

Demersal Trawl Resources off Northeast Coast of India

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The demersal resources in the Bay of Bengal, Lat 18° to 21°N and Long. 83° to 88° E, were assessed by surveying 22 stations taking 21 demersal hauls using Hybrid Trawl (HT), High Speed Demersal Trawl (HSDT) (Fish version) and High Opening Trawl (HOT). The total fish catch was 9,767 kg. Catch per unit effort was 194.7 kg/h for HSDT, 1,085.3 for HOT and 83.4 for HT. Average vertical height obtained for the HT was 2m, for HSDT 1.7 m and for HOT 2.2 m measured with Integrated Trawl Instrumentation (ITI). 48% of the catch was *Rastrelliger kanagurta*, 11% *Ariomma indica*, 8% *Secutor* sp., 6% *Arius* sp. and the rest miscellaneous demersal species. All the different fish species present in the catch are reported.

Key words: Resources, demersal trawl, catch per unit effort

The aquatic resources were considered inexhaustible gift of nature. However, they are not finite and need to be properly managed, if their contribution to the nutritional, economic and social well being of the growing world population is to be sustained (FAO, 1995). It is estimated that the Indian Ocean can yield about 11.0 m t (Dwivedi 1990) fish. Arabian Sea and the Bay of Bengal are different environments. Compared to Arabian Sea, Bay of Bengal is less explored. Systematic zoogeographical studies on fishery resources of this area have taken shape only after commissioning the research vessel FORV Sagar Sampada. Conventional and non-conventional ichthyofauna which are commercially important are also to be assessed to determine the potential of exploitation. The present study is based on the results of the fishing operations conducted from FORV Sagar Sampada.

Materials and Methods

21 fishing operations and 22 hydrographic observations covering an area between Lat. 18° to 21° N and Long. 83° to 88° E in the east coast off Puri, Gopalpur and Paradip were made from FORV Sagar Sampada. The nets used were Hybrid Trawl (HT), High Speed Demersal Trawl (HSDT) (Fish version) (Panicker *et. al.*, 1990) and High Opening Trawl (HOT) (Kunjipalu, 1994) in combination with V-shaped otter boards, 2850 x 1830 mm, weighing 1.5 t each. Demersal trawling was conducted at a depth of 40-100 m. Temperature, salinity, dissolved oxygen, light penetration and pH were collected using Conductivity Temperature Depth Meter using Rosette sampler. Vertical opening of the nets was measured by the Integrated Trawl Instrumentation

(ITI) system. Fish species in the catch were identified (Munro, 1982; Day, 1958; Fischer and Bianchi, 1984) and their percentages were determined.

Results and Discussion

9767 kg fish were landed from 21 fishing operations. The percentage composition of the catch is presented in Table 1. 19% of the catch was contributed by HSDT in 9 hauls, 4% by HT in 5 hauls and 77% by HOT in 7 hauls. About 14% of the total catch was from Lat. 18°N in 6 fishing operations, 79% from Lat. 19°N in 8 fishing operations and 7% from Lat. 20°N in 7 operations. Details of fishing operations with area operated and total catch is presented in Table 2. The catch per unit effort (CPUE) for HSDT is 194.7 kg/h, HOT 1085.3 kg/h and HT 83.4 kg/h. Table 3 shows the hydrographic parameters collected from the fishing stations.

Table 1. Percentage composition of fish (by weight)

Name of fish	Percentage
Mackerel	47.96
<i>Ariomma indica</i>	10.96
<i>Secutor</i> sp.	8.63
Cat fish	6.95
<i>Nemipterus</i> sp.	4.08
Ribbon fish	3.68
<i>Decapterus</i> sp.	3.54
Lizard fish	2.89
Barracuda	1.76
Squid	1.48
Goat fish	1.41
Horse mackerel	0.52
Perch	0.50
Sciaenids	0.49
Kalava	0.42
Carangids	0.36
Silver bellies	0.28
Pomfret	0.24
Cuttle fish	0.16
Croakers	0.16
<i>Mene maculata</i>	0.08
Shark/Ray	0.08
Eel	0.05
Lesser sardines	0.04
Miscellaneous	3.25

There was a single isolated observation of 6 t catch mostly constituted by mackerel in the 18th station. It is seen from the Table that there is a slight reduction in the bottom temperature when this catch occurred. More observations are needed for deciding the correlation between the temperature and this high catch. It is also

Table 2. Details of fishing operations with area covered and depth of operation

Position		Net used	Depth m	Course °	Warp	Vertical opening	Catch kg
Lat	Long						
18°17'48	84°18'12	HSDT	57	230	170	1.7	870
18°31'01	84°33'08	HSDT	70	235	210	1.6	100
18°43'00	84°41'00	Hybrid	56		160	2.1	50
18°18'72	84°21'93	Hybrid	60	240	180	2.0	212
18°30'74	84°29'06	Hybrid	52	216	150	2.1	50
18°38'90	84°33'71	Hybrid	50	215	150	1.9	85
19°15'45	85°05'98	Hybrid	54	42	160	2.1	20
19°21'50	85°16'16	HSDT	58	49	180	1.7	100
19°31'29	85°37'73	HSDT	46	70	150	1.4	165
20°07'07	86°47'79	HSDT	35	54	100	1.9	70
20°06'29	87°04'19	HSDT	73	54	200	1.6	100
20°21'43	87°18'76	HSDT	56	48	150	1.7	91
20°24'64	87°24'47	HSDT	60	48	200	1.6	122
20°55'08	87°55'69	HSDT	45	240	150	1.9	135
20°45'26	87°39'61	HOT	45	225	150	2.5	70
20°35'02	87°37'47	HOT	60	225	200	2.1	59
19°51'85	86°35'09	HOT	78	232	250	1.9	236
19°44'76	86°23'94	HOT	80	225	250	2.3	6250
19°41'00	86°17'50		80	Hydrographic data only			
19°23'32	85°25'64	HOT	74	215	200	2.1	281
19°20'15	85°22'69	HOT	86	232	250	2.1	527
19°11'88	85°13'29	HOT	90	220	270	2.1	174

significant that a pelagic resource is caught in the demersal trawl. Earlier Kunjipalu (1990, 1996) reported significant catch (4t/h) of mackerel during 36th cruise of FORV Sagar Sampada in 1987 from 71 m depth east of False Bay. Similar observations were made by Fishery Survey of India also in the east coast (Joseph, 1986, Joseph and John, 1986; Vijayakumaran, 1988).

There was decrease in the quantity of fish compared with the catches in 1987 using HSDT operated in the same area. The CPUE was 645 kg (Kunjipalu, 1996) whereas in the present study it was only 194.7 kg. It was found that the average vertical opening obtained for HT was 2 m, HSDT 1.7 m and HOT 2.2m. The correlation coefficient between vertical opening of the nets and the total catch was worked out separately for each net. These were not found significant since the number of observations is limited.

A list of fishes caught is also presented to highlight the biodiversity of the demersal fauna. Species of fish present in the bottom trawls were identified and are presented in Table 4. It is helpful for the knowledge of non-conventional species of fish, which are poorly represented in catches by traditional gear of that area. Reports are available

Table 3. Hydrographic data from the fishing stations

No	Temp °C	Salinity ppt	Dissolved O ₂ , ml/l	Light penetration	pH	Depth m	Catch kg
1	26.26	33.96	2.76	78.26	8.42	57	870
2	25.52	34.13	2.08	81.18	8.48	70	100
3	25.21	34.14	2.34	87.40	8.59	56	50
4	26.40	33.93	2.83	71.61	8.26	60	212
5	26.20	34.03	2.65	67.12	8.18	52	50
6	25.71	34.13	1.96	76.13	8.13	50	85
7	26.40	33.93	2.83	71.61	8.26	54	20
8	25.49	34.08	2.19	84.00	8.28	58	100
9	26.33	33.99	3.03	85.45	8.20	46	165
10	26.34	33.56	3.24	56.71	8.22	35	70
11	25.09	34.29	1.64	86.71	8.09	73	100
12	26.06	33.88	2.49	61.72	8.21	56	91
13	26.12	33.86	2.66	57.20	8.29	60	122.5
14	26.65	33.58	3.15	36.55		45	135
15	26.66	33.60	3.29	61.32	8.29	45	70
16	26.25	33.83	2.96	69.99	8.24	60	59.2
17	24.68	34.18	2.19	47.90	8.04	78	236
18	23.65	34.36	0.99	68.05	7.95	80	6250
19	22.22	34.08	0.19	66.66	7.88	80	
20	24.32	34.40	1.29	68.08	8.01	74	281
21	24.94	34.24	1.57	72.50	8.33	86	527
22	23.40	34.51	0.95	75.40	7.99	90	174

Table 4. Fishes identified in the trawl catches

Order/Family	Species	Common Name
Lamniformes		
Carcharinidae	<i>Scoliodon sorrachowah</i> (Cuvier)	Yellow dog shark
Sphyrnidae	<i>Sphyrna zygaena</i> (Linnaeus)	Round headed hammer head shark
Rajiformes		
Rajidae	Unidentified	Skates/Rays,
Torpediniformes		
Torpedinidae	<i>Narcine brunnea</i> (Annandale)	Brown electric ray
	<i>Narcine timiti</i> (Bloch and Schneider)	Spotted electric ray
Clupeiformes		
Clupeidae	<i>Opistopterus tardoore</i> (Cuvier)	Long-finned herring
	<i>Sardinella melanura</i> (Cuvier)	Blacktipped sardine
Dussumieridae	<i>Dussumieria acuta</i> (Valenciennes)	Common sprat
Engraulidae	<i>Stolephorus indicus</i> (Van Hasselt)	Indian anchovy
	<i>Engraulis malabaricus</i> (Day)	Malabar anchovy
	<i>Thrissocles mystax</i> (Bloch & Schneider)	Mustached anchovy

Order/Family	Species	Common Name
Chirocentridae	<i>Chirocentrus dorab</i> (Forsk.)	Wolf herring
	<i>Chirocentrus nudus</i> (Swainson)	Smooth wolf herring
Scopeliformes		
Synodontidae	<i>Saurida tumbil</i> (Bloch)	Greater lizardfish
Siluriformes		
Ariidae	<i>Arius jella</i> (Day)	Small eye catfish
Anguilliformes		
Muraenesocidae	<i>Moraenesox bagio</i> (Bleeker)	Silver conger eel
Beloniformes		
Belonidae	<i>Belone annulata</i> (Cuvier & Valenciennes)	Gar fish
Mugiliformes		
Sphyraenidae	<i>Sphyraena jello</i> (Cuvier)	Giant sea pike
Mugilidae	<i>Valamugil cunnesius</i> (Valenciennes)	Long fin grey mullet
Polynemiformes		
Polynemidae	<i>Polynemus heptadactylus</i> (Cuvier)	Seven thread tassel fish
Perciformes		
Latidae	<i>Epinephelus diacanthus</i> (Valenciennes)	Six barred reef cod
	<i>Epinephelus undulosus</i> (Quoy & Gaimard)	Brown lined reef cod
Theraponidae	<i>Therapon jarbua</i> (Forsk.)	Crescent perch
Priacanthidae	<i>Priacanthus hamrur</i> (Forsk.)	Duskey finned bulls eye
Sillaginidae	<i>Sillago sihama</i> (Forsk.)	Silver whiting
Lactariidae	<i>Lactarius lactarius</i> (Schneider)	Whitefish
Ariommidae	<i>Ariomma indica</i> (Day)	Indian drift fish
Carangidae	<i>Megalaspis cordyla</i> (Linnaeus)	Torpedo travelly
	<i>Decapterus russelli</i> (Ruppel)	Russel's scad
	<i>Carangoides malabarius</i> (Bloch)	Malabar trevally
	<i>Caranx sexfaciatus</i> (Quoy & Gaimard)	Six banded trevally
	<i>Zonichthys nigrofaciata</i> (Ruppel)	Black banded kingfish.
	<i>Mene maculata</i> (Bloch)	Moon fish
Menidae	<i>Rachycentron canadus</i> (Linnaeus)	Black kingfish
Rachycentridae	<i>Pristipomoides typus</i> (Bleeker)	Sharp toothed bass
Lutianidae	<i>Nemipterus japonicus</i> (Bloch)	Japanese threadfin bream
Nemipteridae	<i>Nemipterus bleekeri</i> (Day)	Bleekers threadfin bream
Gerridae	<i>Pertica filamentosa</i> (Cuvier)	Long rayed silver biddy
Leiognathidae	<i>Leiognathus bindus</i> (Valenciennes)	Orange fin bony fish
	<i>Leiognathus equulus</i> (Forsk.)	Common bony fish
Pomadasyidae	<i>Pomadasyus hasta</i> (Bloch)	Lined silver grunter
Sciaenidae	<i>Sciaena</i> sp.	
	<i>Otolithus ruber</i> (Schneider)	Rosy jewfish
Sparidae	<i>Argyrops spinifer</i> (Forsk.)	Long spined red bream
Mullidae	<i>Upeneus vittatus</i> (Forsk.)	Yellow striped goat fish
Ephippidae	<i>Ephippus orbis</i> (Bloch)	Spade fish
Scatophagidae	<i>Scatophagus argus</i> (Linnaeus)	Spotted butterflyfish
Trichiuridae	<i>Trichiurus savala</i> Cuvier	Small headed ribbon fish
Scombridae	<i>Rastrelliger kanagurta</i> (Cuvier)	Rake gilled mackerel
Scomberomoridae	<i>Indocybium lineolatus</i> (Cuvier)	Streaked spanish mackerel
Stromateidae	<i>Pampus argenteus</i> (Euphrasen)	Silver pomfret
	<i>Parastromateus niger</i> (Bloch)	Brown pomfret
Trypauchenidae	<i>Trypauchen vagina</i> (Bloch & Schneider)	Burrowing goby
Platycephalidae	<i>Platycephalus tuberculatus</i> (Cuvier & Valenciennes)	Knobby flat head

Order/Family	Species	Common Name
Pleuronectiformes		
Psettodidae	<i>Psettodes erumei</i> (Bloch)	Indian halibut
Bothidae	<i>Pseudorhombus arsius</i> (Hamilton)	Large toothed flounder
Cynoglossidae	<i>Cynoglossus bengalensis</i> (Day)	Bengal tongue sole
Tetradontiformes		
Triacanthidae	<i>Triacanthus brevirostris</i> (Schlegel)	Short nosed tripod fish
Diodontidae	<i>Diodon hystrix</i> Linnaeus	Spotted porcupine fish
Lagocephalidae	<i>Lagocephalus inermis</i> (Schlegel)	Smooth backed blowfish
Decapoda		
Penaeidae	<i>Metapenaeopsis stridulans</i> (Alcock)	Fiddler shrimp
	<i>Metapenaeus affinis</i> (H. Milne Edwards)	Jinga shrimp
	<i>Penaeus monodon</i> (Fabricius)	Giant tiger prawn
Scyllaridae	<i>Thenus orientalis</i> (Lund)	Flathead locust lobster
Sepioidae		
Sepiidae	<i>Sepia pharaonis</i> (Ehrenberg)	Cuttle fish
	<i>Sepia elliptica</i> (Hoyle)	
Teuthoidae		
Loliginidae	<i>Loligo duvauceli</i> (Orbigny)	Squid
	<i>Sepioteuthis lessoniana</i> (Lesson)	
	<i>Doryteuthis sibogae</i> (Adam)	
Chelonidae	<i>Lepidochelys olivacea</i> (Eschscholtz)	Pacific ridley turtle

on the composition of fish species from Visakhapatnam (17° 44'N Lat. 83° 33'E Long.) (Sujatha, 1995) and from Veraval (Puthra and Manoharadoss, 1996). Sheshagiri Rao (1981) has listed 172 commercially important species off Andhra coast. Sudarsan (1981) has provided key to 273 species of fish in trawl catches off Visakhapatnam. An analysis and region-wise checklist of occurrence and abundance of different demersal fishery resources of an area is important for ichthyological knowledge and also for effective fisheries management.

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