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SEMINAR ON POTENTIAL MARINE FISHERY RESOURCES

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Central Marine Fisheries Research Institute
(Indian Council of Agricultural Research)
P. B. No. 2704, E. R. G. Road, Cochin-682 031, India
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POTENTIAL MARINE FISHERY RESOURCES OF INDIA

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INTRODUCTION

Marine Fisheries resources of our country, being dynamic and self renewing in nature, are subject to fluctuations due to fishery-dependent and fishery-independent factors. Therefore, it becomes necessary to riview periodically the status of exploited resources and make critical assessent of the fishery potential as more and more data are gathered and new knowledge based on exploratory surveys and researches emerges. Such vital information on the potential resources of the country is an essential prerequisite for proper planning of development strategies with regard to the marine fisheries sector.

The marine fish production of the country continues to be predominantly in the hands of the traditional and small-scale mechanized sectors, the efforts of which still concentrate in the narrow coastal belt. This situation has been continuing despite the developmental inputs such as strengthening mechanized fleet by increasing small trawlers to 20,000 and establishing infrastructural facilities such as fishing harbours.

With the declaration of the Exclusive Economic Zone, a vast area of 2.02 million sq.km., having rich marine fishery resources, is thrown open for rational exploitation, offering scope for increasing production.

PRESENT LEVEL OF EXPLOITATION

India's marine fish production, as estimated by the CMFRI, touched the 1 million tonne mark for the first time in 1970 and,

thereafter, for nearly 15 years, has remained stabilized around 1.4 million tonnes. Table 1 gives the current level of production based on the estimates for the years 1980 to 1984, During the previous 5-year period, the average production was 1.36 million tonnes.

Table 1: *Annual Marine Fish Production in India during 1980-1984*

Year	Landings (tonnes)
1980	1,249,837
1981	1,378,457
1982	1,420,624
1983	1,548,475
1984	1,630,678
Annual average	1,445,614

As could be seen from the table, the marine fish production has reached a plateau, which is because of the fishing effort being mainly concentrated in the 0-50 depth zone of the coastal belt. It is estimated that, on an average, the artisanal fisheries sector contributes 39% and the small-mechanized sector 61% of the annual production.

The exploited resources along our coasts are unevenly distributed, with the west coast, with its dominating major fisheries for oil sardine, anchovies, bombayduck, and penaeid prawns, contributing about 2/3 of the present yield. Table 2 givies the regionwise average production for the period of 1980-84.

Table 2: *Regionwise average production of marine fish during 1980-1984* (in million tonnes)

Northwest region (Gujarat & Maharashtra)	... 0.489
Southwest region (Goa, Karnataka & Kerala)	... 0.498
Southeast region (Tamil Nadu, Pondicherry & Andhra Prdesh)	0.386
Northeast region (Orissa & West Bengal)	... 0.065
Lakshadweep region	... 0.004
Andaman-Nicobar region	... 0.004

The all-India marine fish production is made up of pelagic and demersal stocks to the average extents of 51.9% and 48.1%, respectively. The major pelagic stocks are oil sardine (*Sardinella longiceps*), bomdayduck (*Harpodon nehereus*), anchovies *Stolephorus* sp, *Thryssa* sp, *Coilia* sp. and *Setipinna* sp) and 'other sardines' (*Sardinella gibbosa*, *S. albella* etc). The major demersal stocks comprise penaeid prawns *Penaeus* spp., *Metepenaeus* spp., *Parapenaeopsis* spp), sciaenids (*Sciaena* sp, *Pseudosciaena* sp, *Johnius* sp., *Penhania aneus*, *Otolithes* sp,) silverbellies (*Leiognathus* spp) and Elasmobranchs. The average productions of these major groups during 1980-84 are given in Table-3. They together contribute to 54% of the total production. Apart from this, the species of medium importance contributing to the fish production are ribbonfish (*Trichiurus* spp.), mackerel (*Rastrelligen kanagurta*), carangids, pomfrets, seerfish (*Scomberomorus* spp.) catfishes, perches and non-penaeid prawns.

Table-3: *Annual production trends of major species 1980-84 (thousand t)*

Year	Pelagic species				Demersal species			
	Oil sardine	Bombay duck	Anchovies	other sardines	Penaeid prawns	Sciaenids	Silver bellies	Elasmo branch
1980	116	96	63	67	112	89	54	58
1981	221	138	68	62	84	83	69	56
1982	205	86	80	55	111	87	73	64
1983	184	101	126	77	118	101	92	69
1984	189	118	120	68	130	110	57	58
Annual average	183	108	92	66	111	94	69	61

Table-4: *Average annual praduction from species of medium importance during 1980-84 (thousant 5)*

Pelagic species		Demersal species	
Ribbonfishes	50	Catfishes	58
Mackerel	41		
Carangids	44	Perches	48
Pomfrets	48	Non penaeid	
Seer fishes	32	prawns	57

The other groups of commercial importance are the clupeids, (30,000 t), tunas (20,000 t) and cephalopods (15,000 t).

The characteristic feature of most of the exploited stocks is a wide year-to-year fluctuation.

ASSESSMENT OF POTENTIAL RESOURCES

The foregoing paragraphs, showing the current levels of exploitation of the major and minor resources within the present intensively fished 0.50 m zone, point out the existing stagnation in yield and the lack of scope for further increase within the zone in respect of many species. Therefore, we should look to the waters beyond the 50m zone and the EEZ for additional resources. In this context, the assessment made on potential yield (PY) of resources assumes importance.

During the past two decades, many approaches were made for assessing the potential resources of the EEZ. Estimates of PY were made based on the primary production of seas and the exploratory surveys of various agencies, as well as by the approximation based on estimated production from exploited stocks. These estimates of PY ranged from 2 million tonnes to 8.5 million tonnes per annum for the Indian waters (Subranmanyan 1959; Panikkar 1966; Prasad *et al* 1970; Cushing 1971; Gulland 1971; Jones and Banerji 1973; Prasad and Nair 1973; Shomura 1976; and Silas *et al* 1976).

In the context of the declaration of Exclusive Economic Zone in 1977, George *et. al.* (1977) made a comprehensive review of the exploited resources in different regions and, taking into consideration the additional data from the exploratory surveys in the intervening period, gave an estimate of annual potential yield in EEZ as 4.47 million tonnes. Out of this projected potential, the estimates of PY of different regions and depth zones *vis a vis* present productions are presented in Table 5.

As could be seen from the regionwise potentials *vis a vis* present levels of production within the 0.50 m depth zone, there appears to be a scope for increased production only in the north-east region. Whereas, the potential from the 50-200 m depth

Table-5. *Estimated annual potential yield of marine fish in the EEZ of India (in thousand tonnes)*

Region	India's present production	Annual potential yield			
		0.50m	50–200m	beyond 200 m	Total
North-west	489	540	340		880
South-west	498	700	720		1420
South-east	386	480	200		680
North-east	65	540	200		740
Lakshadweep	4	–	90		90
Andaman&Nicober	4	–	160		190
Oceanic of all regions	–	–	–	500	500
Totals	1416	2260	1710	500	4470

zone and the oceanic waters, amounting to 2.2 million tonnes, offers vast scope for exploitation.

The potential yield of 4.47 million tonnes in the EEZ comprises pelagic fishes (1.85 million), demersal fishes (1.1 million) and the rest, consisting of crustaceans, cephalopods, oceanic fishes and miscellaneous fishes. (Table 6).

Table - 6. *Groups of fishes and their potential annual yield in the EEZ of India* (in thousand tonnes)

Groups	present yield	Potential yield
Pelagic fishes	714	1850
Demersal fishes	336	1095
Crustaceans	214	325
Cephalopods	15	180
Miscellaneous	164	520
Oceanic fishes	3	500
Totals	1446	4470

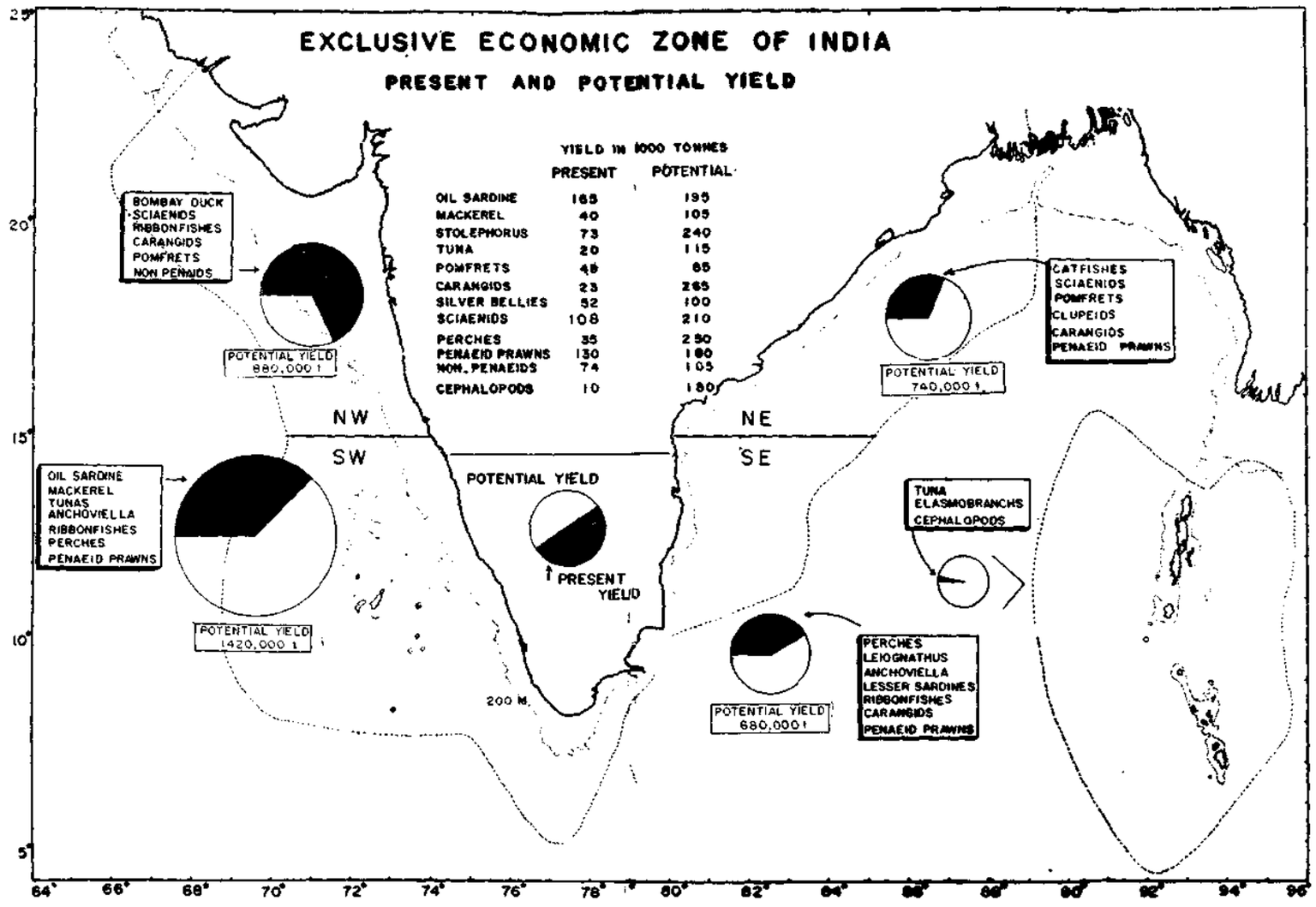

FIG. 1 Map of the EEZ of the India showing the area wise estimated potential yields of different groups.

Potential Pelagic Resources

The present levels of production of different groups and the potentials and scopes for increasing them can be examined in greater detail as follows.

It is estimated that the potential of pelagic stocks is 1.85 million tonnes as against the present yield of about 0.7 million tonnes. By the acoustic and aereal surveys conducted by the

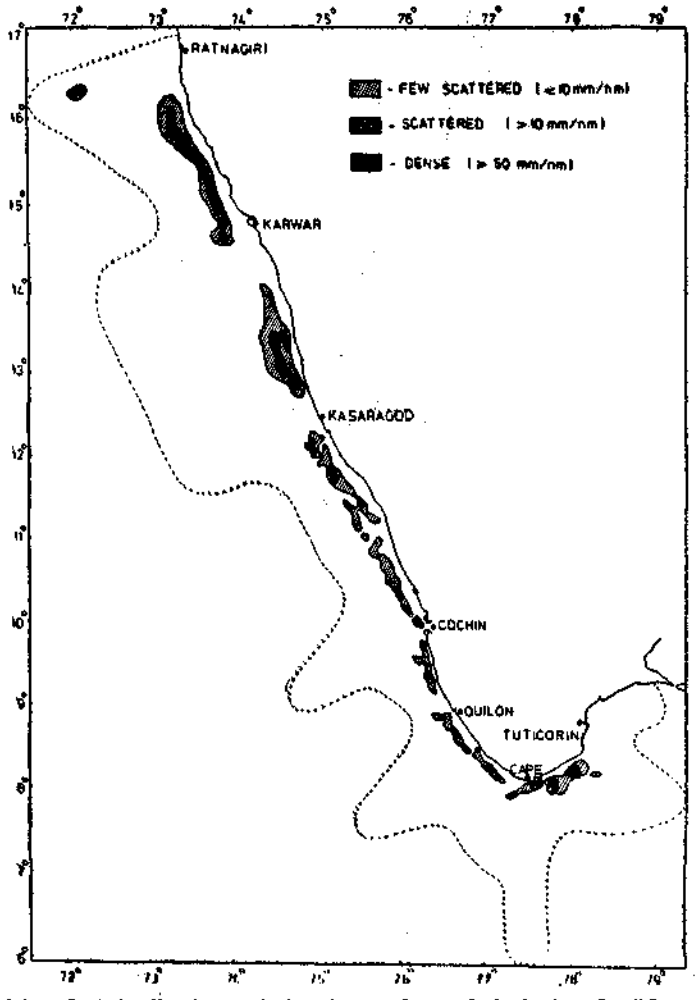

Fig. 2 Distribution and abundance of whitebait during Oct/Nov.

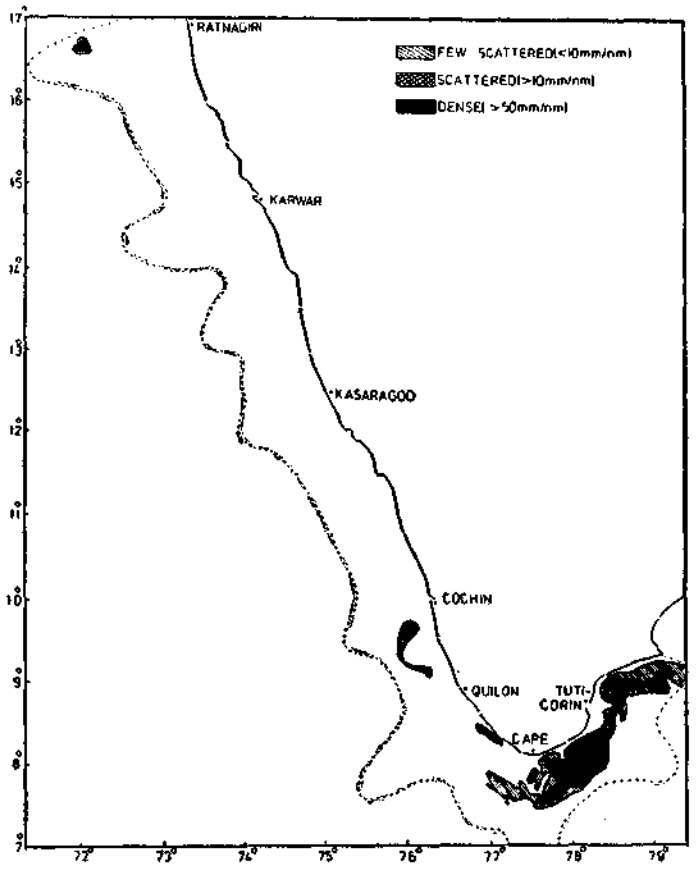

Fig. 3 Distribution and abundance of whitebait during August.

eirstwhile Pelagic Fisheries Project along the southwest coast and in the Gulf of Mannar, the average annual biomasses of white bait, horse mackerel, mackerel and oil sardine have been estimated respectively as 0.75, 0.13, 0.27, 0.55 million tonnes (Anon, 1980), A single-group resource that is reported to have a very high concentration in the 20-50 m zone is the anchovies, particularly in the southwest and Gulf of Mannar regions (figs 2-3) Besides, definite indications of large stocks of oil sardine, mackerel, pomfret. carangids, ribbonfish, lesser sardines and coastal tunas in depth zone 50-200 m have also come from some recent surveys along the east and west coasts of India (Bapat *et. al.* 1982; Silas and

Pillai, 1982; Joseph, 1984; Somavanshi and Bhar 1984 and Ninan *et. al.* 1984).

Stock assessment studies carried out by CMFRI on the exploited major pelagic stocks has indicated that increased production from the stocks in the presently exploited ground is possible by capturing them at increased size or by extending the fishing to unexploited areas.

Among the pelagic stocks, those which promise high production *vis a vis* current production are as follows:

Species	PY (x1000 t)	Av. current yield (x 1000 t)
Other sardines	1410	66
Anchovies	240	92
Other clupeids	165	30
Ribbonfishes	270	50
Carangids	265	44
Coastal tunas and Related species	240	20

By far the most important among pelagic resources, which offer the maximum potential for exploitation, are the oceanic tunas such as yellowfin (*Thunnus albacares*), skipjack (*Katsuwonus pelamis*), bigeye (*Thunnes obesus*), albacore (*T. alallunga*); marline (*Tetrapturus* sp and *Makaira* sp) and oceanic sharks (*Carcharinus melanopterus, C. longimanus etc*). These together have a potential of 0.5 million tonnes and we are exploiting only a fringe of the resources. Recent surveys of CIFNET and FSI vessals which conducted longline fishing in the southwest coast, Andaman sea, west of Maldives and eastern Arabian sea, have indicated rich grounds for these resources, especially in the area 12° to 16°N latitude and 70° to 74° E longitude off west coast of India, where catch rates as high as 8.1 to 25.0 nos/100 hooks have been obtained. (Varghese *et al.* 1684; Anon 1882). (fig. 4).

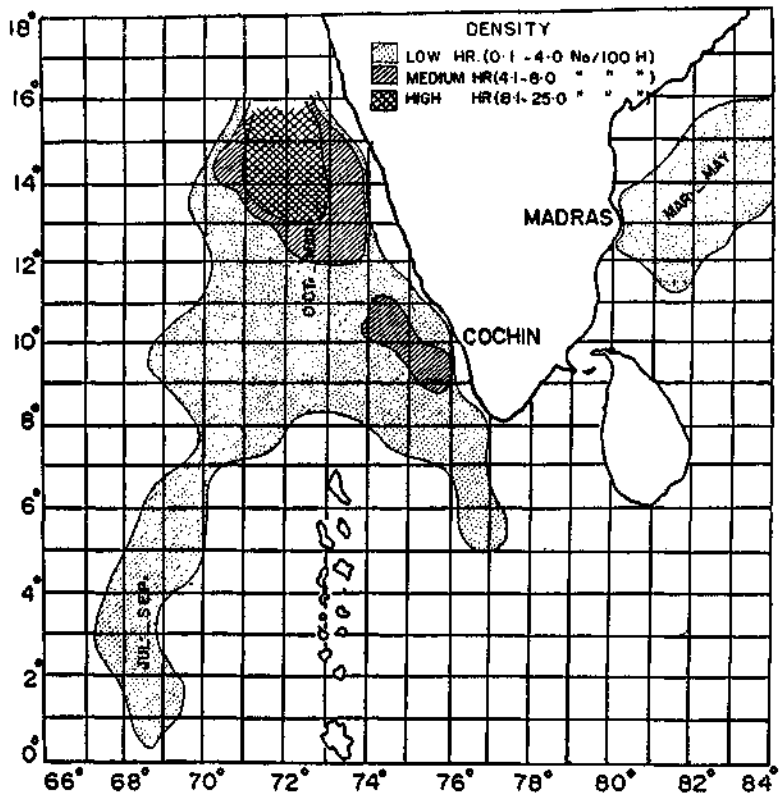

Fig 4. Distribution and abundance of oceanic tuna resources.

Potential Demersal Resources

The demersal fisheries of Indian seas, their component groups and fluctuations, have been well studied by various organizations including CMFRI (Rao, 1973). The estimated potential of demersal finfish resources of thr EEZ is around 1.1 million tonnes, as against the current total yield of 0.34 million tonnes. As has been already stated, the 0-50 m zone is intensively tished, and any increase in effort here is likely to affect the stocks. Enhanced production is possible only by allowing to increase the size of fish at capture of the presently exploited stocks, or by extending fishing to the unexploited grounds, where, too, good concentration of the species presently exploited are found to occur.

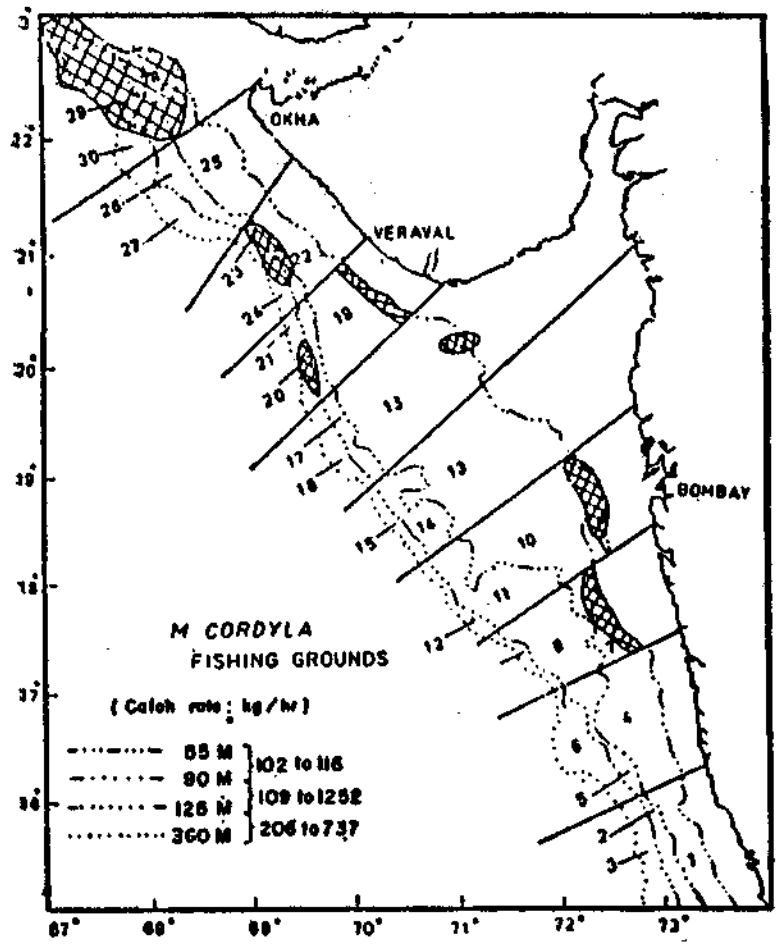

Fig. 5 Horsemackerel fishing grounds.

Based on the results of the exploratory surveys by M. T. *Murena*, the potential harvestable yield of three depth zones (55-90, 91-125 and 126-360 m) in the north western region were estimated to be 0.11, 0.03 and 0-01 million tonnes, respectively (Bapat, *et al.* 1982). The density was indicated to be the greatest in the 55-90 m zone (2. 31 t/km^2), where the resources comprised mainly pomfrets, catfish, clupeids, breams, ghol, koth, dhoma, elasmobranchs and eels. In depths beyond 90m lutianids, serranids, other perches and nemipterids were indicated

to have wide distribution, the catch rates increasing with increasing the depth.

The resource potential of the 'Kalava' grounds off southwest coast of India was estimated by Silas (1969) and Menon and Joseph (1969). The catch rates in these grouds ranged from 125 to 229 kg per 100 hooks per hour, indicating a rich potential for

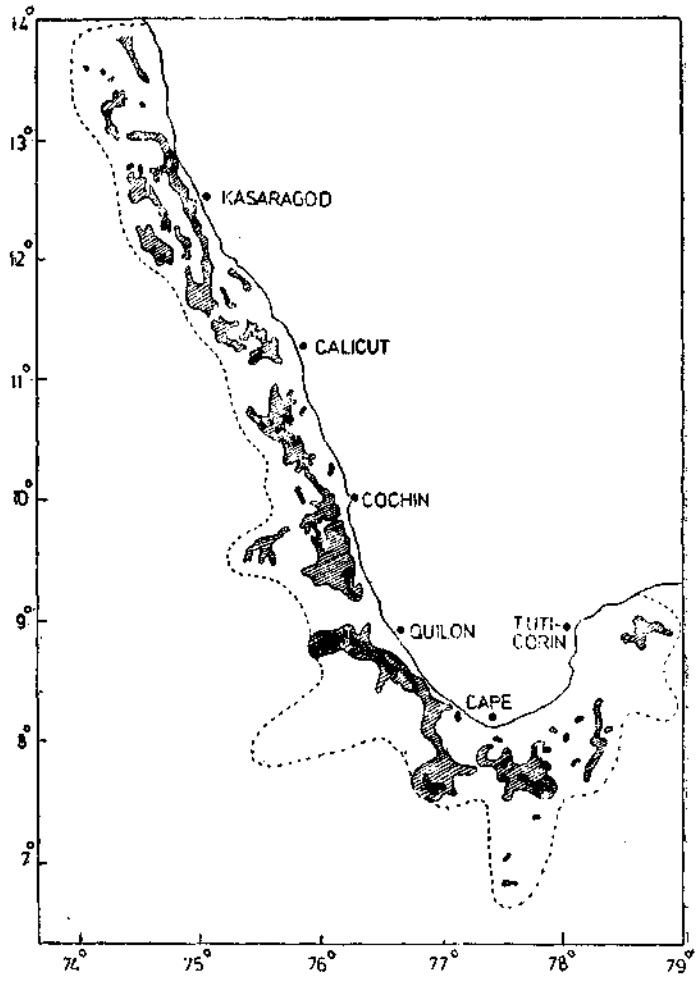

Fig. 6 Distribution and abundance of horse mackerel during September-October

commercial fishery. The main species were *Epinephelus chlorostigma* and *Pristipomoides typus*. Based on trawl surveys conducted in the same region in depth range 75-400 m, Silas (1969) estimated the sustainable yield of demersal resources to be around 60,000 tonnes, with nearly 60% of it in the 100-400 m. The predominant resource in 180-220 mdepth zone was that of the threadfin bream, *Nemipterus* sp.

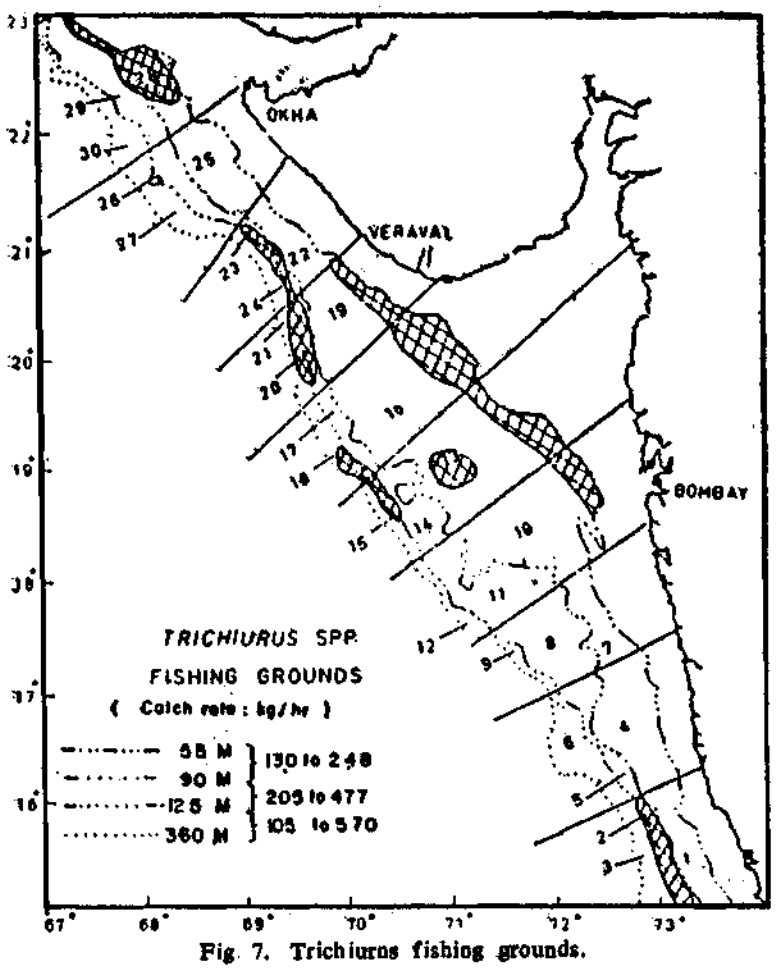

Fig. 7. Trichiurus fishing grounds.

The unexploited and underexploited stocks of catfishes along the southwest coast based on acoustic surveys were estimated to

be 80,000 tonnes (Rao et al 1977). The biomass has been observed to be greater during the monsoon months, but the exploitation has been inadequate due to limitations posed by adverse weather conditions. In general, catfishes are available in greated concentrations over long periods (May to September) off Kerala and Karnataka, where larger size groups occur in deeper waters.

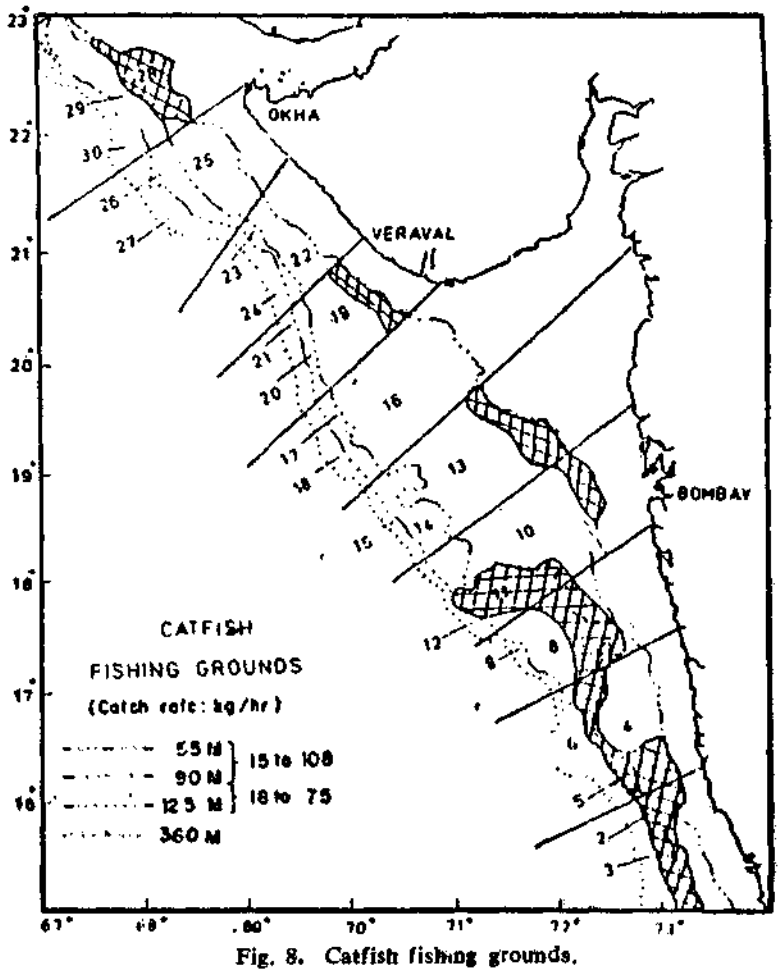

Fig. 8. Catfish fishing grounds.

Among the currently exploited demersal finfish resources, the groups that have greater potential for further exploitation and offer scope for increased production, are as follows:

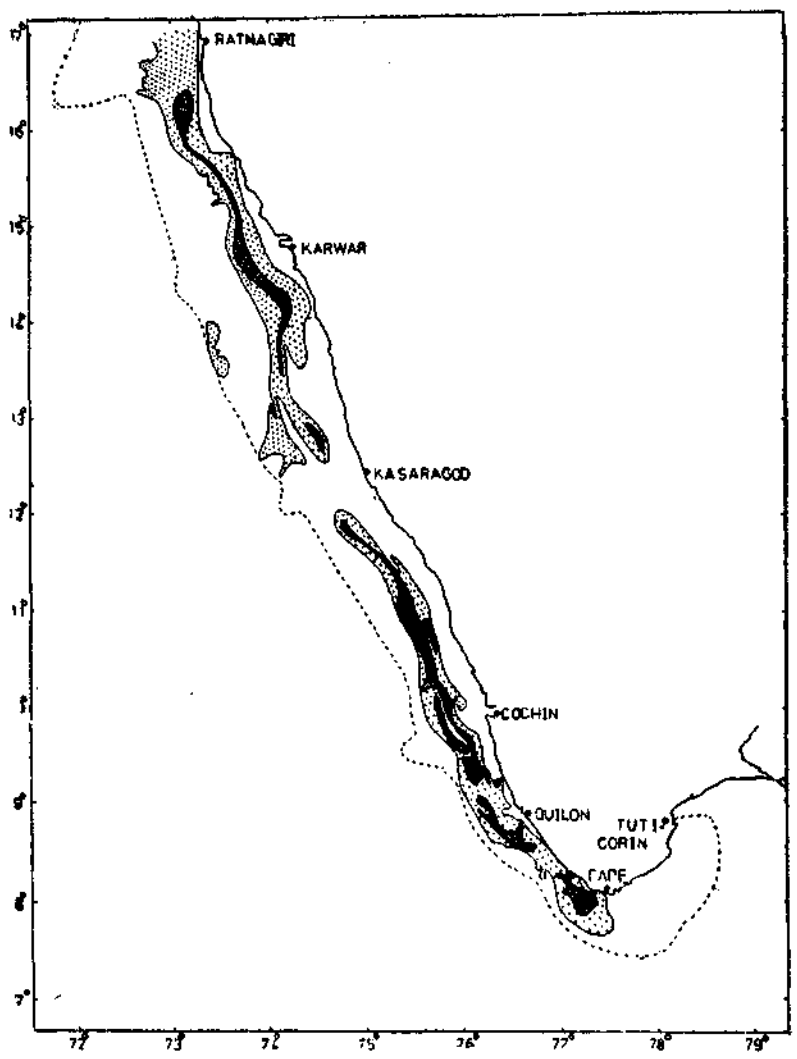

Fig. 9. Distribution and abundance of catfish/ribbonfish during July. August.

Species	P. Y. (x 1000 t)	Av. current yield (x 1000 t)
Elasmobranchs	185	61
Catfishes	310	58
Perches	250	48
Sciaenids	210	94
Leiognathids	100	69

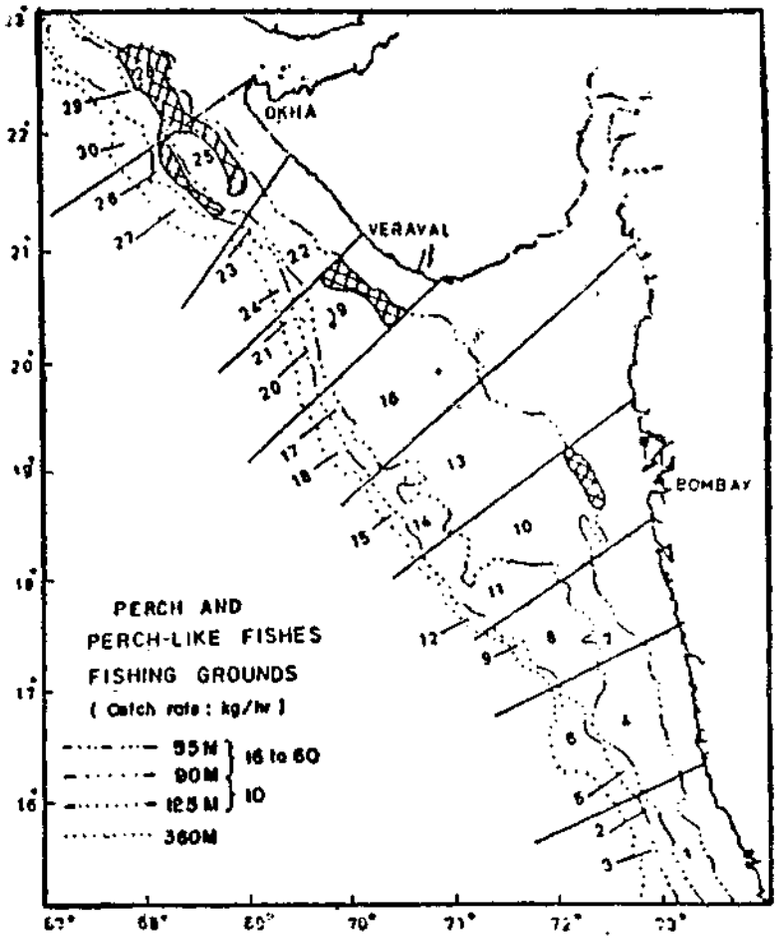

Fig. 10. Perch fishing grounds.

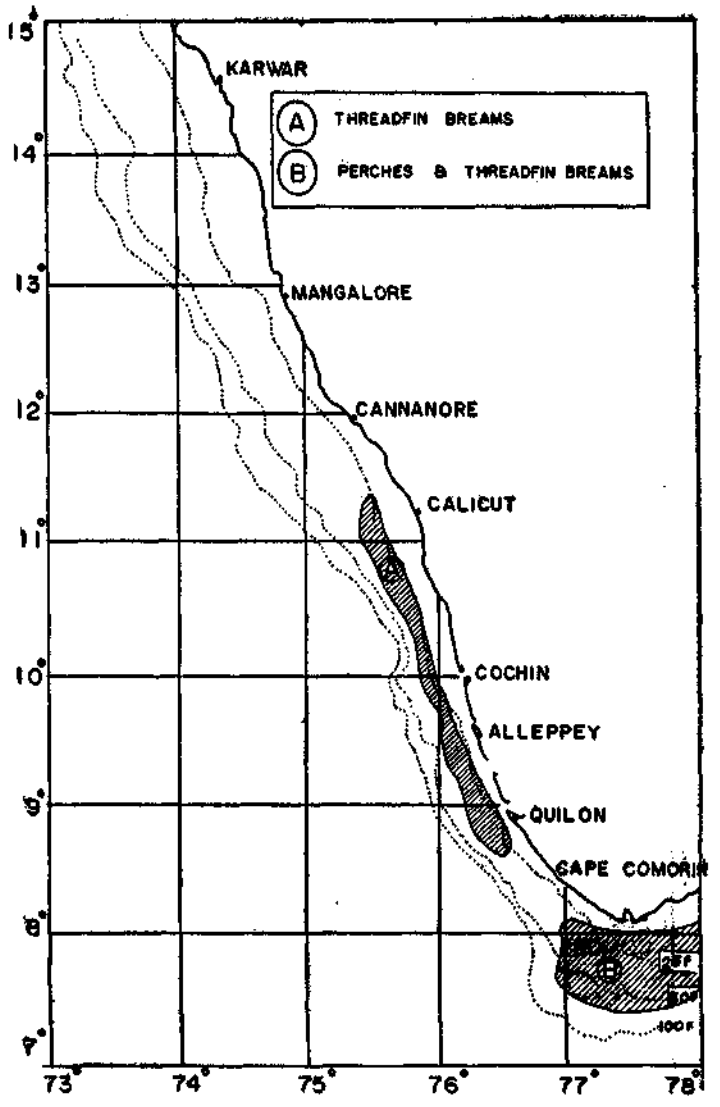

Fig. 11. Depthwise distribution of threadfin breams and perches.

Past and recent surveys by Govt. of India vessels and research vessels of other organization have indicated the availability of non-conventional resources in the deeper waters of the

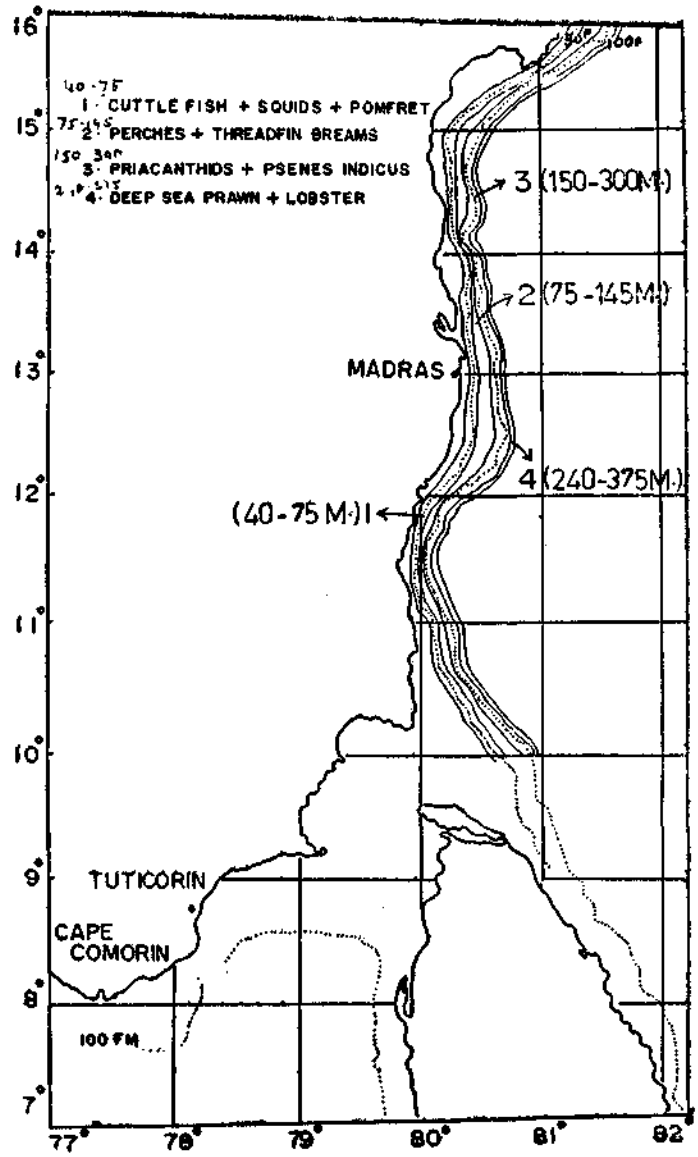

Fig. 12. Depthwise distribution of the potenital resources along lower east coast.

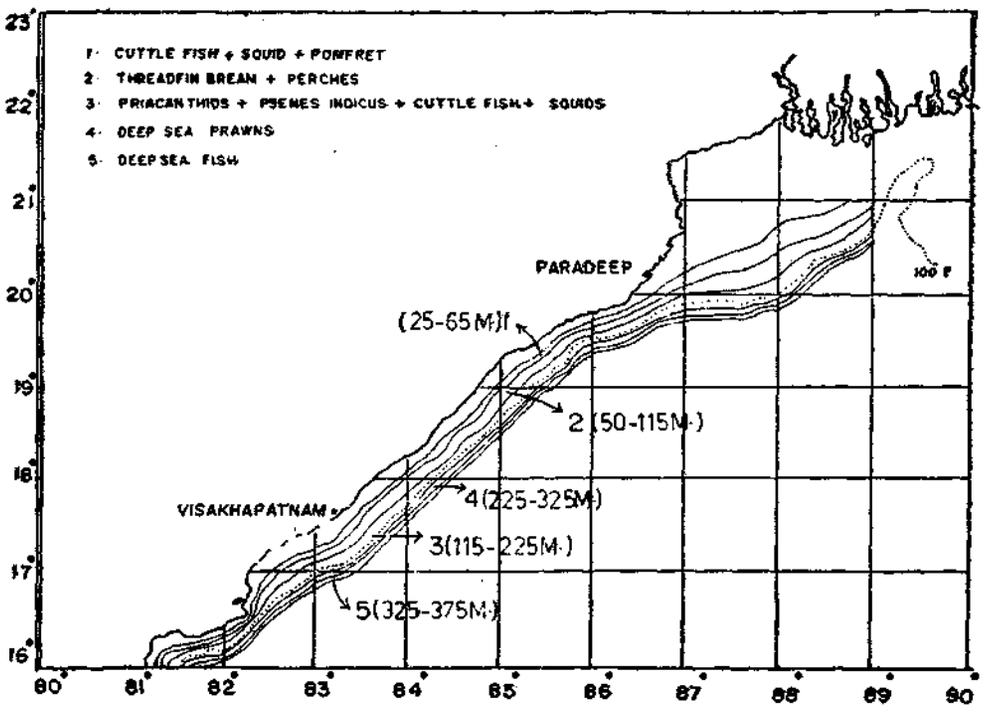

Fig. 13. Depthwise distribution of the potential resources of the upper eastcoast

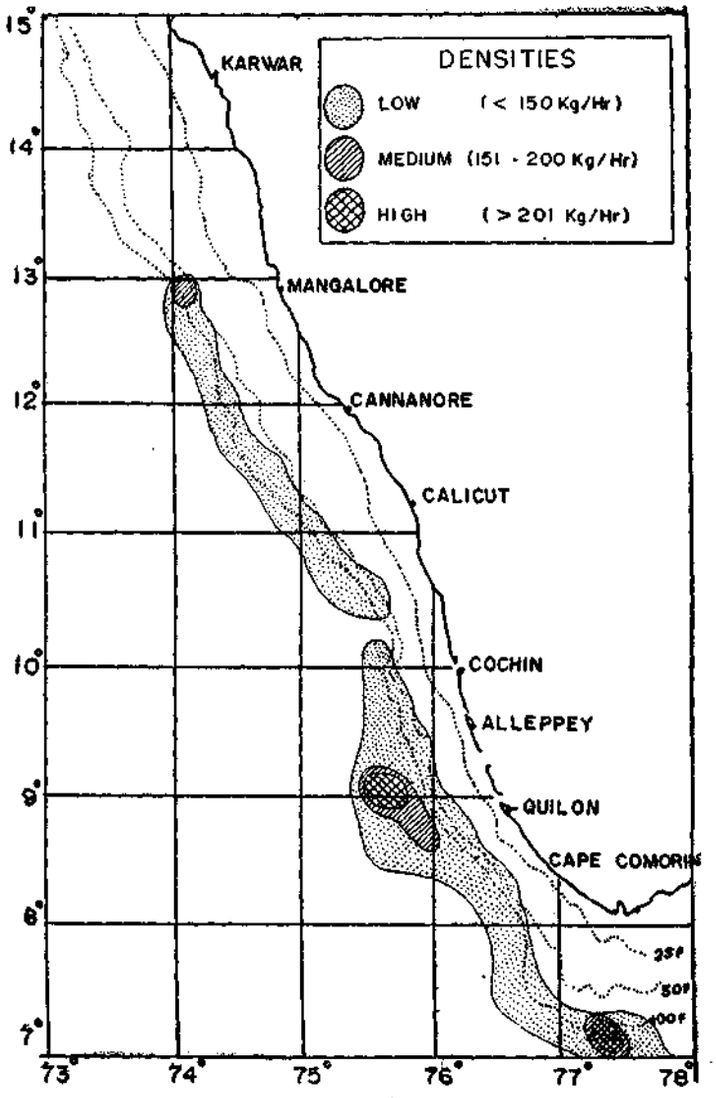

Fig. 14 Distribution and abundance of deep sea lobsters, shrimps and fish.

shelf and slope along the south west coast that are mainly consisting of fishes such as *Chlorophthalmus*, *Cubiceps natalensis* and *Pseneopsis*. Their potential yields have been estimated at 33,000 tonnes. Their maximum abundance is reported to occur in 300-400 m depth in July-January period. (Silas 1969; Mohamed and Suseelan 1973; Tholasilingam *et al.* 1973 and Oomen 1980, 1985)

Surveys by the larger vessels of the FSI in recent years have revealed that in different sections of east and west coasts there exist new and rich resources like Bull's eye (*Priacanthus* spp) black ruff (*Centrolopus niger*) and Indian driftfish (*Psenes indicus*) in depths ranging from 100 to 500 m, with catch rates as high as 600 kg/h, 2000 kg/h and 1400 kg/h, respectively, indicating their commercial potentialities (Somvanshi and Joseph 1983).

Potential Crustacean Resources

Ever since the export market for shrimp got established in the 60s, commercial trawling for this resource rapidly increased in the close-shore areas within 0-50 m depth zone, resulting in economic overfishing in certain regions such as the southwest coast. Studies conducted by CMFRI have shown that, since the stocks have been heavily exploited, very little scope exists for increasing production from the traditional shrimp grounds, Therefore, the potential crustacean resources that are available for further exploitation are those inhabiting the outer shelf and continental slope. Intensive exploratory fishing conducted in the past and in recent years have indicated potentialities for deep-water shrimp, lobsters and crabs off southwest and southeast coasts and in the Gulf of Mannar.

The sustainable potential for deep-sea shrimp along the southwest coast has been estimated at 3,000 tonnes and that for deep-sea lobster *Puerulus sewelli* at 8,000 tonnes for southwest coast and 1,200 tonnes for southeast coast. The maximum abundance of deep-sea shrimp was observed in 300-400 m depth zone, during the months October-January, and for deep-sea lobster in 180-270 m depth, during February-June (Mohammed and Suseelan 1973, Oommen 1980, 1985).

Among the deep-water crab resources, the most promising is that of *Charybdis edwardsii*, which gave a catch rate of 3500 kg/h in try net hauls carried out off Mangalore and Ponnani (Silas 1969). Recent surveys of FORV SAGAR SAMPADA have indicated the occurrence of largesized (23-25 cm) aristaeid prawns *Plasiopenaeus edwardsianus* in 800-900 m depth off Trivandrum. The surveys have also indicated the existence of good concentration of pelagic shrimps widely distributed in the EEZ, forming the major component of Deep Scattering Layer. The species in the main are of the genera *Gennadas*, *Funchalia*, *Acanthephyra* and *Oploohorus*. These appear to have good potentialities for commercial exploitation in future.

Vis a vis the exploited crustacean resources, the potential resources offering scope for increased production marginally are as follows:

Species	P. Y. (x 1000t)	Av. Current) yield (x 1000 t)
Penaeid prawns	180	111
Non-panaeid prawns	105	57
Deep water shrimp & lobster	12	0.5

Potential Cephalopod Resources

Cephalopods, comprising squids, cuttlefishes and octopuses are caught from inshore waters along both the coasts, Lakshadweep and Andaman-Nicobar Islands. The present landings of this group are mainly of shrimp trawlers as by-catch, of which 70% comes from the west coast. Maharashtra, Kerala, Gujarat and Tamil Nadu are the leading States in cephalopod production. Four species of squids, viz. *Loliqo duvaucelii*, *Septotoutis lessoniana*, *Doryteuthis sibogae* and *D. singhalensis*, and six species of cuttlefishes, viz. *Sepia pharaonis*, *S. aculcate*, *S. elliptica*, *S. brevimane*, *S: prashadi* and *Sepiella inermis*, from the commercial catches. Stock assessment of two species of cuttlefishes and one species of squid made by CMFRI indicated that the average annual stocks of these three species in the 0-50

m depth zone along the coastline were *L. duvaucelii*-18203 t; *S. aculeata*-23536 t; and *S. pharaonis*- 15245 t; against the presently exploited figures 5142t, 4483 t and 2397 t, respectively, indicating great scope for increasing production from the exploited stocks.

Besides the above study based on the surveys carried out by the FSI, the MPEDA has given a projection of potential resources of cephalopods in the shelf area of the west coast between lat. 07°30'N and 12°00'N up to 75 m depth as 12000 t (Anon, 1985). The survey by M. T. *Mutena* in 1977 indicated the availability of cephalopods in the area lat. 15°N-24°N in the depth range 55 to 360 m. Moderate catch rates (13.3 kg/hr) were obtained in the Gujarat coast in the depth range 91-125 m, and the catches mainly consisted of *S. pharaonis*, *S. aculeata* and *L. duvaucelii* (Bapat *et al. 1982*).

Silas (1969) drew attention to the fairly abundant resources of oceanic squid, *symplectoteuthis oualaniensis*. occurring in the shelf edge and slope off the west coast of India at depths beyond 180 m in lat. 7°- 14°N and long. 72°-77°E. The occurrence of dense concentrations of this species from October to December in the northern Arabian Sea (lat. 20°N-25°N; long. 62°E-67°E), mostly in depth range 120 to 200 m, during day time, was reported by R. V. *Shoyo Maru* (Anon, 1976 & 1977). Recent surveys by R. V. *Skipjack* and FORV Sagar Sampada brought to light the occurence of juvenile oceanic squids in the Bay of Bengal and the Arabian Sea.

The production potential of Indian Ocean was estimated at 500,000 t by Voss (1973); and George *et al.* (1977) estimated the potential for the shelf waters of India at 180,000 t, of which 55% is in the upper east coast, 11% each in the lower east coast and northwest coast and 20% in the southwest coast.

Thus the oceanic squids form one of the major potential resources of the EEZ.

PROSPECTS FOR INCREASING PRODUCTION

The present level of exploitation and the potential for

additional exploitation in the case of major groups indicated, thus the questions that might be asked by Govt. departments and industry would be about (i) the type and magnitude of the most promising resources that are capable of yielding additional production in the presently exploited inshore regions; (ii) the potential fishing grounds and abundance of resources in the depth zones immediately beyond the 0-50 metres; and (iii) the potential nonconventional and oceanic resources in the deeper water of the EEZ. The answers lie in delineating the levels of underexploited and unexploited resources and identifying the ways and means of exploiting them.

Among the pelagic resources the most important one, promising additional yield, is that of anchovies, especially during July-September in the Gulf of Mannar and during October-December on the south-west coast. The magnitude of additional yield would be 100-150 thousand tonnes within 20-50 m depth, where more than 60% of the anchovy stock is usually concentrated. The efficient means of tapping this resource would be by phased introduction of small purse seines and midwater trawls (Fig. 1 and 2).

Carangids, comprising horse mackerel, scads and trevallys, have a potential for giving additional yields to the tune of 200-000 tonnes from the inshore regions and immediately deeper waters of 50-125 m depth. Rich grounds for horsemackerel and scads have been located along the southwest coast, Gujarat coast and northeast coast. These resources can be efficiently harvested by purse seines and drift gill nets, the latter for larger speces (Fig. 5 and 6).

Ribbonfishes, with a potential of 270 thousand tonnes as already indicated, would yield considerable additional quantities from the depth zones 20-50 m (69%) and 50-80 m (29%) when the stocks are concentrated along the southwest, southeast and northwest coast. Ribbonfish catches can be harvested by improvised boatseines and trawl nets (Fig. 7 and 8).

As against meagre catches of about 20,000 tonnes of

coastal tunas and related species, there is a potential of about 100,000 t in Andaman waters, 50,000 t in Lakshadweep sea and 50,000 tonnes along the mainland coasts. The introduction of large purse seiners and suitably designed drift gill nets would help in tapping this resource.

Catfishes promise the maximum additional resource among the demersal group, with a potential of about 310,000 tonnes against the present yield of 58,000 tonnes. Very productive fishing grounds have been located along the upper east coast, northwest coast and southwest coast, where in depth ranges 20-50 m and 50-100 m 43% and 15% respectively of the stocks are found distributed. Productive grounds have also been located in still deeper waters in the northwest coast (Fig. 7 and 8).

The next important demersal resource is that of perches, which has a potential of 250,000 t against the present yield of 48,000 t. The existence of rich 'Kalava' grounds off southwest coast, wadge bank and northerneast coast is well known. Among the perches, one of the most promising resource, existing along both the coasts and having good potential for exploitation, is that of threadfin bream (*Nemipterus* sp). Large concentrations of this have been located between 75-225 m during February-May and in comparatively shallower waters during July-September (Figs. 10-13).

Among the crustaceans, deepsea prawns and lobsters offer scope for additional exploitation. They occuron the shelf edge and slope regions of southwest coast and Gulf of Mannar and can be exploited by deploying larger shrimp trawlers. (Fig. 14).

The cephalopod resources, which are at present not exploited by direct methods, are expected to give an additonal yield of about 50,000 t from the 0-50 m depth zone if appropriate fishing techniques such as squid trawling and jigging are introduced. Similarly, modern fishing methods when employed in the outer continental shelf would yield about 130,000 tonnes. Of oceanic squids, considerable potential has already been indicated to be in existence in the open ocean (Fig. 12 and 13).

Table 7. *Major Resources Indicating Prospects for Increased Production*

Sl. No.	Species/Group	Present Yield 000 t	Potential Yield 000 t	Area	Depth Range m	Method of Capture
1.	Anchovies	92	240	S. W. coast Gulf of Mannar	20–50	Small purseseiners, mid-water trawls.
2.	Carangids	44	265	S. W. coast, off Gujarat N. E. coast	0-50 & 50-125	Purse seines, drift gillnets
3.	Ribbonfishes	50	270	S. W., S. E. & N. W. coasts	20-50 50–80	Improvised boat seines and trawl nets.
4.	Coastal tunas	20	100+ 50+ 50	Andaman & Nicobar waters. Lakshadweep seas. along mainland coasts.	>100 m >100 m > 50 m	Purse seines and improved drift gill nets.

5.	Catfishes	58	310	N. E., N. W. & S. W. coasts	20-50m & 50-100m > 100	Bottom fish trawl, drift gill nets.
6.	Perches	48	250	S. W. coast, Wadge Bank, N. E. coast	0-50 & 75-225	Fish trawls, handline, traps
7.	Deepsea prawns and lobsters	5	12	S. W. coast (Gulf of Mannar)	300-400 180-270	Large shrimp trawlers.
8.	Cephalopods	15	180	N. W., S. W. & S.E. coast	0-50 50-200	Squid jigging, Fish trawl
9.	Oceanic tunas	—	500	Oceanic waters of EEZ	—	Longlining, purse seining
10.	Deepsea nonconventional resources			S. W. & E coasts	200-500m	

Except for a marginal production of skipjack in the Lakshadweep, there is at present no fishery in India exploiting oceanic resources. The total oceanic fish potential in the EEZ is estimated at 500,000 t, consisting mainly of yellowfin, big eye, oceanic skipjack, sail fish, marlin and oceanic sharks. These rich resources could be profitably exploited by introduction of long-lining and purse seining on a commercial scale (Fig. 4). Besides, there are potential non-conventional deepsea resourees on the upper continental slopes (200-500 m depth) of the southwest and east coasts which offer considerable scope for exploitation. These potential resources consist of bull's eye, Indian drift fish, black ruff and a host of other deep sea fishes (Figs 12-14).

(The above projections are summerised in Table-7).

GENERAL CONSIDERATIONS

For rational exploitation and management of the presently exploited resources and to utilize the potential resources of the EEZ the following aspects merit consideration.

1. Motorization of the country craft engaged in fishing in traditional grounds and beyond to help in augmenting the catches of large pelagic species such as coastal tunas, seer-fish, pomfrets, trevellys, sharks etc.

2. Regulations on purse seining such as restricting their fishing to areas beyond 30 m depth to help in reducing conflicts between purse seining and traditional fishing and to result in exploitation of resources that are now beyond the scope of traditional sector.

3. Exploitation of rich anchovy resources by phased deployment of purse seines and midwater trawls in depth zone between 30 and 50 m.

4. The demersal fishery, being primarily shrimp oriented, uses small-meshed gear, resulting in wasteful exploitation of young fish resources. Specific fish trawls for finfishes have to be introduced for increasing their production.

5. Strict regulation of mesh size, fishing seasons and areas of fishing to be enforced in order to avoid indiscriminate destruction of spawners and young fish.

6. The inshore shrimp catches to be stabilized and managed properly for sustaining the present level of production.

7. For exploiting the potential resources avilable in deeper waters of the shelf and beyond, considerable additional inputs are required. This could be compensated by bulk capture. This measure will require the designing and development of suitable boat and gear combination along with adequate storage facilities for long periods in the vessel. This point merits immediate consideration.

8. It is necessary that the Govt. of India organizations who posses different types of vessels conduct simulated commercial fishing for identified potential resources to work out the economic viability of these operations.

9. Creation of adequate infrastructure facilities such as for berthing, handling, storage, ice production and marketing at fishing harbours is an essential prerequisite to ensure remunerative price to the producer, which alone could be an incentive for additional production. This will also help in diversification of the industry.

CONCLUSION

As the marine fish production of our country from the presently exploited grounds has remained rather stagnant for more than a decade now, it is imperative that the potential resources of various species and areas as indicated in this account should be properly tapped by extending our fishing effort to middle and outer shelf, continental slope and oceanic region of the EEZ with concurrent development of infrastructure facilities. This would hopefully help in bridging the gap between the potential resources and present production.

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