost of possessing and operating the aqualung makes it all the more easy for the developing country to introduce this system of diving in the sea bottom explorations off its coast.

Fig. 2. Pearl oyster collection in progress.

Underwater work in India

Today in India only skin diving is practised in commercial fishing in some parts of the country, es-pecially in the south east coast where a section of the fishermen dive for chanks at depths up to 18 m. In almost all the major harbours the port authorities maintain a team of divers who are trained in diving with helmet and suits essentially for carrying out re-pairs and maintenance work alongside the harbour piers at shallow depths. The Indian Navy maintains its own team of 'Frogmen' solely for military reasons. Diving work as a means of doing exploratory scientific investigations was unknown till the beginning of 1958.

Through a programme initiated by the Government of India in 1958 the services of an Italian underwater diving expert, Dr. Salvadori, who is also a biologist, was obtained with the help of the F.A.O. for training Indian biologists in aqualung diving. He visited India thrice between 1958 and 1960 during the course

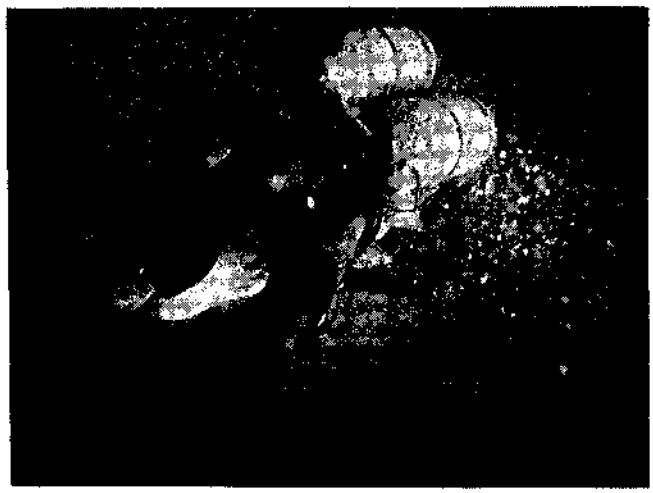


Fig. 3. Return to the launch after diving.

of which he not only trained a batch of 4 members, 2 scientists from the Central Marine Fisheries Research Institute and two technical staff of the Tamil Nadu Fisheries Department, but also conducted an initial survey of the sea bed off Tuticorin with the help of the trained scientist. This pioneering survey work was started in 1961 and completed in 1964. Many interesting scientific observations were made and published as a result of this survey. The pearl oyster and chank fishing grounds off Tuticorin were properly charted and demarcated. Till to-day these remain as the only publication in underwater research in the country.

In our country there is vast scope for the development of the diving activities with aqualung. India has the advantage of a very long coast line, extending over 6000 km with excellent locations all along the coast for exploratory diving work. Underwater study of the inshore areas will throw new light on the faunal and floral richness. Explorations of the coral reefs surrounding the innumerable islands of Andaman, Nicobar, Lakshadweep and the Gulf of Mannar by the SCUBA diving scientists of CMFRI have brought to light interesting information on the commercial possibilities in the exploitation of the many marine animals and seaweeds. The waters all around will offer enough scope for exploration and sport fishing, archaeological research, photography, fish watching, prospecting for minerals and salvage of sunken treasures and objects. Fun and pleasure can be combined with serious work.

Although development in this field involving advanced types of underwater equipments like the bathyscaph may not be possible immediately, a phased programme could be implemented. The first step would be to popularise the diving activities amongst people by introducing the aqualung system of diving. There is a mistaken impression that only people with robust health, physique and dare devil attitude can do diving work. In almost all foreign countries even whole families consisting of children, men and women between the age of 6 to 60 are attracted to this work and do diving as a hobby. So the development of this branch of work has to be viewed in its proper perspective so that diving becomes popular in India at least during the 80's.

Training in aqualung diving

People should be trained to become conversant with the use of masks, snorkels, fins and swimming at the surface at shallow depths in lagoons, swimming pools or tanks where water is clear. Side by side with this the basic principles governing the aqualung diving

Fig. 4. Group of trained technicians of the Institute ready for diving.

will have to be imparted to them. This should be followed by taking the trainees periodically for aqualung diving at shallow depths so that practical training can be imparted to them to give confidence in the use of these equipments. Once this initial period is over in a period of six to eight weeks, depending on the

ability of the individuals they can be taken to deeper areas for further experience in diving. By this time they would have gained considerable knowledge in overcoming minor and major defects which are likely to arise while diving. Organising diving clubs in several places in our country is another important aspect. These clubs will not only impart training to the aspirants but also cater information to them on all matters connected with the progress of diving activities.

The next stage in the development of the underwater activities is the manufacture of diving equipments in India itself. Abundant talent is available in our country and the necessary resources also. Enterprising firms who come forward to manufacture them should be encouraged by giving them all help. To start with it may become necessary to import equipments, but this dependence can be minimised once the interest in our country increases and the manufacturers get the confidence that their investments will bring good returns. Based on the measures of popularity of this branch during the first five years further schemes for expansion can be planned.

One of the sure ways of catching the eyes of the younger generation is by audio visual publicity, showing the interest evinced by other countries in diving activities. An educative documentary can be prepared with Indian bias to inform the people of the potentialities of underwater exploration and to popularise the aqualung diving method.

The Central Marine Fisheries Research Institute has in its regular programme a project for training scientists and technical personnel in aqualung diving. Under this project, training is given for a period of 8 weeks in the different systems and techniques of diving. Scientists, technicians and commercial diving fishermen (with some educational background) are eligible to be trained. Medical fitness of the individuals have to be checked before the commencement of the training. It is also recommended that those undergoing the training should get their lives insured by sponsoring agencies or by the associations deputing them. Tuticorin is chosen as the venue and the period of training starts during the fair weather of November extending up to the middle of April next year. It is hoped that University departments and Fisheries agencies of the various States will make the best use of this opportunity.

NEWS—INDIA AND OVERSEAS

Plan to exploit the rich marine resources of Tamil Nadu

The results of a preliminary study undertaken under the "country programme" of the Food and Agriculture Organisation (FAO) of the United Nations showed the availability of 5,30,000 tonnes of fish in the continental shelf of the east coast of India. Based on this the Tamil Nadu Government is making extensive plan to exploit the fishery wealth of its 41,400 sq. km area of the extended exclusive economic zone. In the Sixth plan proposals 26 trawlers are to be bought for exploitation of the additional resources. In order to help fishermen in diversification of fishing activities, subsidies on the cost of fishing nets are proposed. In addition to setting up 10 demonstration fish culture farms in different districts, it is programmed to establish a commercial prawn farm at Adiramapattinam in Tanjavur and a pilot demonstration farm for fresh water prawns in Chingelpet district.

Conservation of the Antarctic ecosystem

Representatives of 15 nations namely, France, Australia, New Zealand, United Kingdom, United States, Soviet Union, Japan, Norway, South Africa, Argentina, Chile, Belgium, Poland, Federal Republic of Germany and Democratic Republic of Germany met at Canberra, Australia in May 1980 to initial an historic treaty designed to manage commercial uses of living

resources in the Southern Ocean surrounding Antarctica. The agreement to ensure rational harvesting of Antarctica's finfish, molluscs, crustaceans and other species is not only the first of its type to take an "ecosystem" approach to preserving a region's environment, but its drafting also represents the first time that nation have united to save species before their existence is put in jeopardy.

It may be five to seven years before the ratification process for the "Convention on the Conservation of Antarctic Marine Resources" is completed. The key articles in the treaty establish an international commission and a scientific advisory committee. The Commission and its expert advisors would be responsible for continually monitoring the population size of Antarctic organisms, establishing harvesting quotas for specific species, ordering open and closed seasons on hunting of different animals and designating protected species. To further increase knowledge of the area's marine eco-system, the Commission is also empowered to reserve areas, regions, or subregions as specially protected places for scientific and conservation studies.

International Exchange News 24 (2): 1980

Unmanned submersibles for under water work

As oil exploration and production move further offshore, under seas work becomes more complex and hazardous for divers. Unmanned, untethered vehicles with their potential for mobility and decision-making, might be taught to inspect or repair offshore structures at depths where a diver would require days of compression and decompression for brief minutes of actual work. Such vehicles might also perform a variety of data gathering research and survey tasks, particularly in deep water or remote locations.

Three different University projects on unmanned submersibles were discussed at a recent meeting at Massachusetts Institute of Technology. Students at MIT are fabricating Robot II, a sophisticated sonar platform tailored for search and survey work. Another project at MIT concentrates on supervisory control of semi-autonomous vehicles and man-machine interactions. The University of New Hampshire presented an experimental autonomous vehicle (EAVE-East), which is being trained to follow pipelines on the seafloor. Communications between operators and vehicles must improve if machines are to replace humans in complicated jobs.

Research in Ocean Engineering 1 (4): 1979

Warming up of the Pacific

Oceanographers and meteorologists of U.S. National Marine Fisheries Service Southwest Centre in La Jolla, California, who keep a close watch on ocean temperature in the Pacific have recorded abnormally high surface temperatures off the west coast of North America since November 1979. This warm water covers a vast area (about two million sq. miles) of the Pacific Ocean from about the tip of Baja California in Mexico to British Columbia and seaward to about the Hawaiian Islands, as deep as 50 m throughout.

Complex air-sea interactions resulting in an apparent reduction in heat loss in ocean surface layer during the winter months, a large pool of warm water which developed during the late summer of 1979 remaining in place along the area, northward movement of warm waters from the tropical and central areas of the Pacific and a virtual shut down of the traditional coastal upwelling are among the reasons which oceanographers attribute to this unusual warming up of the eastern North Pacific waters. These warm ocean conditions are associated with unusual patterns of atmospheric pressure distribution and are believed to change the lives and habits of both fish and people.

FNI 19 (6): June 1980.

BOOKS

Advances in fish science and technology: Edited by J. J. Conell, Fishing News Books Limited, Surrey, England, pp 528, 1980.

This volume contains almost all the papers from the international conference held in Aberdeen in 1979 to celebrate the fiftieth anniversary of the Torry Research Station of Scotland. In the first two chapters are gathered together all the review papers written by world experts on topics in fish science and technology. Each reviewer has described the development of his topic over the years along with an appraisal of the current trends and a look into the future.

The second part of the book is the recent advances section containing research papers on a wide variety of problems of fish science and technology from different parts of the world. The topics are grouped in chapters such as minced fish, process and new product investigations, smoking, chilled and frozen storage, krill, by-products, fish technology and its transfer, seasonal changes, quality assessment, protein studies, microbiology, low molecular weight compounds, water in fish and histology. This extensive compilation is a comprehensive record of how fish science and technology has developed, its current advances and future possibilities.

Fundamental tissue geometry for biologists: By K. J. Dormer, Cambridge University Press, Cambridge. pp. 149, 1980.

The quantitative description of tissue geometry is of fundamental biological importance, but until now it has been considered inappropriate to seek any uniform system of mathematical analysis for histological problems. This is the first coherent account of the subject and provides explanations for many phenomena which have hitherto been regarded as more or less unintelligible. Mathematical modelling techniques are used to link the fate of individual cells to the general processes of growth and differentiation, and the geometrical aspects of these processes are successfully reduced to calculation. It incorporates a large number of recorded observations which will be an important practical aid to routine computation in histological laboratories.

Microbial physiology: By Albert G. Moat, John Wiley & Sons, New York, pp. 600, 1979.

The author draws together the current knowledge of the fine structure, metabolism and genetics of microorganisms and describes the interaction of these physiological activities in the growth of microbial cells and the development of populations of microorganisms. The book contains (a) general introduction and classification of microorganisms, (b) subcellular structure of microorganisms, (c) three chapters offering insight into the metabolism and biosynthesis of different classes of compounds by microorganism and their energy production, (d) two chapters on biochemical and genetic analysis of the ability of microbial cells to synthesize DNA, RNA and proteins, (e) growth and (f) morphogenesis. It is well illustrated with photomicrographs, charts and other illustrations.

Compiled and prepared by M. J. George, S. K. Dharmaraja and G. Subbaraju. 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