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AN ASSESSMENT OF DEMERSAL STOCKS IN THE SOUTHWEST COAST OF INDIA WITH PARTICULAR REFERENCE TO THE EXPLOITABLE RESOURCES 'IN OUTER CONTINENTAL SHELF AND SLOPE

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ABSTRACT

In spite of added inputs, the increase in marine fish production in India has been only marginal during the last several years. In some segments of the coast, exploitation of target species have apparently reached the level of MSY. But in the case of some other species, wide gaps exist between the estimates of stock size and the actual level of exploitation A general awareness has rightly been created that shrimp-oriented growth of industry is rather limited and further addition to production can largely be realised only by exploiting the stocks of outer shelf and continental slope.

In this paper, an attempt has been made to assess the exploitable stocks off southwest coast between 8° North and 15° North latitudes, covering Kerala and Karnataka coasts Several estimates of stock sizes projected by different authors were mostly based on indirect methods or fragmentary data. Recent data available has been analysed in the light of increase in fishing pressure and the estimates of the resources have been revised.

Trawl survey data collected by 17.5 m vessels from inner shelf area up to 50 m depth and the data collected by the larger vessels up to the continental slope are considered. From the catch and effort data, stock density by the swept area method is worked out for each depth zone separately for Kerala and Karnataka coasts. Quantitative assessment is made on the major demersal stocks, viz., rays, catfish, perches, nemipterids, lizard fish; carangids, bull's eye, green eye, black ruff, cephalopods, deepsea lobsters and deepsea prawns. The density indices are converted to absolute standing stock estimates. MSY figures for the species mix as well as for the major species are computed with due regard to the mortality parameters and present level of exploitation.

INTRODUCTION

The national output from marine fisheries sector in India has been growing at slow rate during the last two plan periods, in spite of mechanisation and addition to the fishing fleet of the country. Though the potential of exploitable fishery stocks in Indian seas

have been placed at a higher order, the present marine fish production is about 1.78 million tonnes as in 1984 (Anon, 1986)! Contributing about 30-35 percent of demersal landings in the country, south west coast is subject to the most intensive fishing pressure. Even though the production is well below the estimated assessments of potential yield, the trend in catches is not indicative of any significant expansion of fishery in the coastal belt. The shrimp oriented growth of industry has resulted in exploitation of stocks from a narrow coastal belt, thereby leaving the resource in the outer shelf and continental slope virtually unexploited. Availability of some of the coastal species has been considerably reduced in recent years indicating signs of strain on the stocks. Such a scenario calls for re-assessment of the size and state of fishery stocks in different sections of the Indian coast. This paper attempts an assessment of the stock size and sustainable yield level of demersal resources off the south west coast between lat. 8° to 15°N upto 500m depth.

DATA SOURCE

The estimates are made on the basis of data collected in exploratory cruises of Fishery Survey of India vessels during April, 1980 to March, 1987. Extensive coverage of different latitudes and bathymetric zones was made in the survey as listed in Table 1. 11,315 hours sampling was done by 17.5m vessels in the coastal belt within 50m depth and 588 hours survey was accomplished by the larger vessels Matsya Nireekshani, Matsya Shakti and Matsya Vishwa in the outer shelf and continental slope.

METHODOLOGY

The density of demersal stock as well as the major components were worked out by applying the 'swept area' method. The area covered in one hour was worked out taking the trawling speed of 2 knots for the 17.5m vessels and 3.5 knots in case of the larger vessels. Horizontal spread of the gear was taken as 40% of the head rope length.

The fish density per unit area was calculated separately for Kerala and Karnataka coasts in the different depth strata. A catchability coefficient of 0.5 was considered for the different gears except for the 34m fish trawl operated by Matsya Nireekshani. This gear, having mesh size in the range of 80-400 mm, was assumed to have a reduced catchability coefficient of 0.4. The stock density was further converted to absolute biomass for each strata in the northern and southern regions and then summed up.

Due to the different levels of exploitation, calculation of MSY required different approaches. The coastal areas within 50m depth is under intensive exploitation and the MSY is computed by the expression Y max = 0.5 (Y + MB) where Y is the current yield, M is natural mortality coefficient and B, the biomass (Gulland, 1983). Beyond the 50m depth line the demersal stocks are virtually unexploited and the MSY estimate is arrived at by applying the formula Y max = 0.5 M Bv, where Bv is the virgin standing stock (Gulland, 1971).

In South East Asian demersal trawl fisheries, the above equations are generally used in conjunction with value of M = 1, considering these fishes as relatively small and short-lived. Pauly (1983) suggests that this value is essentially a guess work and has been uncritically applied to a wide variety of stocks, including multispecies stocks. Sainsbury (1979) has discussed the negative consequences of its use. Gulland (1979) has suggested a more conservative estimate of 0.5 for western Indian Ocean south of equator. From the catch components of demersal stocks in south west coast, several of the species cannot be categorised as small or short-lived. (elasmobranchs, perches, catfish etc). With due regard to the mortality parameters of related species in other tropical fisheries the natural mortality factor is roughly taken as 0.5 in case of rays, perches and cat fish, 1.5 for deep sea prawns and cephalopods and 1.0 for the other species. These values are obviously first approximations which need refinement with the parameter estimations, of major species in our own fisheries.

TABLE 1

Distribution of sampling effort and vessel & gear employed

Latitude	Depth range	Sampling hours	Vessel	Period	Gear
8°-12°	below 50m	6289	Utpadak & Sachetak	April, '80-May,83	24m Fish trawl
	50-200m	1971	Nireekshani	May-Sept. 83, Aug. 85 -March,83	34 m Fish trawl
	200-500m	697	Nireekshani	May, 85 March, 87	45m shrimp trawl
12°-15°	below 50m	5026	Pradata, Tarangini & Anavashak	April, 80-Nov, 84	24m fish trawl
	50-200m	3050	Shakti, & Vishwa	April, 83-March,87	27m fish trawl
	200-500m	170	Sakthi & Vishwa & Jan,86-March,87	April, 84-March 85,	47m shrimp tawl

TABLE 2

*Stock density and standing stock of demersal resources
along South West coast between LAT. 8° to 12°N*

Latitude	8° to 12°N							
Depth strata	Below 50m		50-100m		100-200m		200-500m	
Area (Km²)	14150		13310		3505		6180	
Stock Density kg/kg²) Standing Stock (tonnes)	Density	Standing Stock	Density	Standing Stock	Density	Standing Stock	Density	Standing Stock
Rays	451	6382	157	2090	10	35	3	19
Perches	53	750	219	2915	15	53	19	117
Cat fish	1236	17489	844	11234	4	14	—	—
Lizard fish	149	2108	266	3640	107	375	6	37
Nemipterids spp.	1053	14900	1672	22254	2613	9157	—	—
Caranx spp.	130	1840	53	705	47	165	—	—
Priacanthus spp.	28	396	437	5816	944	3309	14	87
Centrolophus spp	—	—	—	—	91	319	1406	8689
Chlorophthalmus spp	—	—	—	—	436	1258	992	6131
Other deep sea fishes	—	—	—	—	—	—	578	3572
Deep sea prawns	—	—	—	—	—	—	690	4264
Deep sea lobster	—	—	—	—	—	—	570	3524
Cephalopods	196	2773	396	5271	36	126	—	—
Other varieties	1608	22754	924	12299	2102	7367	106	655
TOTAL :	4904	69392	4968	66124	6405	22450	4384	27094

STOCK DENSITY AND STANDING STOCK

The density of demersal stocks along Kerala coast ranged from 4.4 tonnes to 6.4 tonnes per km in the different depth strata. Highest stock density of 6.4 tonnes per km² was recorded in the 100-200m depth zone followed by 5.0 tonnes per km² in 50-100 m zone. The density along Karnataka coast was comparatively low in all depth ranges, the maximum of 4 1 tonnes per km² being in the inner shelf areas. The stock density of demersal resources in the different sections of the coast are given below.

Latitude	Stock density (tonnes per km²)			
	Depth (m)			
	below 50	50-100	100-200	200-500
8° -12°N	4.9	5.0	6.4	4.4
12°-15°N	4.1	2.9	3.8	3.7

The density figures have further been worked out for the major species/groups furnished in Tables II and III. It can be seen that cat fish and thread-fin breams constitute the dominant varieties in the coastal areas within 50m depth. In the 50-100m depth zone, besides the above varieties, 'Bulls eye' (Priacanthus spp) forms a major component whereas in 100-200 m thread-fin breams and 'Bulls eye' dominate the stock. The continental slope in 200-500m depth supports high densities of 'Black ruff' Centrolophus sp), 'Green eye' (Chlorophthalmus sp), deep sea prawns and deep sea lobster.

The standing stock in the two regions of the coast is assessed as 1.85 lakh tonnes in lat. 8°-12°N and 1.85 lakh tonnes in lat. 8°-12°N and 1.47 lakh tonnes in lat. 12°-15°N. Break up details in different bathymetric zones are given below.

TABLE 3

Stock density and standing stock of demersal resources along south west coast between LAT. 12° to 15°N

Latitude	12° to 15°N							
Depth strata	Below 50m		50-11m		100-200m		200-500m	
Area(Km²)	1445		16950		6740		3930	
Stock Density (kg/km²) Standing Stock (tonnes)	Density	Standing stock	Density	Standing stock	Density	Standing stock	Density	Standing stock
Rays	102	1444	46	780	49	330	2	8
Perches	88	1246	63	1068	74	499	—	—
Cat fish	1445	20464	518	8780	81	546	—	—
Lizard fish	66	934	125	2119	439	2659	213	837
Nemipterids spp	548	7757	483	8187	1788	12501	.–	—
Caranx spp	73	1033	143	2424	13	88	—	—
Praicanthus spp	363	5138	536	9085	810	5459	271	1065
Centrolophus	—	—	15	254	79	532	2077	8163
Chlorophthalmus spp	—	—	—	—	—	—	—	—
Other deep sea fishes	—	—	—	—	—	—	319	1254
Deep sea prawns	—	—	—	—	—	—	600	2358
Deep sea lobster	—	—	—	—	—	—	118	464
Cephalopods	84	1190	132	2237	136	917	—	—
Other varieties	1344	19024	798	13526	302	2036	143	561
TOTAL :	4113	58220	2859	48460	3771	25417	3743	14942

Latitude	Standing stock ('100 tonnes) Depth (m)				
	below 50	50-100	100-200	200 500	Total
8° -12°N	69.4	66.1	22 4	27.1	185.0
12°-15°N	58.2	48.5	25.4	14.9	147.0

For standing stock estimates of major species reference may be made to Tables II and III.

POTENTIAL YIELD

The aggregate potential yield of demersal stocks in south west coast is assessed as 2.4 lakh tonnes. The depth wise distribution of the harvestable yield is estimated in Table IV, the gist of which is given below.

Depth (m)	Potential yield ('00 tonnes) below 50	50-100	100-200	200-500	Total
Potential yield	140.6	52.6	24.2	22.8	240.2

DISCUSSION

The potential yield estimate arrived at in this paper is below the assessments by several earlier authors. In adequacy of data in the past

and variations in the methodology adopted for estimaton of stock density as well as MSY are of the assessment of demersal stocks of south west coast is given below.

Author	Region latitude	depth range (m)	p. y. (lakh tonnes)
Silas (1969)	Cape Comorin-Karwar	75-450	0.59
Jones & Banerji (1973)	South west Coast	0-180	1.51
Mitra (1973)	Kerala & Karnataka	0-75	0.86
Joseph et al (1973)	Kerala & Karnataka	0-75	1.15
George et al (1977)	Kerala, Karnataka & Goa)	0-50	2.35
		50-200	3.25
Joseph (1980)	Lat. 7°-15°	0-73	3.77
Oomen (1985)	Lat. 7°-13°	180-460	0.26
Joseph (1987)	Lat. 7°-15°	0-100	2.49
		100-200	0.27
		200-500	0.27
Present study	Lat. 8°-15°	0-50	1.41
		50-100	0.53
		100-200	0.24
		200-500	0.23

TABLE 4
Potential yield of demersal resources along south west coast 8° to 15°N
'000 tonnes

Depth stata (m)	Below 50			50-100		100-200		200-500	
	Current Yield	St. Stock	P. Y	St. Stock	P. Y	St Stock	P. Y	St Stock	P. Y
Rays	5.9	7.8	4.9	2.9	0.7	0.4	0.1	—	
Perches	2.8	2.0	1.9	4.0	1 0	0 6	0.2	—	—
Cat fish	16.8	37.9	17.9	20.0	5 0	0.6	0.2	—	—
Lizard fish	5.1	3.0	4.1	6.7	2.9	3.3	1.7	0.9	0.5
Nemipterids sop	30.5	22.7	26.6	30.4	15.2	21.2	10.6	—	—
Caranx spp	3.9	2.9	3.4	3.1	1.6	0.3	0.2	—	—
Priacanthus spp	—	5.5	2.8	14.9	7.5	8.8	4.4	1.2	0.6
Centrolophus spp	—	—	—	0.3	0.2	0.9	0 5	16.9	8.5
Chlorophthalmus spp	—	—	—	—	—	1.5	0.8	6.1	3.1
Other deep sea fishes	—	—	—	—	—	—	—	6.1	3.1
Deep sea prawns	—	—	—	—	—	—	—	6.6	5.0
Deep sea lobster	—	—	—	—	—	—	—	4.0	2.0
Cephalopods	3.4	4.0	4.7	7.5	5.6	1.0	0.8	—	—
Other varieties	106.8	41.8	74.3	25.8	12.9	9.4	4.7	—	—
TOTAL :	175.2	127.6	140.6	112.6	52.6	48.0	24.2	41.8	22.8

The present estimate is closely comparable with the recent assessment by Joseph (1987) in so far as the depth zones of 100-200 m and 200-500 m are concerned. The differential approach and variations in the extent of area considered in most of the earlier reports render any critical comparison rather difficult.

The level of exploitation of demersal stocks in south-west coast is about 1.75 lakh tonnes per annum (1380 84) harvested exclusively from the coastal region within 50m depth. This exceeds the potential yield estimate of 1.41 lakh tonnes assessed here from the relative inshore area. A cautious approach possibly with reduction in fishing pressure on the demersal stocks in the coastal belt appears necessary.

A potential yield of 52,600 tonnes is harvestable from the 50-100 m depth zone. Apart from the operation by a few chartered vessels, the resources are totally unexploited. P Y. in the order of 5600 tonnes of cephalopods from this strata and comparatively high stock density particularly in the southern grounds is highly significant. The bulk of nemipterid stock in 50-200m is capable of supporting very high returns in quantitative terms. Potential yield of this group from the unexploited zone is about 25,800 tonnes. The next stage in development of Indian marine fishery has to be with accent on exploitaion of stocks from 50-100m depth zone by suitable type of vessels.

It is found that with increasing depth the quantity of low value fish increases. But the positive aspect of the stock structure in the continental slope (200-500m) is the availability of deepsea crustaceans in considerable magnitude. A potential yield of 5000 tonnes of deepsea prawns and 2000 tonnes of deepsea lobster is assessed from the Kerala - Karnataka coast with high stock density in Quilon Bank. The area can further support an yield of 15,300 tonnes of deepsea fishes. Development of appropriate technology for production of value added fish products from the deepsea demersals appears inevitable for expansion of fishery to the continental slope.

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