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Fishery, biology and population dynamics of *Nemipterus japonicus* (Bloch) off Visakhapatnam

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ABSTRACT

Threadfin breams formed 9% of the total small trawler catches of Visakhapatnam, *Nemipterus mesoprion* and *N. japonicus* being the dominant species. The estimated growth parameters for *N. japonicus* are L_∞ = 340 mm and K = 0.52 year^{-1}. Size at first maturity is estimated as 128 mm. The species spawns during July to April with a peak in September. The mortality rate Z, F and M were 3.52, 2.41 and 1.11 respectively.

Introduction

Threadfin breams are one of the important demersal resources caught throughout the year in small trawlers and sona boats off Visakhapatnam coast. Some information is available on the fishery, biology and population dynamics of *Nemipterus japonicus* from Visakhapatnam (Krishnamoorti, 1971, 1973, 1976, 1978; Dan, 1980 and Murty *et al*., 1992). Detailed information is available on fishery and population dynamics of threadfin breams from Kakinada (Murty, 1983, 1984, and 1987), Madras (Vivekanandan, 1990 and Vivekanandan and James, 1986) and Cochin (Vinci and Nair, 1975 and Vinci, 1983). The present paper deals with the changes in trend of fishery and some aspects of population dynamics off Visakhapatnam.

Materials and methods

Data on catch, effort, length, weight and species composition collected from commercial trawlers twice a week during the period 1990-1999 were analysed in the present study. Size at first maturity (L_{50}) was determined by plotting the percentage of mature specimens (stage III and above) against the length. Proportion of gravid and ripe females (V &VI) over time was taken to determine the spawning season.

The von Bertalanfy growth parameters were estimated using FiSAT (Gayanilo Jr. *et al*., 1995) after raising the sample size to day's catch and monthly catch (in numbers). The data for the period 1997-2000 was pooled and analysed for the estimation of growth parameters. The total mortality rate (Z) was estimated from the length converted catch curve method (Pauly 1983a) and natural mortality (M) from Pauly's empirical formula (Pauly 1983 b). Yield/recruit was estimated using Beverton and Holt (1957) yield equation.

Results

Fishery

The small trawlers (9.6-11.2 m OAL) fitted with 63-93 H.P engine, operate four seam shrimp trawls with a cod end mesh size of 15-20 mm in a depth range of 10-70 m undertaking voyage for 3-5 days. During the period 1990-'99, small trawlers landed an estimated average annual catch of 328 t, which formed 9 percent of the total landings. The annual threadfin bream landings showed wide fluctuations ranging from a maximum of 743 t in 1992 and a minimum of 39 t in 1999. The catch per hour also followed a similar trend (Fig.1). A comparative study of the early nineties (1990-'92) and later nineties (1997-'99) revealed that threadfin bream fishery declined considerably in later period as indicated by the decreased landings, lower Cph and lesser proportion. The Cph of threadfin breams ranged from 0.57 kg in August to 4.93 kg in April with better catch rate during February –May (2.84-3.46kg). Threadfin breams occur abundantly in February-May (Fig. 2).

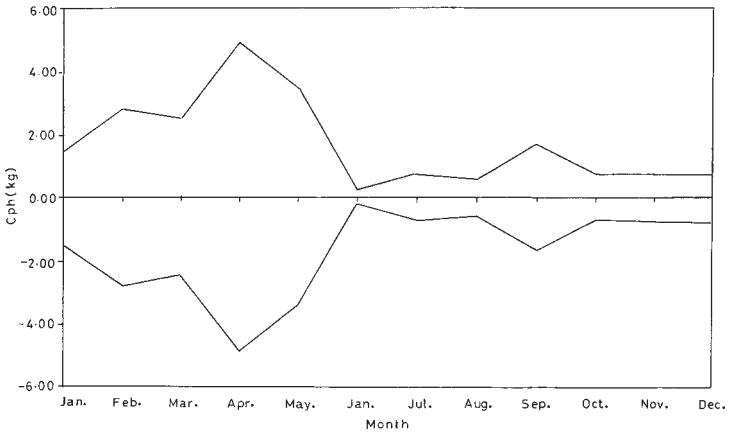

Fig. 2. Seasonal abundance of threadfin breams off Visakhapatnam.

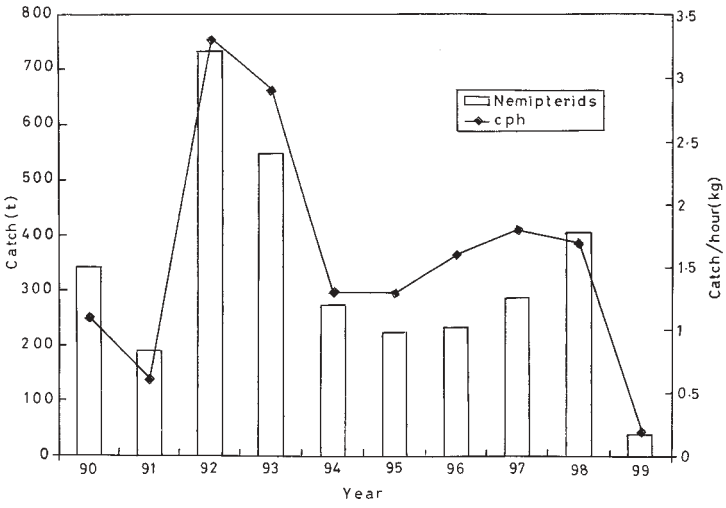

Fig. 1. Annual small trawler landings of threadfin breams off Visakhapatnam during 1990-1999.

Species composition

Five species of threadfin breams, *Nemipterus japonicus*, *N. mesoprion*, *N. tolu*, *N. luteus* and *N. delagoae* were caught of which, the former two species dominated the fishery (Fig.3). *N. mesoprion* catch was more compared to *N. japonicus* but the occurrence was seasonal. The percentage composition of *N. mesoprion* gradually declined from 90% in 1992-93 to 31% in 1999.

Size at first maturity

674 female specimens in the length range of 85-285 mm were considered for

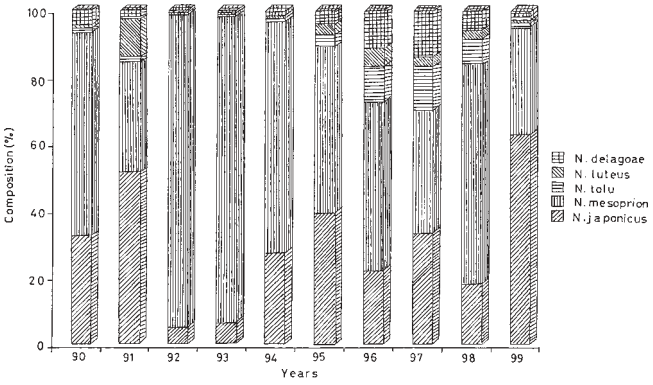

Fig. 3. Species composition of threadfin breams.

the study. The length at first maturity (L_{50}) was 128 mm (Fig.4).

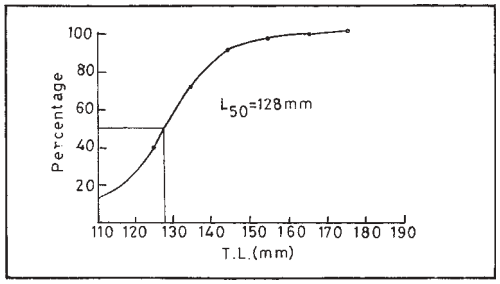

Fig. 4. Size at first maturity of *N. japonicus*

Spawning

A total of 674 females of *N. japonicus* were used for determining the spawning season. Except for May, samples were available throughout the year. The distribution of spawning population over time showed that the spawning period extends from July to April with a peak in September (Fig.5).

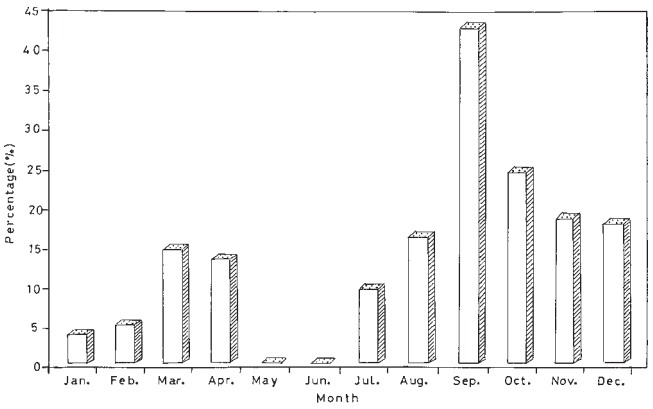

Fig. 5. Percentage composition of spawning population of *N. japonicus*.

Age and Growth

A total of 2715 fishes of 90-285 mm were used for estimation of growth parameters. The estimates of $L\infty$ and K are 340 mm and 0.52 $year^{-1}$. Length after completion of the first and second year was 125 and 210 mm respectively (Fig.6).

Mortality

Total mortality rates estimated separately for each year from length converted catch curve (Fig.7) are presented below. The average values of Z, M and F are 3.52, 1.11 and 2.41 respectively.

Year	Z	M	F
1997	3.71	1.11	2.60
1998	3.75	1.11	2.64
1999	3.41	1.11	2.30
2000	3.22	1.11	2.10
Average	3.52	1.11	2.41

Exploitation

Exploitation rate (E) of *N. Japonicus* was 0.69, indicating heavy exploitation.

Yield/recruit

The relative yield/recruitment and biomass/recruit were determined as a function of $Lc/L\infty$ and M/K. The present exploitation is beyond the optimum level. The yield/recruit curve shows that the maximum sustainable yield can be obtained at exploitation rate of 0.5170 (Fig.8). In the present study

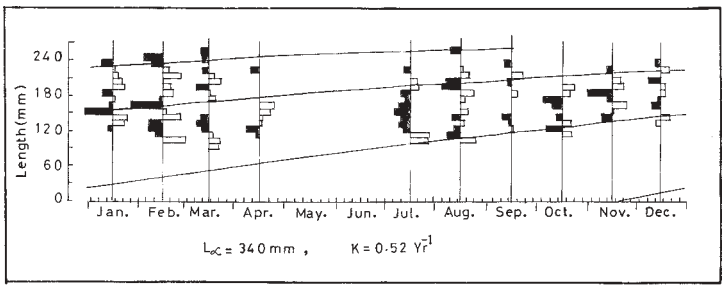

Fig. 6. Restructured growth curve of *N. japonicus* for 1997-2000

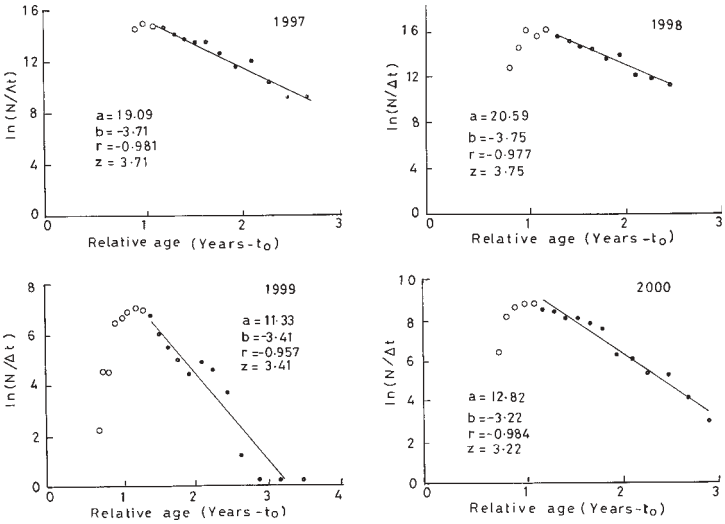

Fig. 7. Length converted catch curve of *N. japonicus.*

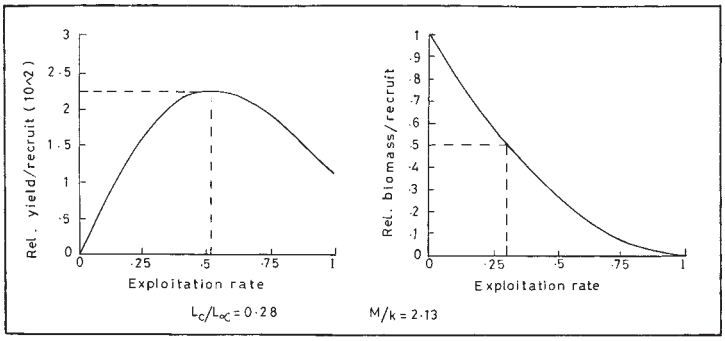

Fig. 8. Yield/recruit and biomass/recruit of *N. japonicus.*

the exploitation rate was 0.69, and the yield per recruit was (1.9) 190g. At this exploitation rate the added biomass/recruit was very less (0.1). Hence for obtaining optimum yield and biomass per recruit the exploitation rate should be brought down to 0.5.

Discussion

Fish stocks are subjected to many changes over a period of time due to changes in fishing patterns and environmental conditions. The total annual catches of threadfin breams decreased gradually over the period. Though five species contributed to the fishery, *N. mesoprion* and *N. japonicus* formed more than 90% of the fishery. Krishnamoorti (1973), Rao (1989) and Murty (1984) also reported the dominance of these along the Andhra coast. An interesting observation was that whenever the percentage of one species increased the other decreased in almost the same magnitude and vice-versa. Though the effort was more during July-September, catch and catch/hour of threadfin breams was high during February-May. Rao (1989) reported similar findings for the year 1980, but fluctuating seasonal patterns for 1981 and 1982. Murty (1984) reported almost similar results (January-April) off Kakinada coast.

In the present study size at first maturity was 128 mm. Murty (1984) reported the size at first maturity of fe-

males as 125 mm, which was almost similar to the present. Vivekanandan and James (1986) reported higher length (145 mm) at first maturity off Madras. Krishnamoorti (1971) had observed 165 mm (V and above) length at first maturity off Visakhapatnam. A prolonged spawning period extending from July to April with a peak in September was observed. The extended spawning activity was reported by Murty (1984); Vivekanandan and James (1986) but with different peak periods, while the former observed peak spawning in September and February and the latter from December-March off Kakinada and Madras respectively.

The population parameters, $L\infty$, K, Z, M and F for *N. japonicus* published by different authors are 339 mm, 0.40, 2.12, 0.94 and 1.18 (Murty *et al.*, 1992) from Visakhapatnam; 339, 0.52, 2.64, 1.11 and 1.53 (Murty, 1987) and 351, 0.49, 2.16, 1.06 and 1.1 (Murty *et al.*, 1992) from Kakinada and 305, 1.004, 2.9853, 2.5254 and 0.4599 (Vivekanandan and James, 1986) from Madras. Earlier works showed that the asymptotic length ($L\infty$) and growth constant (K) of *N. japonicus* ranged from 305-351 mm and 0.40-1.004 year respectively along the east coast of India. The present estimates are within the above range. However the total mortality rate was higher, which was due to the increase in fishing effort. The exploitation rate 'E' was higher than the optimum value of 0.5, which can be brought down to optimum level by reducing the effort.

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