DEEPSEA FISHING IN INDIAN WATERS

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INTRODUCTION

THE development of Indian marine fisheries since the early 60s from a traditional, subsistence oriented one into an industrial fisheries was quite substantial. This change got accelerated mainly in the mechanised era of the marine fishery sector. Although with the declaration of the EEZ, an area of 2 million sq. km. came into existence in 1977, there has never been a commercial deepsea fishing worth mentioning. However deepwater trawling conducted by two Mexican trawlers (24 m OAL) imported from the USA in 1972 has paved the way for a humble beginning in the deepsea fishing operations. Gradually by 1982-83 about 110 chartered and joint venture deepsea fishing vessels began fishing operations and almost without exception, they exploited mostly the inshore grounds upto 50 m and rarely upto 100 m. But once the depth limitations beyond the 80 m depth line for offshore fishing operations was enforced in 1983, almost all these chartered vessels left the country. Most of the Visakhapatnam based big trawlers (22-25 m OAL), which are deepsea vessels by definition, invariably operate in the shallow grounds of Sandheads for shrimps. In the early years these 'deepsea' big trawlers made voyages of 18-23 days and operated two identical shrimp trawlers from the outriggers of the vessel with shrimp catch rates ranging from 16 to 30 kg/hr. The number of large trawlers in operation gradually increased from 37 in 1978-79 to 147 in 1989-90 and thereafter it declined progressively. Their production included finfishes and cephalopods along with the target resource of prawns. All these trawlers yielded coastal species of penaeid prawns such as *Penaeus monodon, P. semisulcatus* and *P. indicus* to the tune of an average 39% and *Metapenaeus monoceros, M. ensis* and *M. affinis* to tune of 60%. Often the low quality bycatch is discarded in order to save the fishhold space for storing shrimps and quality finfishes. The operations of these large vessels in the upper Bay of Bengal region showed gradual decline in the rate of shrimp production to as low as 14 kg/hr. More than 50% of the effort of these vessels was expended in 21-50 m depth zone and they never fished beyond the 50 m depth. The chartered and joint venture trawlers which operated along the southwest coast in 1982-83 were reported to have been catching the stocks at the rate of about 13 tonnes a day per vessel in round the clock trawling (Sudarsan *et al.*, 1991). These vessels also discarded back into the sea about 8 tonnes of trash fish a day per vessel. Similarly the large or medium size Indian trawlers also discarded the low quality bycatches for want of any worthwhile domestic or foreign markets.

Since the Govt. of India has identified fisheries development as a high priority area, entrepreneurs including large industrial houses and multinational companies are permitted to

undertake deepsea fishing through joint venture arrangements. In order to strengthen the deepsea fishing industry, the government has also formulated various schemes and projects which have ultimately resulted in the operation of 174 vessels of 22 m OAL and above in the Indian EEZ. During 1990-92, 40 chartered vessels were operating which included 23 tuna long liners, 5 stern trawlers and 12 pair trawlers. Most of these vessels have been reported to operate within the 42-88 m depth belt. In addition to the above more than 100 foreign trawlers are reported to be poaching in the Indian EEZ, mainly within the depths of 50-200 m.

Status of Deepsea Fishing

Coastal fish production has almost crossed the estimated potential of 2.21 million tonnes from this sector. In order to meet the estimated demands for fish towards the turn of the century (12 million t), it is essential to increase the production from deeper grounds and oceanic waters beyond 50 m which has a potential of 1.7 million t, and through mariculture practices. Our present knowledge about deepsea fishery resources is mainly restricted to information gathered through exploratory surveys conducted by several government agencies and to a limited extent by commercial vessels. Commercial fishing activities beyond the 100 m depth were highly restricted due to various constraints such as inadequate flow of finance for the procurement of vessels and development of shore infrastructure for processing and marketing, delays in clearing projects, longer gestation periods between proper initiation and implementation, capital intensive and risk prone operations, lack of economic assessment of deepsea fishing operations, target interest in exploitation and lack of sufficient skilled manpower.

Based on the data collected through exploratory surveys and information on primary and secondary production, marine fisheries potential beyond 50 m in the Indian EEZ is estimated at 1.69 million tonnes, contributed by 7,42,000 t of pelagic fish resources, 2,95,000 t of oceanic fish resources and 6,53,000 t of demersal fish resources (Table 1) (Anon., 1991).

Table 1. *Estimated groupwise fishery potential in the Indian EEZ*

Groups	(in '000 tonnes) Beyond 50 m
Elasmobranchs	103
Catfish	63
Other clupeids	14
Lizardfish	21
Perches	125
Sciaenids	22
Ribbonfish	216
Carangids	304
Silverbellies	4
Pomfrets	12
Mackerels	62
Tunnies	242
Cephalopods	21
Priacanthus sp.	55
Blackruff	9
Indian driftfish	7
Deepsea prawns	3
Deepsea lobster	5
Oceanic tunas	209
Billfishes	4
Others	189
Total	1690

Fishery Resources of the Deepsea/Offshore Regions

Pelagic fish resources : Of the 7,42,000 t of potential yield (PY), 4,01,000 t is from the 50-100 m and the rest from the 100-200 m depth zone (Table 2). The potential of the northwest coast is 1,61,000 t in the 50-100 m depth and 27,000 t in the rest of the area in

the 100-200 m depth zone. The southwest coast accounts for the highest potential yield of pelagic resources (2,45,000 t), comprising 1,83,000 t in the 50-100 m zone and 62,000 t in the rest of the continental shelf. The southeast coast of India contributes 32,000 t in the 50-100 m depth and 29,000 t in the 100-200 m. The estimated PY of the northeast coast is only 46,000 t with 25,000 t in the 50-100 m depth zone. In the seas around Lakshadweep, the potential is assessed at 63,000 t while around the Andaman & Nicobar Islands, it is 1,39,000 t.

TABLE 2. *Potential yield of pelagic resources over the continental shelf (50-200 m)*

(in '000 tonnes)

Depth zone	50-100 m	100-200 m	Total
Northwest coast	161	27	188
Southwest coast	183	62	245
Southeast coast	32	29	61
Northeast coast	25	21	46
Total for west and east coasts	401	139	540
Lakshadweep	...	...	63
Andaman & Nicobar Islands	...	...	139
GRAND TOTAL			742

Source : Sudarsan *et al.*, 1990

The important fish groups constituting the above potential resources are the anchovies, carangids, ribbonfishes, tunas and pelagic sharks. Of these, the anchovies form a promising group, especially in the Gulf of Mannar during July to September and along the southwest coast during October to December. The magnitude of the additional yield is estimated to be 100-150 thousand tonnes, particularly in the mid-continental shelf region.

Rich grounds of carangids comprising of horse mackerel, scads and trevallys with an estimated additional resource of 200,000 t from the inshore and the immediately deeper waters of 50-125 m have been located along the southwest coast, off Gujarat and the northeast coast. Similarly, about 75% of the potential of 266,000 t of ribbonfishes in the 50-200 m depth zone is concentrated along the southwest and northwest coasts.

Among the oceanic conventional pelagic fish potential, tunas constitute the major resources and pelagic sharks, dolphinfish, billfishes, wahoo and lancelet fish form the bycatch in the tuna fishery (Silas *et al.*, 1985). Compared to the present catch of about 52,000 t of coastal tunas and related species, there is a potential of 100,000 t in Andaman and Nicobar waters and 50,000 t along the mainland coast immediately beyond 50 m. The stocks of pelagic sharks in the 50-200 m depth region are mostly available in the northwest (15,000 t) and southwest (29,000 t) coasts.

Mesopelagic resources : The mesopelagic realm of the Indian EEZ is rich in pelagic shrimps, swarming crabs, cephalopods and many groups of finfishes like myctophids, gonostomatids, bregmacerotids etc. Fridtjot Nansen (1975-76) and US GLOBEC (1993) findings gave an estimate of 100 million tonnes of myctophids in the Arabian Sea. Their nutritive value and possibilities for value addition are also known and documented.

Demersal fish resources : The potential yield of demersal resources in the 50-200 m depth zone is 6,53,000 t, of which 4,23,000 t could be harvested from the 50-100 m deep area and the rest from the 100-200 m depth zone (Table 3). The northwest coast is the richest

in regard to demersal fish (3,78,600 t), followed by the northeast coast (1,17,400 t), southwest coast (92,300 t) and southeast coast (36,800 t). Excepting the southeast coast, the potential is greater in the 50-100 m depth zone in all the areas. The PY is estimated at about 30,000 t for the region beyond the 200 m depth, the southwest coast producing the maximum (65% of the total) in this depth zone.

TABLE 3. *Potential yield of demersal resources in the continental shelf and slope beyond 50 m depth along Indian coast based on trawl surveys*

(in '000 tonnes)

Region	Depth zone (m)			
	50-100	100-200	200-300/500	Total
Northwest coast	274.3	104.3	0.4	379.0
Southwest coast	63.2	29.1	20.0	112.3
Lower east coast	13.4	23.4	3.1	39.9
Upper east coast	72.9	44.5	0.8	118.2
Andaman sea	...	...	...	...
Sub Total	423.8	201.3	24.3*	649.4
300-500 m depth zone**			4.0	4.0
Total	423.8	201.3	28.3	653.4

* Includes resources upto 500 m depth in lat. 8°-10°N along the west coast and upto 300 m in other regions.

** Except lat. 8°-10°N along the west coast.

The dominant demersal fish groups available in the 50-200 m depth zone are the threadfin breams, saurids and catfish along the northwest coast followed by the southwest coast, Wadge Bank and northeast coast. The elasmobranchs could be mainly harvested from the northwest coast. The other demersal resources available for exploitation in the 50-200 m depth zone are the perches, croakers, lizardfishes, deepsea prawns and lobsters.

The species constituting the shrimp resources in this region (51-80 m) are made up of two groups, a portion by the larger species of the coastal waters (*Penaeus semisulcatus* and *Metapenaeus monoceros*) and the other by the smaller varieties of deepwater species (*Trachypenaeus, Solenocera, Metapenaeopsis*). The exploitable yield is estimated as 3,000 t each in the northwest and southwest coasts; 1,800 t in the lower east coast and 8,000 t in the upper east coast.

Eleven important species, five belonging to the group known as Pandalidae and six to Penaeidae, contribute to the resources in the deepsea regions. Commercially exploitable resources of these prawns have been located in the southwest and southeast coasts, particularly in the depth range of 150-375 m. The sustainable potential of deepwater prawns along the southwest coast is estimated at 5,300 t (Mohammed and Suseelan, 1973). These grounds also sustain deepsea lobster resources, the potential of which is estimated at 13,000 t off the southwest coast and over 1,800 t off the lower east coast. Some of the deepsea fishing vessels operating at present exploit these resources seasonally from December to February/March.

Another important resource identified from the area beyond 50 m is cephalopods comprising of squids, cuttlefishes and octopii. An additional 50,000 t of these resources is estimated from this area.

Deepsea nonconventional fishes

A general appraisal of the resources in the offshore and deepsea regions reveals that the species complex, except for a few groups, is by and large, composed of nonconventional species. Among the deepsea nonconventional fishes the bull's eye (*Priacanthus* spp.) is a potentially rich unexploited fish often caught by bottom trawls. It is widely distributed all

along the shelf and slope waters of the Indian EEZ, in the depth ranges of 50-400 m with particular abundance off the southwest coast. Surveys of FORV *Sagar Sampada* revealed some dense pockets at latitude 07°59.48'N, longitude 76°51.5'E (4900 kg/hour) and latitude 15°30'N and longitude 73°03'E (1500 kg/hour), from depths 74 and 120 m respectively (James and Pillai, 1989). The estimated biomass of this group from the region betwen 15° and 22° N is 0.88 lakh tonnes. The Indian driftfish (*Ariomma indica*) formed 0.03% in the total yield from the northwest coast, 5.1% from the southwest coast, 1.1% from the Wadge Bank and the Gulf of Mannar, 7.4% along the lower east coast and 2.3% along the upper east coast and the estimated potential is 7,000 t from the 50-500 m depth belt (Joseph and John, 1987). The blackruff (*Centrolophus niger*) occur in substantial quantities in depths of 200-500 m with a potential yield of 9,000 t. Some of the other unfamiliar unexploited finfish resources with much greater potential for further exploitation include *Chloropthalmus* spp., *Neoepinula orientalis, Psenopsis cyanea* and *Trichiurus auriga.*

The results of the operation of chartered fishing vessels in the Indian EEZ as stated by Sudarsan *et al.* (1991) may help minimise the apprehension of the entrepreneurs as to the economic returns of deepsea fishing based on the exploitation of such resources. 44 tuna long liners (41.8 - 57.9 OAL and 400 to 752 GRT) operated during January to June 1990, undertook 45 voyages to land a declared catch of 44,363 t valued at 4.5 million US $ and earned a foreign exchange of 892,893.68 US $. Yellowfin tuna formed the bulk of the catch (72.4%) followed by bigeye tuna (1.8%) and skipjack (0.6%). Billfishes formed 19.4% and the share of the sharks was 5.8%. The maximum catch rate was 1.23 t/day.

The results of the three pair trawlers have shown that the major portion of the catch was ribbonfishes (24.1%), followed by *Nemipterus* (16.7%), bull's eye (*Priacanthus* spp.) (12.9%), croakers (12%), golden snapper (*Lutjanus* spp.) (10%) and *Lethrinus* spp. (5.9%). The average catch per trawler per voyage was 333 t. In three voyages, pair trawlers realised a catch of 999 t, valued at 1.0 million US $ and earned 1,52,000 US $ in foreign exchange.

During February to May '90, six stern trawlers (29 m - 76.6 m OAL), undertook 6 voyages and obtained 507.3 t of fishes valued at 0.76 million US $ (foreign exchange earned 0.15 million US $). The major components of the catch were deepsea prawns (26.1%), followed by croakers, ribbonfishes, threadfin breams and perches.

Information on the results of operation of chartered vessels in the EEZ would definitely establish the abundance and distribution of the resources in the offshore/deepsea regions and thus help attract more entrepreneurs into the sector.

It has also been shown that the fishes available in these grounds though belong to the nonconventional varieties, are in demand in the external markets, and with appropriate value added product development and their preservation, it would be possible to realise higher prices. The strategy of resource utilisation in the zone, therefore, should be to maximise exploitation and utilisation of these resources.

Strategy for Exploitation of Deepsea Resources

To increase the production from the present 2.3 million tonnes to the potential of 3.9 million tonnes from the EEZ, the government has liberalised many fishing policies including the deepsea fishing and related joint venture with foreign technical/financial collaborations, single window clearance and integrated projects

involving fishing, processing and marketing. Accordingly, there was a collaborative move by entrepreneurs to start joint ventures in (1) trawling for deepsea shrimps and lobsters, (2) longlining for larger pelagics, (3) purseseining for tunas and (4) squidjigging and handlining for oceanic cephalopods. Such joint ventures with higher capabilities for fishing in deeper waters have often deviated from the designated fishing grounds and encroached the territorial shallow waters which lead to inappropriate harvest of coastal resources, often leading to conflicts with coastal fishing sectors.

The exploratory surveys by FSI, IFP, FORV *Sagar Sampada* etc. have often projected higher catch rates of pelagic and demersal resources from the deeper grounds (above 100 m) and most of this remains underexploited or unexploited. The results also indicate concentration pockets for resources such as threadfin breams, saurids, perches, carangids, ribbonfishes and nonconventional resources like bull's eye, Indian driftfish, greeneye, blackruff, deepwater shrimps, lobsters and oceanic squids. Many such concentration pockets were located within the depth belt of 100-400 m along the outer shelf and slope areas of both east and west coasts of India. It could be possible for medium sized vessels (22-25 m OAL) to venture into these identified areas for commercial fishing with the available expertise in the country.

The Indian coastal fishermen are now fishing far beyond the 50 m depth and the traditional concept of coastal fishing within the 50 m depth belt is not very valid as fishing extends upto 100 m or more. Often exploitation takes place unabated by traditional and small scale mechanised sectors through multiday fishing in middle shelf waters. Upgradation of their skill to continue operations beyond 100 m should be encouraged.

It is necessary to clearly define and delimit deepsea fishing areas to cover the region beyond the 150 m depth zone. It is further important that care should be taken that the deepsea commercial operation should in no way encroach upon or disturb the resource availability to the coastal sector. Legal restrictions should be imposed for the conservation of threatened and endangered deepsea resources such as shrimp and lobsters. Economic assessment of the performance of joint venture vessels should be made for a critical evaluation as to the profitability of the operations and the benefits to the country. A copy of the log sheets of the joint venture operations should be made available to the fisheries institutes dealing with the research and development for monitoring the characteristics of the resources. Whenever possible the traditional fishermen should be actively involved in the programmes of exploitation of resources beyond their present fishing areas through capability building and training.

Licencing of joint venture vessels for the exploitation of oceanic pelagic resources (tunas, billfishes and oceanic sharks) by using purseseining and longlining beyond the 150 m depth zone should be encouraged.

Shore based infrastructure facilities for preservation, processing and marketing should be strengthened at strategic centres along the coasts.

While there is enormous potential for the exploitation of nonconventional resources from the mesopelagic realms of deepwaters, it is essential to develop value added products for domestic and export markets.

It is essential to create awareness on the edible qualities and the nutrient values of these nonconventional resources among the public through various media so as to generate a free market for many such deepsea resources.

Research and development programmes should be strengthened through projects on exploratory deepsea surveys for pelagic, mesopelagic and bathypelagic resources and their trophic and population dynamics. There should be a mechanism for quick dissemination of the results of such scientific investigations in an understandable language to the end users and entrepreneurs.

It is now over two decades since the country is endeavouring establishment of deepsea fishing. So far it has been possible to deploy only 174 vessels in this sector and the resources remain largely unexploited. Although several schemes have been introduced and implemented, the development in this sector has not taken place to the desired extent. Deepsea fishing is a multi-disciplinary subject and necessitates the input of several activities in an integrated manner for its development. Therefore the strategy for increasing production should be an integrated approach of exploiting and utilising the offshore, oceanic and deepsea resources and promoting internal market and overseas trade.

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