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Finfish resources in the north eastern region in the Indian EEZ

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ABSTRACT

Bottom trawling conducted in 53 stations lat. 16°00'N -20°30'N; long. 81°30'E - 87°15'E revealed a production range of 3 - 15000 kg/haul with a mean of 581 kg/haul; the average catch in the region was 567.3 kg/hr. The dominant finfish in the surveyed area were Indian drift fish (36.4%), carangids (22.5%), catfishes (7.1%), bull's eye (6.9%), goat fishes (3.9%), nemipterids (3.3%) etc. The bathymetric zones above 200 m and 51-100 m were found to be highly productive with average catch rate of 1615 and 830 kg/hr respectively. In the surveyed region the highest production rate was at lat. 19°N (1384 kg/hr).

INTRODUCTION

Northeastern region of Indian EEZ has an estimated fishery potential of 321000 tonne, out of which about 63% (204000 tonne) is presently exploited (Anon, 1991). The potential demersal fish resources in the area is 143000 tonne, whereas only 68% (97000 tonne) is currently exploited by the commercial fisheries. The fishery survey results of 1980-85 period in the Indian EEZ (Joseph & John, 1987) indicated catch rate of 228.5 kg/hr in the northeast coast with major composition as catfishes (40 kg/hr), mackerel (28.3 kg/hr), carangids (33.7 kg/hr), sciaenids (16.0 kg/hr), perches (11.5 kg/hr), nemipterids (10.9 kg/hr), elasmobranchs (19.7 kg/hr) etc. Similar survey conducted during 1980-'86 along the northeast coast (16°- 20°N) revealed promising catches of tunas, carangids, sharks, catfishes, silverbellies etc. in the coastal waters and bull's eye, Indian drift fish (*Psenes indicus*), *Centrolophus niger* etc. from deeper regions (Sudarsan & Somvanshi, 1988). Ruben *et al.* (1989) estimated the trawl fishery resource potential of continental shelf and adjacent areas along the northeast coast, based on exploratory fishery surveys as 151000 tonne. The earlier cruises (nos. 1-44) of FORV Sagar Sampada have conducted trawling all along the Indian EEZ during January 1985 to March 1988 and located fairly rich fishing grounds for mackerel, bull's eye, carangids, *Psenes indicus*, catfishes, barracudas etc. in the lat.

15°- 20°N along the northeast coast of India (James & Pillai, 1990; Sivakami, 1990; Bande et al. 1990). As those cruises were of general survey nature, full justice to estimates, could not be made on the bathymetric, geographical and seasonal abundance of several fish resources available in the northeastern region. In view to fill the above lacuna, concerted efforts were made to have more coverage in the area and all seasons of 1988 and 1989 so as to assess the resource potential in this area. Exclusive cruises on board *FORV Sagar Sampada* (such as nos. 45, 47, 49, 51, 53, 54, 57 and 58) were undertaken during April 1988- February 1989 in the northeastern region of the EEZ with an emphasis to cover repeatedly most of the geographical areas during different months in different depth zones.

MATERIALS AND METHODS

During the 8 cruises, bottom trawls were operated from 53 stations, spread over a year, in order to locate the seasonal and bathymetric distribution and abundance of various fish resources. The area covered in the above 8 cruises extend from latitude 16°-20°30'N and long. 81°30' -87°15'E with a track distance of 22000 line km and an approximate area of 65000 km². The depth of operation of bottom trawl ranged from 30-203 m with greater emphasis in 51-100 m depth zone. This survey is based on information drawn from the reports of 8 cruises of *FORV Sagar Sampada*, and an attempt is made to interpret the fish production and species-wise abundance of different resources in the latitude, seasons and bathymetric realms of 0-50, 51-100, 101- 150, 151-200 and above 200 m along the northeast coast. The standing stock in each area of 10' grids was estimated by the swept area method of Gulland (1965). The potential yield is reckoned as 60% of the standing stock. As trawling is mainly carried out in the depth belt 30-200 m, the estimates given pertain to that area.

RESULTS

Demersal resources

The finfish production by bottom trawling along the northeast coastal region as a whole ranged from 3-15,000 kg/ haul with a mean of 581 kg. The average catch was 567.3 kg/hr. Some of the high concentration fishing grounds along this region were: 17°26.5'N, 83°32.9'E (1700 kg/hr), 19° N, 85°05'E (1991 kg/hr), 19°19'N, 85° 15'E (15000 kg/hr), and 19°22'N, 85°19'E, (12000 kg/hr) in the depth zones 51-100 m and above 200 m. The finfish catch (Table 1) in this region consisted mainly of demersal and column fishes such as *Psenes indicus* (36.4%), carangids (22.50%), catfishes (7.1%), bull's eye (6.9%), nemipterids (3.3%), goat fishes (3.9%) etc. The depth-wise fish abundance data of the 8 cruises revealed that bathymetric zones above 200 m and 51-100 m are highly productive with catch rates of 1615 and 830 kg/hr respectively followed by 0-50 m depth zone (196 kg/hr), 101-150 m (127 kg/hr) and 151-200 m (29 kg/hr).

Table 1 - Production, rate of production and percentage in total catch of major finfishes in the north-eastern region of the EEZ

Fishes	Production (kg)	Rate of production (kg/hr)	Total catch (%)
<i>Psenes indicus</i>	10982	205.3	36.4
Carangids	6790	127.5	22.5
Catfishes	2138	40.0	7.1
<i>Priacanthus</i> spp	2985	39.2	6.9
Goat fishes	1181	22.2	3.9
Nemipterids	1007	18.9	3.3
Barracudas	333	6.3	1.1
<i>Epinephelus</i> spp	276	5.2	0.9
Elasmobranchs	130	2.4	0.4
<i>Lutianus</i> spp	99	1.9	0.3
Others	5154	96.3	17.2
Total	30175	564.0	

Cruise wise resource abundance

Cruise-wise fish resource abundance, seasons and percentage composition of major groups are shown in Table 2. During the cruise no. 45 along lat. 16°00' - 20°30' N and long. 81°30' - 87°15' E in the month of April 1988, the bottom trawl produced a total catch of 1567 kg with an average catch rate of 145.8 kg/hr. The depth of operation ranged from 30 to 60 m. The catch composed chiefly of nemipterids (30.8%) and goat fishes (21%). During the cruise (no. 47) the vessel surveyed almost the same area (16°00' N-20°30' N and 81°30' E- 84°48' E) and trawled five stations along the depth region 89-203 m in May/June 1988. The total production was 2700 kg with a catch rate of 540 kg/hr. The highest catch of 1700 kg was recorded from the station, 17°26' N, 83°33' E at a depth of 203 m and composed chiefly of *Priacanthus* spp (80%). The cruise no. 49 was conducted during July 1988 and covered the same area within the depth zone 60-175 m. In the total production of this cruise, *Priacanthus* spp. (43%), catfishes (14.2%), *Psenes indicus* (13.9%) and carangids 12.9% were the dominant groups landed by bottom trawls. Bottom trawl operated from 6 stations (37-65 m depth) during cruise no. 51 in September with catches ranging from 40 to 374 kg/haul. Out of the 17 stations covered in cruise no. 53 bottom trawl operated only at 6 stations in the depth zone 55-170 m during October 1988. The catch per haul ranged from 32- 1009 kg with a mean of 316.4. The cruise no. 54 (November) yielded a total fish catch of 1565 kg from the depth belt 35-95 m at a mean catch rate of 208.7

Table 2 - Cruise-wise and seasonal production of major finfish (kg), their percentage composition (in parentheses) and total catch rate along the northeastern region of the EEZ

Cruise no.	Period	Trawling (hr)period	Catfishes	Elasmobranchs	Nemip-terids	Caran-gids	Lizard fish	Barra-cuda	<i>Pria-canthus</i> spp	<i>Epine-phelus</i> spp	<i>Lutjanus</i> spp.	<i>Psenes indicus</i>	Goat fish	Others	Total	Catch (kg/hr)
45	April	10.75	195.0 (12.4)	4.5 (0.3)	483.0 (3.8)	118.0 (7.5)	1	-	10.0 (0.6)	-	-	2.0 (0.1)	330.0 (21.0)	423.5 (27.3)	1567	145.8
47	May/ June	5.0	10.0 (0.4)	3.3 (0.1)	338.2 (12.5)	61.4 (0.3)	31.3 (0.2)	-	1525.2 (56.5)	-	-	32.0 (1.2)	50.3 (1.9)	648.3 (23.9)	2700	540.0
49	July	6.75	43.0 (14.2)	3.5 (1.2)	0.4	39.0 (12.9)	-	1.2 (0.7)	130.0 (42.9)	-	-	42.0 (13.9)	-	43.9 (14.2)	303	44.9
51	Sept.	6.00	39.0 (5.1)	40.0 (5.3)	3.0 (0.4)	128.0 (16.9)	26.0 (3.4)	-	3.5 (0.5)	-	-	2.0 (0.3)	128.0 (16.9)	386.5 (61.2)	756	126.0
53	Oct	5.5	21.0	-	1.0	73.0 (4.2)	2.4 (0.1)	16.3 (0.9)	81.0 (4.5)	215.0 (12.4)	425.0 (24.4)	-	14.0 (0.8)	891.3 (51.5)	1740	316.4
54	Nov.	7.5	165.0 (10.5)	40.5 (2.6)	36.0 (2.6)	616.0 (39.4)	30.0 (1.9)	2.5 (0.2)	128.8 (8.2)	10.0 (0.6)	18.0 (1.2)	19.0 (1.2)	95.3 (6.1)	403.9 (25.8)	1565	208.7
57	Jan.	5.0	38.0 (1.7)	5.5 (0.7)	47.0 (2.1)	83.5 (3.7)	-	221.0 (9.9)	17.0 (0.8)	3.8 (0.2)	87.0 (3.9)	1182.0 (52.8)	224.0 (10.0)	328.2 (14.7)	2237	447.4
58	Feb.	7.0	1647.0 (8.5)	3.9 (0.2)	97.0 (0.5)	5670.8 (29.3)	91.6 (0.5)	199.0 (1.0)	40.0 (0.2)	-	91.0 (0.5)	9703.0 (50.2)	336.0 (1.7)	1427.6 (7.4)	19306.9	2758.1

kg/hr and carangids (39.4%) were the most abundant item. The total production from cruise No. 57 (January) was 2237 kg with a catch rate of 447.4 kg/hr. *Psenes indicus* formed 57.3% of the total catch and covered 16 stations. Bottom trawling conducted in cruise No. 58 from seven stations along the depth zone 62-68 m produced a total catch of 19342 kg (ranging from 250- 15000 kg/haul) in February. A peak concentration of 15000 kg/hr was realised from the station 19°19' N, 85°15' E at a depth of 62 m and 50% of the catch consisted of *Psenes indicus*.

Latitudewise yield and abundance

Finfish production and rates of yield in different latitudes of 15°-20°N and their major catch composition are given in Table 3. The production (23586 kg) as well as rate of production (1429 kg/hr) were the highest in 19°N latitude along the depth belt of 42-178 m. In 17°N latitude (48-203 depth) the total catch was 3091 kg with a mean catch rate of 263 kg/hr. The trend of total production in latitude 18°N and 20°N were 1915 kg and 1310 kg respectively with corresponding catch rate of 147 and 174 kg/hr. Indian drift fish (*Psenes indicus*), carangids and catfish were the dominant fishes in 19°N, whereas in 18°N, *Epinephelus* spp, *Lutjanus* spp., *Priacanthus* spp and carangids were the chief components. Fish like nemipterids, *Priacanthus* spp, elasmobranchs and carangids occurred in fair quantities in the lat. 16°, 17° and 20°N.

Table 3 - Latitude-wise fish production, rate of production and the major components in the northeastern region of the EEZ

Lat. (°N)	No. of stations	Total trawling hours	Total production (kg)	Catches (kg/hr)	Depth (m)	Major species
15°	1	0.75	5.1	6.8	100	-
16°	5	3.5	331.6	94.7	50-170	<i>Priacanthus</i> spp, elasmobranchs, carangids, catfishes
17°	10	11.75	3091.4	263.0	48-203	<i>Priacanthus</i> spp, nemipterids
18°	14	13.0	1915.1	147.3	45-160	<i>Epinephelus</i> spp, <i>Lutjanus</i> spp, <i>Priacanthus</i> spp, carangids
19°	16	17.0	23522.0	1383.6	42-178	<i>Psenes indicus</i> , carangids, catfishes
20°	6	7.5	1310.0	174.7	30-60	Nemipterids, carangids

Depthwise yield and abundance

Percentage composition of various finfishes in the bathymetric zones of 0-50 m, 51-100 m, 101-150 m, 151-200 m and above 200 m are given in Table 4. In the depth zone below 50 m, the average catch rate was 196 kg/hr and the catch composed mostly of nemipterids, goat fishes, cat fishes and carangids. The depth zone 51-100 m yielded an average catch rate of 545 kg/hr with the major component fishes as *Psenes indicus* carangids and catfishes. A mean catch rate of 127.2 kg/hr was recorded from the depth zone, 101-150 m and the yield consisted mainly of nemipterids, carangids and lizard fishes. The rate of yield was the lowest (29.1 kg/hr) in the bathymetric realm, 150-200 m and the catch, composed of *Priacanthus* spp. (61.2%) and *Psenes indicus*. From above 200 m depth only one station was trawled with a catch rate of 1615 kg of finfishes/hour. *Priacanthus* spp (84.5%) and nemipterids were the chief component of the catch.

Table 4 - Depth-wise abundance (kg/hr) of major fishes in the northeastern region of the EEZ

Fish	Depth zones (m)				
	0-50	51-100	101-150	151-200	>200
Elasmobranchs	2.9	3.2	0.2	-	-
Nemipterids	40.8	5.8	45.1	0.1	124.1
Carangids	21.2	213.2	9.1	0.2	17.0
Lizard fish	2.0	1.6	4.3	-	-
Barracudas	0.4	10.9	0.1	-	-
<i>Priacanthus</i> spp	0.8	21.1	3.1	17.8	1360.0
<i>Epinephelus</i> spp	0.3	9.2	-	-	-
<i>Lutianus</i> spp	1.1	2.8	-	-	-
Other perches	0.2	23.0	-	-	-
<i>Psenes indicus</i>	0.3	362.0	-	1.1	28.4
Goatfish	34.1	25.5	-	-	-
Catfish	24.6	60.9	-	-	-
Others	67.2	90.8	65.2	9.9	85.0
Total	196.1	830.0	127.2	29.1	1615.0

Abundance trends of specific fish resources

Indian drift fish (*Psenes indicus*)- Its catch rate fluctuated from 0.5 -7500 kg/haul. The average catch per hour was 206.2 kg. The species was abundant in 19°00'N-85°05' E (1180 kg/hr) at 84 m depth; in 19° 19' N-85° 15'E (7500 kg/hr)at 62 m depth and in 19° 20' N- 85° 19'N (1800 kg/hr) at 65 m depth. The highest production was during February.

Carangids- The yield per haul ranged from 0.2 - 5250 kg with a mean of 127.5 kg/hr. High concentrations were located in stations, 19°26'N- 85°09'E (90 m depth) with a catch rate of 500 kg/hr; 19°19'N,85°15'E (62m) with a catch/hour of 5250 kg and 18°06'N,84°02'E (64 m) with a catch rate of 200 kg/hr. Production of carangids was high in February and November.

Carfishes- The catch per haul fluctuated from 0.3-1500 kg. High concentration of 1500 kg/hr was located at 19°19'N,85°15'E from a depth of 62 m in February.

Bull's eye (*Priacanthus spp.*)- The catch per haul ranged from 1- 1360 kg and the average catch rate was 39.2 kg/hr. High concentration (1360 kg/hr) of bull's eye was located at 17°26.5'N,83°32.9'E from a depth of 202 m during May. The catch per haul of goat fishes ranged from 0.3-300 kg. Good concentration of goat fishes were located at stations, 20°30'N,87°15'E (200 kg/hr from 30 m depth), 19°00'N,85°05'E (221 kg/hr from 84 m depth) and 19°19'N,85°15'E (300 kg/hr from 62 m depth) during January-April. The catch of nemipterids fluctuated from 0.8-300 kg/haul and better catches were obtained in April, May. The yield of barracuda *Sphyraena spp* ranged from 0.3 - 220 kg/haul at an average catch rate of 6.3 kg/hr. High density ground for barracudas was located at 19°00'N,85°05'E (220 kg/hr at 84 m depth) during January. The catch of *Epinephelus spp* varied from 38-210 kg/haul and the average catch rate was 5.2 kg/hr. Elasmobranchs were caught at an average catch rate of 2.4 kg/hr.

Seasonal abundance

Seasonal abundance trend of bottom trawl catch in the northeast region showed comparatively high values almost throughout the year ranging from 45 kg/hr (July) to 2758 kg/hr. (February). The production rate was found to be higher in the months of October to February. The higher catch rates are invariably backed by rich availability of the Indian drift fish, *Psenes indicus* and perches. In the depth belt 50-100 m the monthly catch rate varied from 5-2758 kg/hr. Fairly high rate of production was recorded from above 100 m depth zone in May.

Potential demersal yield

The estimated potential yield of ground fish resources in the northeast coast within the depth belt 30-200 m is 154000 tonne at the rate of 2.2 tonne/km². The depth zone 51-100 m has an estimated potential of 89600 tonne forming 58% of the total potential yield. The rate of production from this depth zone is estimated at 5.2 tonne/km². The

depth zone 100-200 m has a lower potential of about 17000 tonnes with a production potential rate of 1.2 tonne/km². The shallow coastal waters upto a depth of 50 m has only a limited potential yield of 47500 tonne at a rate of 1.2 tonne/km². This depth belt was only sparsely covered by *FORV Sagar Sampada* cruises and therefore the estimated potential might be an under estimate and needs further confirmation. The depth zones of 50 m are currently poorly exploited by the commercial fishing fleet. The potential yield is high in latitude 19°N (84900 tonne) followed by 17°N (17800 tonne) and 20°N (1700 tonne).

Pelagic resources

The pelagic trawl was operated at 17 stations during 5 cruises and a total catch of 30 kg was landed with a catch rate of 1.76 kg/hr. Among the 17 stations surveyed by pelagic trawling, fish were caught only from three stations (18°N, 84°15'E; 19°28'N, 85°30'E and 18°16.3'N, 84°24'E) at 60, 58 and 78 m depth respectively. The pelagic trawls failed to land any resources from many of the stations whenever it was operated. The average catch consisted of a cow-nose ray (20 kg), seer fish, goat fish, wolf herring (*Chirocentrus* spp) and juveniles of sardines and mackerel.

DISCUSSION

The results of the region-wise exclusive surveys indicated the spatial, seasonal and bathymetric abundance of varied types of finfish resources along the northeastern region of the EEZ. The rate of total fish production of 567 kg/hr achieved in the present cruises showed tremendous improvement over the value of 228kg/hr obtained by exploratory surveys from the same region during 1980- 85 (Joseph & John, 1987) and the production rate of 315 kg/hr reported by Sivakami (1990), based on the results of the first 44 cruises of *FORV Sagar Sampada* during 1985-88. Present yield rates obtained in respect of *Psenes indicus* (206 kg/hr), carangids (127 kg/hr), *Priacanthus* spp (39 kg/hr) and nemipterids (19 kg/hr) are far higher than earlier rates *Psenes indicus* 5.2 kg/hr, carangids, 33.8 kg/hr; *Priacanthus* spp 9.3 kg/hr and nemipterids (10.9 kg/hr) reported from the northeast coast of 16°-20°N (Joseph & John, 1987). Further, the production rates of various fish resources recorded by Sivakami (1990) from the east coast also showed lower values as compared to the present surveys. Abundance of some of the major resources in different depth zones is comparable with the earlier survey results from this region. Higher rates of production were recorded at different depth zones, for nemipterids (0-50 and 100-200 m), perches (50-100 m), carangids (50-100 m), catfishes (0-100 m), *Priacanthus* spp (50-100 m) and *Psenes indicus* (50-100 m) when compared to FSI results (Joseph & John, 1987). Latitude-wise fish production rates obtained in the present surveys are considerably higher than FSI's *Matsya Shikari* catch rates in 17° N and 19° N; whereas similar trends are noticed in 18° and 20°N latitudes (Sudarsan & Somavanshi, 1988).

The estimated potential of 154000 tonne in this region up to 200 m depth is very close to the estimated potential of 143000 tonne given by the working group on revalidation of potential marine fisheries resources of the EEZ for the north east coast (Anon, 1991) and the estimate of Ruben *et al.* (1989) at 151000 tonne. Since the survey coverage below 50 m depth is inadequate, the estimate from this depth zone might be an under estimate (47500 tonne). Similarly depths above 200 m are also not adequately covered and therefore, no attempt was made to estimate the potential from this depth zone. The present survey results clearly showed that the depth belt 50-100 m is highly productive with a potential of 5.2 tonne/km² and the major finfishes caught from this realm were Indian drift fish and carangids. Sudarsan *et al.* (1988) have reported high density finfish stock in this area throughout the year. Bottom trawling results from the mid shelf (51-100 m) areas have also indicated consistently high production rates throughout the year with peak in October- February months.

Present survey results from the northeastern region of the EEZ have shown that this region's share to marine fish production of the country could be substantially increased through intense bottom trawling in depths above 50 m for exploiting some of the conventional and non-conventional resources. This survey unfolds some of the concentration pockets for *Psenes indicus* along the region which could be exploited on a commercial scale.

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