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STUDIES ON THE DISTRIBUTION AND ABUNDANCE OF BULL'S EYE (*PRIACANTHUS* SPP.) IN THE EEZ OF INDIA

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ABSTRACT

Bull's eye is one of the important constituents of the fishes available on the outer shelf in the EEZ of India. The fishery and oceanographic survey conducted by FORV *Sagar Sampada* during 1985-'87 period in her cruises 1-30 showed that the bull's eye *Priacanthus* spp., occurred in 62 out of 182 stations where bottom trawl was operated. It formed 40% of the total catch. The catch rate varied from 0.3 to 4,905 kg. The resource is available from 20 - 262 m depths. The depth-wise catch rate was 184.5 kg in 0- 100 m, 249.4 kg in 100-200 m and 25.0 kg in depth more than 200 m. The present paper gives the distribution and abundance of this species in different latitudes and depth zones in the EEZ.

INTRODUCTION

Eversince the declaration of the EEZ , with a total exploitable area of 2.02 million km^2, there was a growing awareness among scientists and fishery managers for a better and rational exploitation for full utilisation of the fish resource potential, which is far in excess of the present annual marine fish landings. With this objective, resource surveys were conducted in the neritic and oceanic waters by different government agencies such as the erstwhile Pelagic Fisheries Project, Fishery Survey of India etc. George *et al.* (1977) estimated the potential yield from the Indian EEZ as 4.47 million tonnes, when the annual average yield was only 1.16 million tonnes (1980-'84 period). The earlier surveys by the Pelagic Fisheries Project unfolded various concentration pockets, seasonal migratory behaviours and potential resources of some of the commercially important pelagic fishes along the southwest coast of India. The Fishery Survey of India also made attempts to survey the Indian EEZ.

The present survey by FORV *Sagar Sampada* in the Indian EEZ is aimed at charting out exploited, under -exploited and unexploited regions and also to locate virgin fishing grounds of conventional and non-conventional resources. It is also envisaged to estimate the resource potentials of commercially important and non-conventional fishery resources during different seasons and at various bathymetric realms.

A study on the availability, abundance, geographical and seasonal migrations of one of the important demersal non-conventional resources, the Bull's eye or Big eye (*Priacanthus* spp.) which commonly occurred in the course of the survey by FORV *Sagar Sampada*, was taken up . The earlier investigations on the Bull's eye were by Joseph (1984, 1986), Joseph and John (1986), Sivaprakasam (1986), John and Sudarsan (1988), Vijayakumaran and Philip (1988), Sulochanan and John (1988), Vijayakumaran and Nayak (1988, 1989 a), Gopalakrishnan *et al.* (1988) and Biradar (1989). The present paper deals with the geographical and bathymertric distribution and abundance of Bull's eye based on data collected by FORV *Sagar Sampada* in her cruises 1-30, during February , 1985 to June, 1987.

MATERIAL AND METHOD

The catch and effort data of bottom trawl and pelagic trawl operated from FORV *Sagar Sampada* along the Indian EEZ during her cruises, 1-30 (February, 1985 to June, 1987), covering 499 fishing stations were utilised for the study. The trawling was conducted for a duration of one hour at each of the bottom and pelagic trawl stations. The bottom trawl was operated at 182 stations and the pelagic trawl at 317 stations. Out of 499 trawling stations there was fish catch at 110 stations (22.2%) whereas Bull's eye was obtained from 74 stations (15%): 62 bottom trawl and 12 pelagic trawl operations. Total catch, species composition etc. were recorded at each fishing station. Random samples were collected from each haul for biological investigations on length-frequency, sex, maturity, food etc. Stand-

ing stock was estimated using the swept area method of Gulland (1971).

Results

Distribution of Bull's eye in the Indian EEZ

The bottom and pelagic trawling surveys conducted by FORV *Sagar sampada* revealed that *Priacanthus* spp. was one of the important non-conventional resources distributed all along the shelf and upper slope regions of the EEZ. The study further indicated the possibility of this resource being migratory both in the horizontal and vertical directions. The bathymetric distribution showed that the resource is available along the shelf at 20-262 m depth. The pelagic trawl caught Bull's eye from an oceanic station with bottom depth of 3,719 m (16°00'N 69°00'E) while trawling at a depth of 60m.

Geographical yield and abundance

Bull's eye is widely distributed all along the areas surveyed with particular abundance on the west coast. The highest catch of 4,905.5 kg was recorded at station No. 143 (07°59'4"N and 76°51' 5"E) during night by bottom trawl. The next important density pocket was at station No. 706 (15°30'N 73°03'E), with a yield per hour of 1,500 kg in bottom trawl. The average catch rate (kg/hour) along the west coast was 193 kg whereas on the east coast it was 59.8 kg. Regionwise abundance showed that the northwest coast had a catch rate of 159.9 kg and the southwest produced 219.7 kg; and the north east and the southeast regions were less productive with 116.6 kg and 3 kg respectively.

High density pockets were located off southwest of Kanyakumari in the Wadge Bank area at 74 m depth and off Marmagoa along the shelf at 120 m depth with a catch rate of 4,905.5 kg and 1,500 kg per hour, respectively. The next dense grounds (200-500 kg) were south of Kanyakumari in the Wadge Bank area, northwest of Mangalore along the shelf, southwest of Marmagoa and off Veraval on the west coast. Areas which produced Bull's eye at the rate of 100-200 kg per hour were off Marmagoa and in the head of Bay of Bengal off Paradip in the shelf region. The areas along the shelf and outer shelf regions off Quilon, south of Marmagoa, Calicut, and Kandla on the west coast produced 50-100 kg per hour. Less dense regions with 0-50 kg per hour were located along the west coast in the shallow regions of the shelf (Fig.1). The stationwise abundance of *Priacanthus* spp. in the EEZ with more than 25 kg per hour is given in Table 1.

Stations 705 (13°30'N 73°E) and 706 (15°30' N 73°03'E) yielded exclusively *Priacanthus* spp. in the bottom trawl operations during day with catch rate of 600 and 1,500 kg/hour respectively. The areas which yielded more than 80% of *Priacanthus* spp. in total catch were stations 21, 162, 167, 532 and 638.

Bathymetric yield and abundance

The depthwise abundance in the EEZ showed that the depth zone 0-100 m was rich for Bull's eye with an average rate of 184.5 kg, whereas the depth zone 100-200 m produced the highest mean catch rate of 249.4 kg per hour. The depths more than 200 m produced only 25 kg/hour. Bull's eye commonly occurred in high concentrations in the shelf region upto 200 m. In all-fish total catch, *Priacanthus* spp. formed 80.5% upto 100 m, 83.6% in 100-200 m and only 20.4% in 200 m and more. The depthwise abundance of *Priacanthus* spp. along the Indian EEZ is given in Fig. 2.

Off the northwest coast, the highest catch rate (419.8 kg) was recorded from the depth zone 100 - 200 m and the shallow zone upto 100 m produced only 61 kg per hour. This resource formed 93.2% of the total fish catch from the 100-200 m depth zone. On the southwest coast the bathymetric zone of upto 100 m yielded Bull's eye at the rate of 318.6 kg per hour, whereas the 100-200 m zone and above 200 m produced 56.9 kg per hour and 25.6 kg per hour respectively. The percentage composition of Bull's eye in total fish yield was 42.5 and 35% in the regions upto100 and 100-200 m respectively. The resource abundance of the west coast of India in general showed that 268.6 kg per hour was recorded from 100-200 m depth zone and 200.3 kg per hour from upto100 m zone. As high as 84% of total fish catch by bottom trawl from the depth zone 100-200 m was composed of Bull's eye.

The bathymetric abundance along the northeast coast showed that upto 100 m zone produced Bull's eye at the rate of 165.4 kg per hour with a percentage yield of 80 in total fish catch. On the other hand, the 100 - 200 m depth zone produced only 18.9 kg per hour. On the southeast coast, Bull's eye was recorded in the shallow waters with a poor catch rate of 3 kg per hour. The shallow waters of upto 100m on the east coast as a whole yielded the resource at 68 kg per hour, with a share of 47.4% in total fish production of the depth zone.

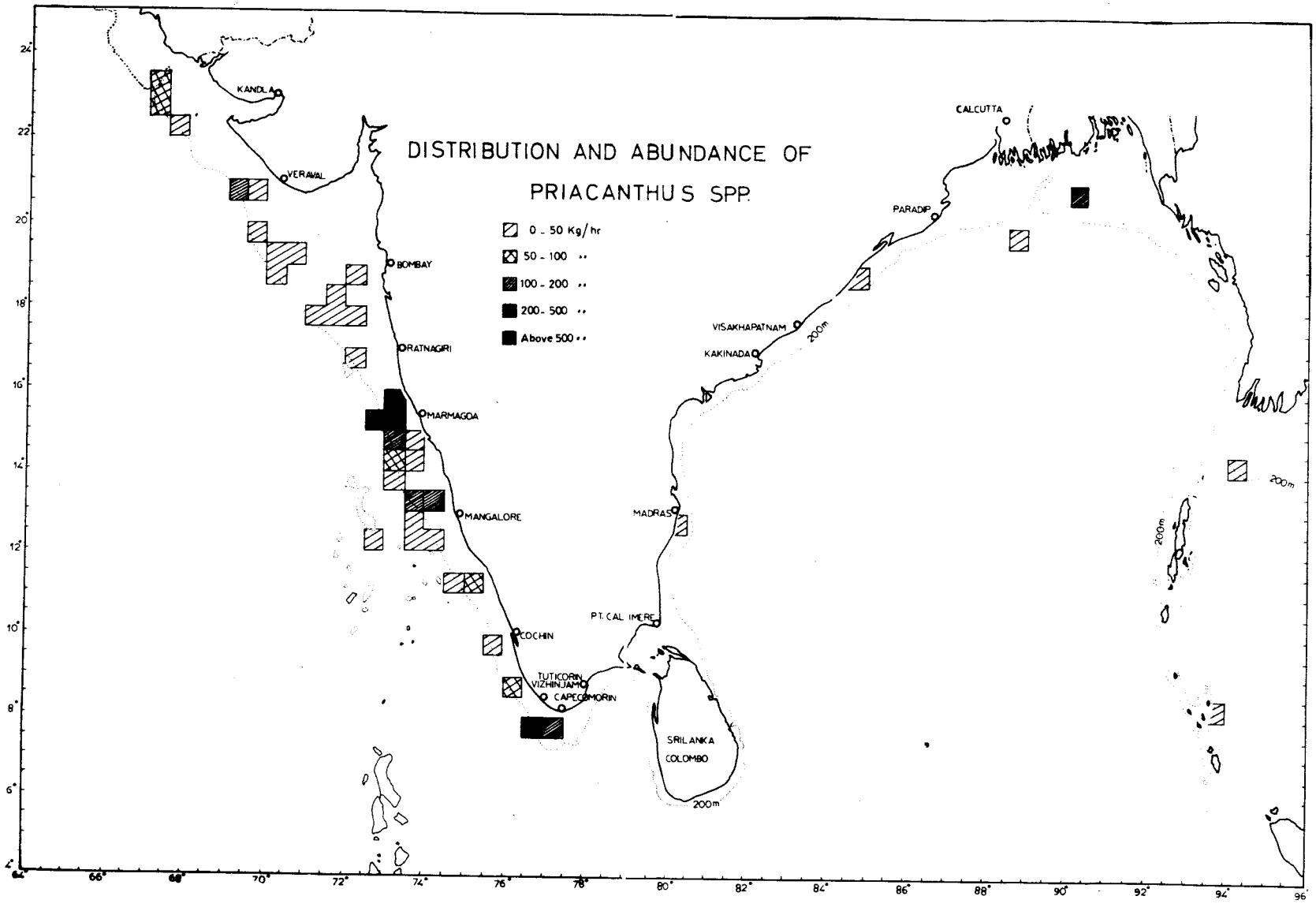

Fig.1. Distribution and abundance of *Pricanthus* spp. in the Indian EEZ.

TABLE 1. *Stationwise abundance of* Priacanthus *spp. in the Indian E. E. Z. (catch per hour of less than 25 kg not included)*

Gear: Bottom Trawl

St. No.	Position		Catch/ hour (kg)	Depth of station (m)
	Latitude (N)	Longitude (E)		
143	07° 59'	76° 52'	4905.5	74
706	15° 13'	73° 03'	1500.0	120
728 A	15° 00'	72° 58'	750.0	161
705	15° 30'	73° 10'	600.0	81
728	15° 00'	72° 58'	422.4	161
805	13° 08'	74° 03'	382.5	80
142	07° 47'	77° 14'	380.9	57
532	20° 57'	90° 30'	219.0	88
797	15° 00'	73° 18'	214.4	104
620	11° 28'	75° 02'	200.0	52
802	13° 30'	73° 50'	198.9	94
30	15° 24'	73° 06'	120.9	100
218	23° 30'	67° 00'	100.0	92
777	22° 53'	67° 00'	100.0	104
691	07° 30'	77° 30'	90.0	90
21	14° 28'	73° 10'	83.5	220
608	08° 49'	76° 18'	75.0	58
167	12° 05'	72° 31'	49.7	80
638	15° 00'	72° 02'	40.8	188
935	19° 30'	88° 50'	39.8	70
721	14° 00'	73° 30'	36.8	108
320	20° 42'	69° 35'	36.5	80
37	18° 30'	70° 26'	31.1	79
616	12° 30'	74° 24'	25.9	109

Seasonal abundance

Since the present coverage along the Indian EEZ is not sufficient enough to arrive at a conclusion on the seasonality of the distribution of Bull's eye in different geographical regions, only a general trend of their seasonal availability is given in this report. Along the west coast, Bull's eye was abundant during July-November with the peak abundance in August. On the southwest coast in particular, this resource was abundant during August, whereas, in the northwest it was in September. As there was only very little coverage on the east coast, no trend of seasonal abundance was evident.

Pelagic trawling results

Bull's eye was caught by pelagic trawl net from 12 stations (2501-3719 m) along the slope and

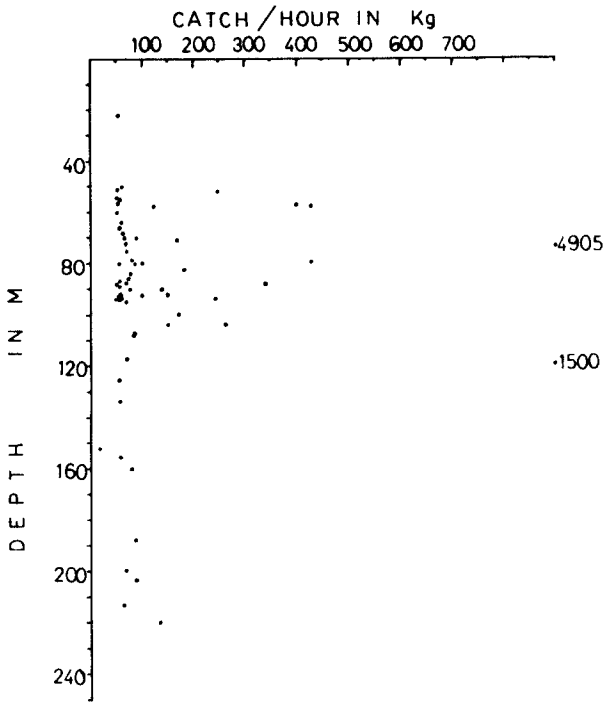

Fig. 2. Bathymetric abundance of *Priacanthus* spp. in the Indian EEZ.

oceanic waters. The net was trawled in the depth strata of 100 to 50 m along the slope and the resultant total fish yield varied from 0.1 to 120 kg. The Bull's eye catch ranged from 0.5 to 100% of the total fish taken by the gear. The highest production of 84 kg per hour (70% in the total fish catch) was recorded from station 750 (17° 58' N 69° 00'E, depth: 3373 m) from 60 m depth. Station 746 (18° 00' N 68° 30' E, depth: 3443 m) and 757 (19° 00' N 67° 00' E, depth : 3260 m) were also rich in Bull's eye with production rates of 50 and 30 kg per hour respectively. Invariably high catch of the fish by pelagic trawl was obtained in night trawling, possibly indicating the vertical ascend of this resource during night into the column waters in search of food in the rich DSL.

Species composition

The species encountered in the catches from the EEZ were *Priacanthus hamrur, P. tayneus, P. blochii,* and *P. macrocanthus.* Biological study on the most dominant species, *P. hamrur* showed that the size range in the bottom trawl catches was 12-34 cm and with maturity stages II to IV domianting during September- November. They feed on demersal fishes and prawns. During night they voraciously

feed on pelagic shrimp, *Leptochela*. These shrimps formed an important component of the DSL exhibiting vertical migration.

Standing stock

The biomass of Bull's eye in the regions surveyed is estimated to be around 3.95 lakh tonnes. Region-wise biomass estimate showed that the southwest coast is the richest ground with 2.9 lakh tonnes and the north west coast has only 0.86 lakh tonnes. The east coast is less productive with a standing biomass of 0.18 lakh tonnes. The potential yield from the Indian EEZ is estimated around 0.79 lakh tonnes, following the equation for MSY of Sparre (1988) or 1.95 lakh tonnes by following Gulland (1979).

Discussion

Bull's eye is a widely distributed potentially rich deep water fish resource recorded from shallow shelf to 3719 m in oceanic waters. Joseph (1984, 1986) recorded Bull's eye along north Kerala and Karnataka coasts with peak occurrence in 100-150 m depth during April-June, (average catch rate of 72.8 kg) forming 11.3% in the total fish yield; an average catch rate of 32 kg was recorded from 90-250 m depth from the Gulf of Mannar and the Wadge Bank. On the Andhra coast an average catch rate of 60 kg was recorded from depth zone 120-200 m, forming 5% in total fish yield. This resource "migrate across the shelf and parallel to the shelf, probably depending on cold water current". The Fishery Survey of India surveys indicate rich grounds for Bull's eye in the Gulf Mannar (Somavanshi and Bhar, 1984) and off Andhra Pradesh in 14°-18° N upto 500 m depth (Ninan *et al., 1984)* . Sulochanan and John (1988) reported high concentration of Bull's eye from deeper regions of the shelf off Kerala during May - October, contributing as high as 34.7% to the total fish catches from 50 - 100 m depth.

The present survey by FORV *Sagar Sampada* unfolds some density pockets of Bull's eye along the southwest coast within 07° 00' - 15° 00' N and 72° 30' - 70° 00' E, sometimes, the entire catch being composed of Bull's eye. This observation agrees well with that of Joseph (1986) based on FSI survey, but with a higher concentration in the current observations.

Vijayakumaran and Naik (1988 a) found that *Priacanthus* spp. is abundant in depth zone upto 100 m in latitudes 11° - 12° N along the west coast and 100 - 200 m in latitude 13° N. They reported a south ward shallow water migration in pre-monsoon for breeding and return towards northwest in post-monsoon. The present study with regard to three different depth zones, upto 100 m, 100- 200 m and above 200 m showed that the zone upto 100 m is more productive (318.64 kg/hr) along the southwest coast, whereas in the northwest, the 100- 200 m depth zone was rich with about 420 kg/hr. On the east coast the shallow region upto 100 m yielded 68 kg per hour.

Biradar (1988) found that the resource is abundant in the depth zone 50 - 100 m within 15° N and 22° N latitudes and estimated the biomass of the region as 0.88 lakh tonnes and John and Sudarsan (1988) estimated the biomass as 0.65 lakh tonnes. The present estimate from the same region is about 0.86 lakh tonnes. The biomass estimate for the Indian EEZ is 3.95 lakh tonnes; whereas John and Sudarsan (1988) found it as 1.17 lakh tonnes. As the resource being virgin and unexploited, the MSY may be calculated by using the formula 0.5 X B_0 (Gulland, 1971) which resulted in 1.95 lakh tonnes or by the formula of Sparre (1988) which gives the MSY value at 0.79 lakh tonnes.

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