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Standing Stock of Three Species of Demersal Fishes from Southwest Coast of India

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Standing stock of three principal demersal fishes of the inshore waters off Mangalore was assessed. The assessment was based on fortnightly samplings conducted in an area extending over *ca* 850 km². The data gathered was computed employing Alverson's methods. The standing stock of *Nemipterus japonicus, Saurida tumbil* and *Grammoplites scaber* indicates that this area supports good quantities of these fishes and if properly exploited, will sustain a profitable demersal fishery.

Information on the standing stock of any species of fish contributing to a potential fishery is of immense importance for proper planning and exploitation of the resources. Estimations of standing stock are dependent to a great extent on theoretical values and subjectivity in analysis (Alverson, 1967) and further, it is not possible or not expected to make a thorough sampling of representatives of the stock distributed over wide areas. The extreme patchiness of the shoals, the mobility of the fish and their tendency to avoid vessels, may invalidate the results of the quantitative acoustic survey on the stock. Working on the stock assessment of *Sardinops ocellata* in the southeast Atlantic, Cram & Hampton (1976) have suggested that these survey errors can be reduced considerably by employing an aerial/acoustic strategy where the aircraft locates and measures the shoal area and the vessel makes synchronous measurements of the thickness and packing density from as many shoals as possible. The combined data may be expected to provide a direct estimate of the stock size. The recent publications by the UNDP/FAO Pelagic Fishery Project in Cochin (Anon, 1976) have taken into consideration mainly the data obtained by acoustic methods and supplemented with the results of aerial surveys. High resolution echosounders coupled to echo-integraters are used to locate and quantify fish shoals, followed by a mathematical computation of the available stock. This has proved to be useful and sufficient to give a more or less truthful picture of the standing stock. Even though this technology is infinitely faster and convenient, it is still not a perfect one, particularly in the tropical seas where multiplicity of species poses problems in the interpretation of data. Usually, an assessment of standing stock by direct methods of survey will not give any information on recruitment. Therefore, it should be supplemented with a detailed knowledge of biological aspects, such as breeding habits, development, growth, size and age at maturity and migration of the concerned species. Another important institution in India which has worked out estimations of standing stock, particularly of demersal fishes, is the Exploratory Fisheries Project of the Government of India.

A direct computation of the stock by way of sampling demands precise data on area trawled, the efficiency of the gear, period of investigation and the catch statistics. Therefore, data collected from landing centres, which seldom provide the above details, will not be of much use in the estimation of standing stock. Since during the present investigation these aspects could be followed critically to a great extent, it was possible to make attempts to assess the standing stocks of three most dominant demersal fishes of this area, namely the threadfin bream *Nemipterus japonicus,* the lizard fish *Saurida tumbil* and the flathead *Grammoplites scaber.*

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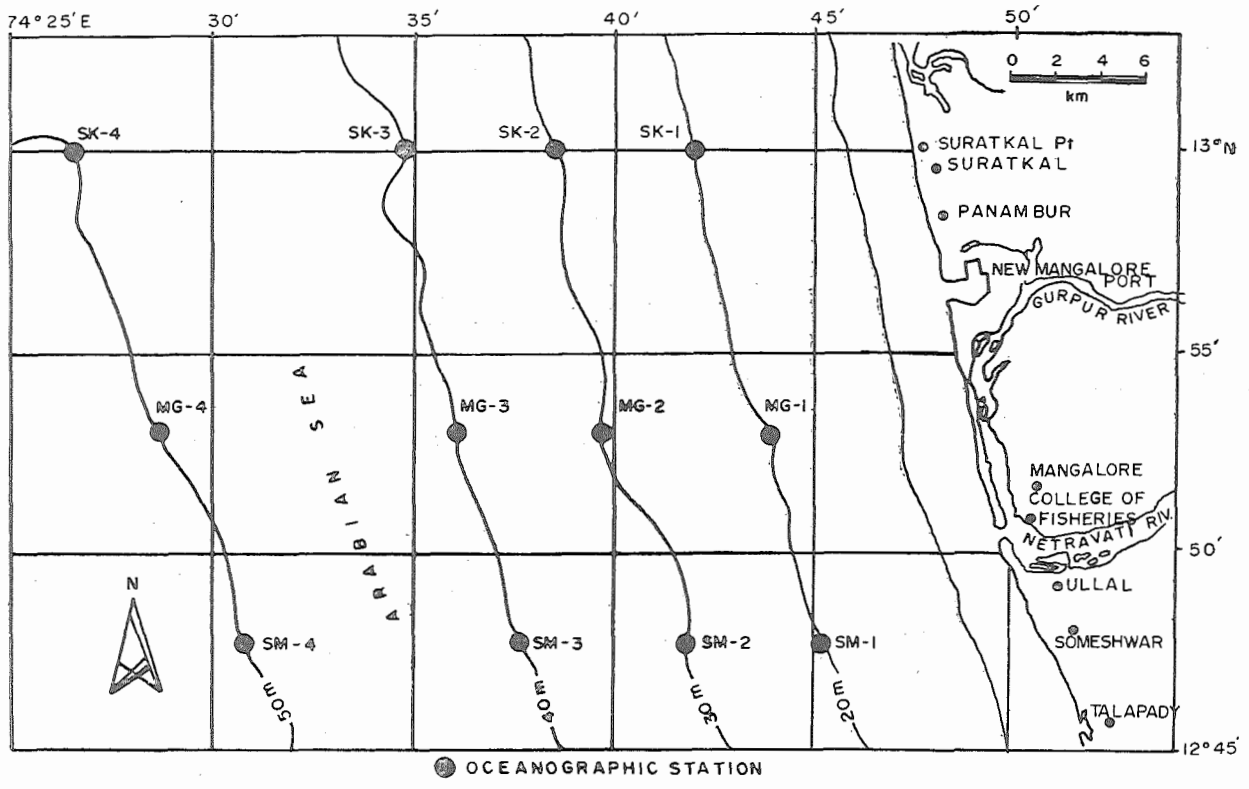

Fig. 1. Area of investigation and location of oceanographic stations

Materials and Methods

The region investigated covers a water-spread area of about 850 km² of the Arabian Sea along the coast of Mangalore, between Suratkal in the north and Someshwar in the south, extending up to 50 m isobath. This area lies between Long. 74° 25′E and 74° 51′E and Lat. 13°N and 12° 45′N (Fig. 1). Within this area, 12 sampling stations were fixed at four depth zones (20, 30, 40 and 50 m) along three sections.

The cruises were made with the help of a stern trawler, MFV *Dolphin* of the College of Fisheries, Mangalore. The specifications of the vessel are as follows: LOA 13.26 m, LWL 11.79 m, beam 3.76 m, mean draught 1.17 m and displacement 18.5 tonnes, fitted with Ruston 6 YDAM MK II engine capable of developing 102 bhp at 1800 rpm.

Throughout the period of investigation, bottom trawling was carried out employing a four-seam trawl of standard commercial design at all the stations. The trawl gear had a headline length of 39.2 m, stretched length of the net being 40.5 m and mesh size at cod-end being 30 mm. The average sweep of the trawl was empirically estimated to be 12.4 m based on the relationships suggested by Kostyunin (1971) and Fridman (1973). The vertical opening of the trawl mouth was approximately 2.5 m. The constructional details and dimensions of the trawl and otter board are given in Fig. 2.

Fortnightly samplings over eight months from March 1976 to March 1977, embracing the postmonsoon and the premonsoon periods, were made at the different stations. During monsoon, sampling was found to be impossible owing to rough weather and limited facilities at disposal. Usually trawling was done between 7 a.m. and 3 p.m. Each time the trawl was dragged for a period of 60 min. at 1.8 knots, covering an average distance of about 3.3 km and an area of approximately 0.041 km² of the continental shelf. The net was invariably dragged parallel to the coast at a constant depth. The direction of trawling was reversed every fortnight to nullify the effect of any error that might have crept in due to the differences in the time of sampling. The catches were analysed on board the vessel for species composition, species-wise weight and total weight.

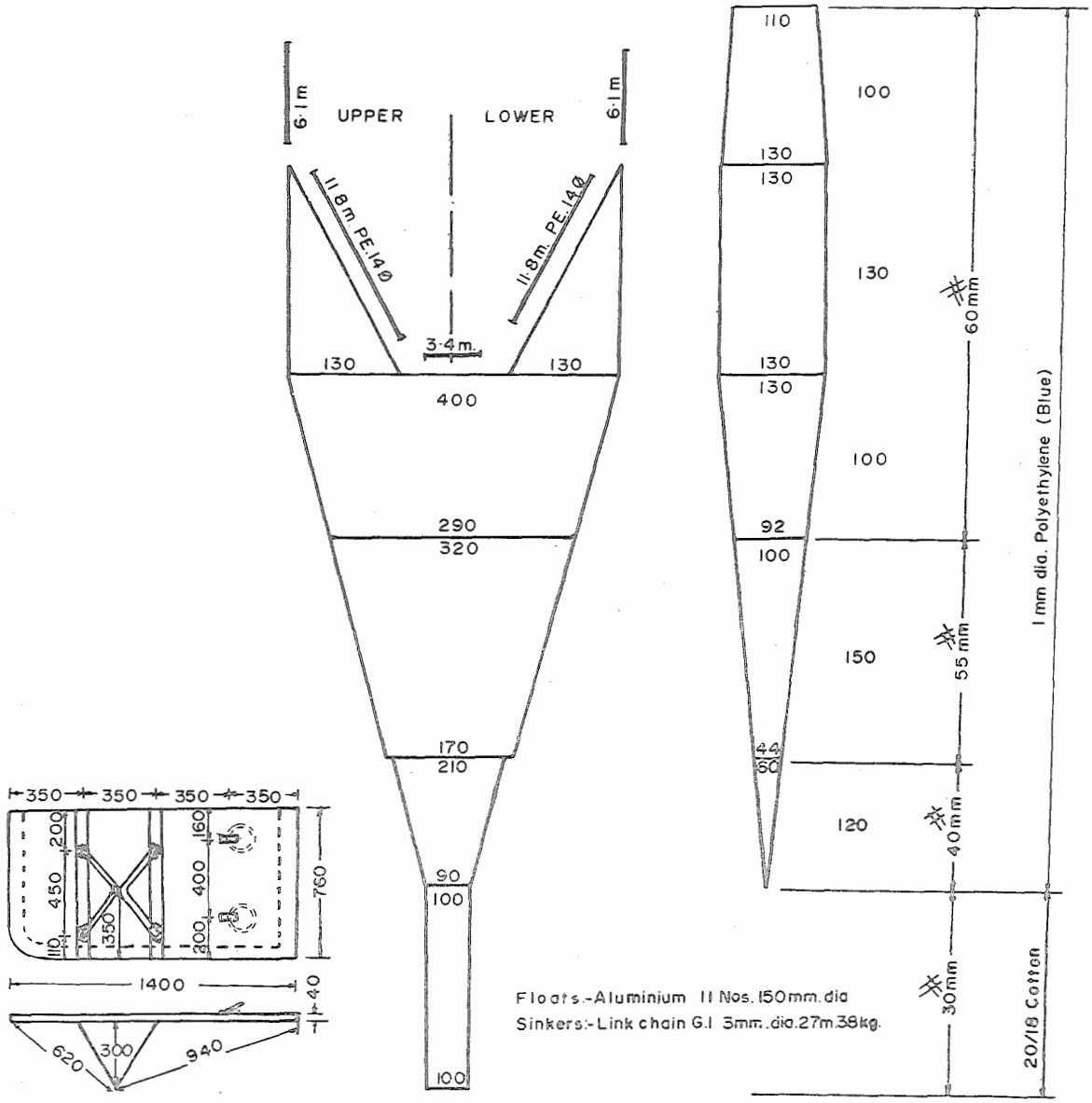

Fig. 2. Four seam trawl and otter board used in the study

The technique described by Alverson (1967) was employed to determine the standing stock. The method is founded on the basic assumption that catch per unit of effort is a function of the average stock density in the area being surveyed (Ricker, 1940; Gulland, 1964) and that the changes in the catch per unit of effort are directly proportional to changes in density. The formula adopted for the variance of effort is identical to that used by Cochran (1963).

Results and Discussion

The three species of demersal fishes, whose standing stocks have been estimated, together formed around 48% of the total catch. *Nemipterus japonicus* constituted 28.6% while *Saurida tumbil* and *Grammoplites scaber* constituted 10.9% and 8.7% respectively. The total weight of each of these species, the catch per hour and the details of estimation of the standing stock are presented in Table 1.

It is clear from Table 1 that populations of *N. japonicus* were more dense than those of the other two.

The estimated standing stock of this species was 3 x 10^5kg. The 90 per cent confidence limits were 2.3 x 10^5 and

Table 1. *Estimated standing stocks of the three most abundant demersal fish in the inshore waters off Mangalore, based on exploratory fishing survey data*

Stock assessment particulars	*N. japonicus*	*S. tumbil*	*G. scaber*
No. of hauls (n)	96	96	96
Hours fished (f)	96	96	96
Total catch (C), kg	1371.3	524.5	415.7
Average catch per hour (cpue), kg	14.3	5.5	4.3
Estimated standing stock (SS), kg	3×10^5	11×10^4	9×10^4
Variance of C ($\hat{V}$ (C))	416	56.71	25.21
Variance of f ($\hat{V}$ (f))	0	0	0
Covariance of C, f (Cov (C,f))	0	0	0
Variance of cpue ($\hat{V}$ (cpue))	4.30	0.59	0.26
Standard deviation of SS ($\sqrt{\hat{V}}$ (SS)), kg	4.3×10^4	1.5×10^4	1×10^4
90% confidence interval of ss ($SS \pm 1.6 \sqrt{\hat{V}}$ (SS)), kg	2.3×10^5 to 3.7×10^5	8.5×10^4 to 13.5×10^4	7.4×10^4 to 10.6×10^4

3.7×10^5 kg. This species was followed by *S. tumbil,* whose standing stock was estimated at 11×10^4 kg, with 90% confidence limits at 8.5×10^4 and 13.5×10^4 kg. *G. scaber,* the least in abundance among the three, had a standing stock of 9×10^4kg. The limits were 7.4×10^4 and 10.6×10^4 kg, at 90% confidence. These estimations are for an area of 850 km² of the sea bed off Mangalore.

There is no published evidence which suggests that species exploited by the Mangalore trawl fishery are being overfished in the biological sense. In fact, the effects of fishing on most species are unknown, as data to evaluate man's impact on stocks are laking for most species. The exploitation of any stock is largely determined by economic considerations. Whether or not be stock levels are above or below those of maximum sustainable yield is not known because of insufficient knowledge of fishery biological parameters.

The present findings indicate that a considerable amount of these three demersal species are available in the inner shelf off Mangalore. Considering the area sampled and the results obtained, it appears that a profitable fishery of these three fishes exists in this region. If it is to be assumed that comparable conditions are existing along the inner shelf region of the west coast of India, these ground-fishes will be a potential source of exploitation.

It is well known that estimation of standing fish populations are subject to considerable limitations. The results could be vitiated, since the organisms involved are quick moving and to a great extent migratory. Probably, estimates which would be near to reality will be those of sedentary benthic populations. Since the sea is an ecosystem of heterogeneity and variability, even the application of the most exact mathematical models might yield only rough estimates. The harvesting of one kind of organism might affect the subsequent replacement rate not only on the direct feedback mechanism built into the species itself, but also through the complex inter-relationships in the real trophic sense (Schaefer, 1954).

Further, the vertical distribution pattern of the fishes caught is another important aspect. The vertical opening of the bottom

trawl is confined to a restricted height just above the sea bed. If the species studied are capable of certain amount of vertical movement which might be time-or food–dependent, the amount taken from any particular region at a defined time might vary. The actual density gradient for demersal fishes above the bottom is unknown. Besides, undoubtedly, a considerable segment of the demersal fish population in the path of a trawl net is capable of avoiding or escaping it. The extent of effect of trawl sweeps or bridles on concentrating fish in the path of the net is unknown. These factors seldom find a place in a mathematical model. Probably, intensive sampling can help in reducing the degree of variability in assessment. Notwithstanding all these limitations, attempts are being made the world over to estimate the magnitude of standing stocks for proper management, conservation and prediction of the concerned fishery.

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