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 $L\infty$ = 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

dicated 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).
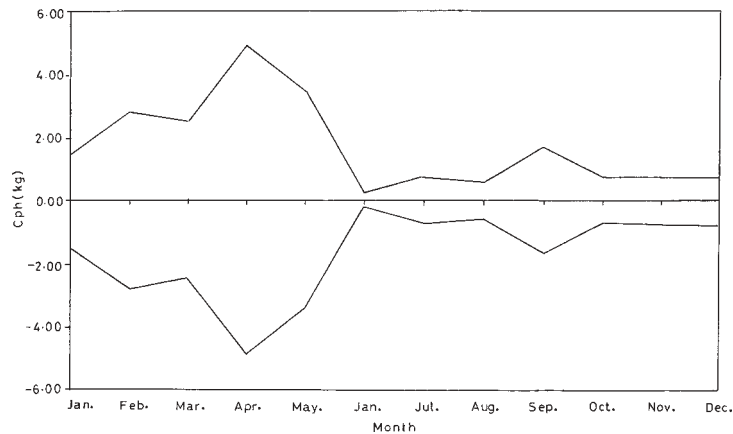

Fig. 2. Seasonal abundance of threadfin breams off Visakhapatnam.

Species composition

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

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.
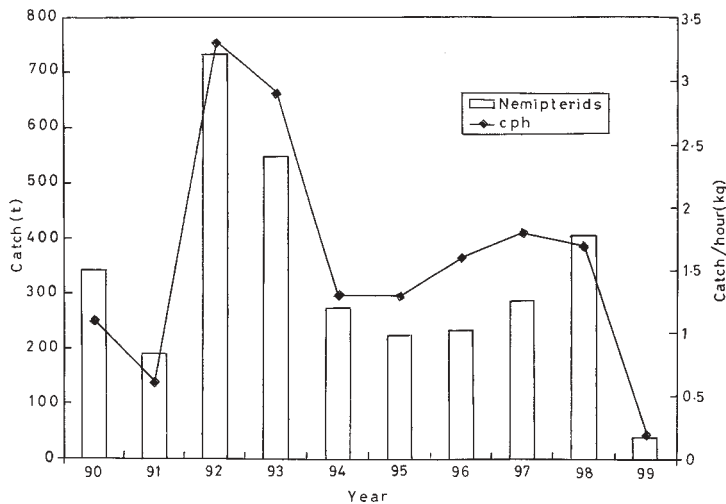
comparative study of the early nineties (1990-'92) and later nineties (1997-'99) revealed that threadfin bream fishery declined considerably in later period as in-

Size at first maturity

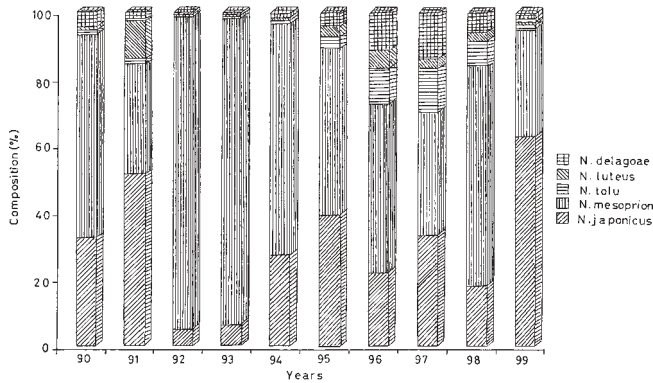674 female specimens in the length range of 85-285 mm were considered for

Fig. 3. Species composition of threadfin breams.

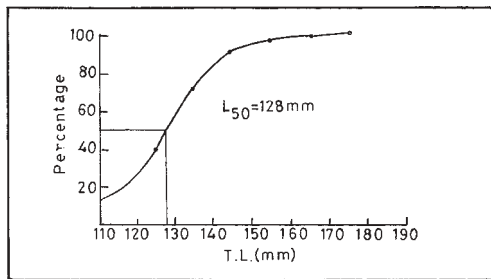the study. The length at first maturity (L$_{50}$) was 128 mm (Fig.4).

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 dis-
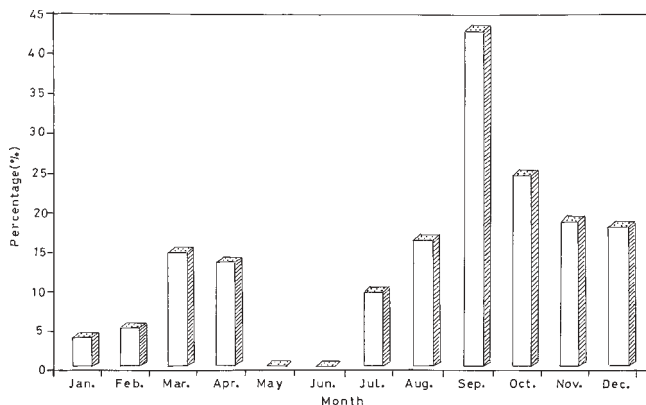

Fig. 5. Percentage composition of spawning population of *N. japonicus.*

tribution of spawning population over time showed that the spawning period extends from July to April with a peak in September (Fig.5).

Age and Growth

A total of 2715 fishes of 90-285 mm were used for estimation of growth parameters. The estimates of L∞ 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∞ 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
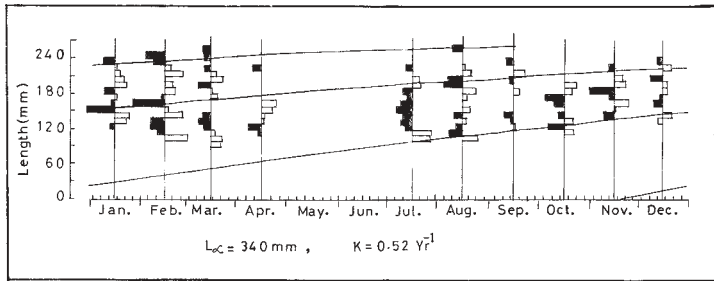
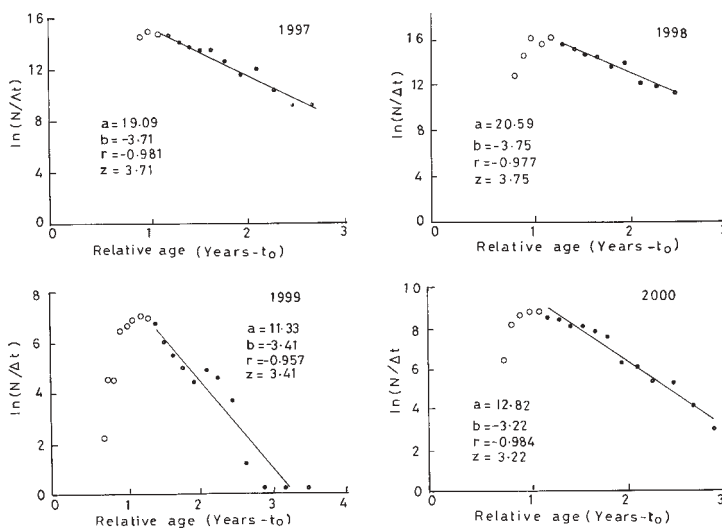Fig. 6. Restructured growth curve of *N. japonicus* for 1997-2000
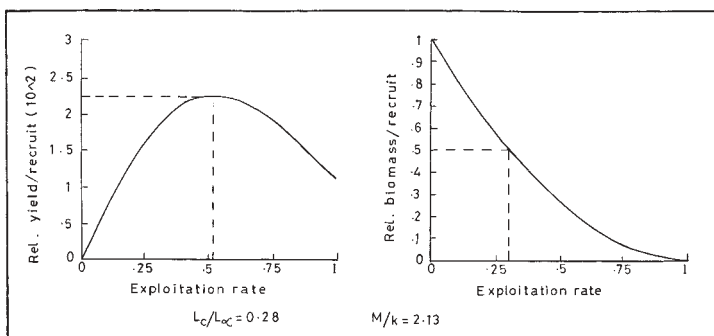

Fig. 7. Length converted catch curve of *N. japonicus.*

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

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-

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

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_∞, 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_∞) 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.

Acknowledgements

References

Beverton R. J. H. and S. J. Holt 1957. On the dynamics of exploitated fish populations. *Fish.Invest. Ser. London,* 2, **19**: 553 pp.

Dan, S. S. 1980. Intra-ovarian studies and fecundity in *Nemipterus japonicus* (Bloch). *Indian J. Fish.,* **24**:48-55.

Gayanilo, F. C. Jr., P. Sparre and D. Pauly 1995. *FAO-ICLARM Stock Assessment Tools (FiSAT), User's Manual. FAO Comp. Info. Ser. (Fisheries),* **8**: 126 pp

Krishnamurthi, B. 1971; An assessment of *Nemipterus* fishery of Andhra – Orissa coast based on exploitory fishing. *Proc. Symp. Living resources of the seas around India, CMFRI: Spl. Pub.,* p. 496-516.

Krishnamurthi, B. 1973. Biology of threadfin bream, *Nemipterus japonicus* (Bloch). *Indian J. Fish.,* **18**: 1-21

Krishnamurthi, B. 1976. A note on size difference between male and females of *Nemipterus japonicus* (Bloch). *Indian J. Fish.,* **21**: 608-609.

Krishnamurthi, B. 1978. A note on the mortality rate and yield per recruit in *Nemipterus japonicus* (Bloch). *Indian J. Fish.,* **23**: 252-256.

Murty, V. S. 1982. Observation on some aspects of biology of the threadfin bream *Nemipterus mesoprion* (Bleeker) from Kakinada, along the east coast of India. *Indian J. Fish.,* **28**: 199-207.

Murty, V. S. 1983. Estimates of mortality, population size and yield per recruit of *Nemipterus japonicus* (Bloch) in the trawling grounds off Kakinada. *Indian J. Fish.,* **30**: 255-260.

Murty, V. S. 1984. Observations on the fisheries of threadfin breams (Nemipteridae) and on the biology of *Nemipterus japonicus* (Bloch) from Kakinada. *Indian*

J. Fish., **31**: 1-18.

Murty, V. S. 1987. Further studies on the growth and yield per recruit of *Nemipterus japonicus* (Bloch) from the trawling grounds off Kakinada. *Indian J. Fish.,* **34**(3): 265-276.

Murty, V. S., T. Appa Rao, M. Srinath, E. Vivekanandan, K. V. Somasekharan Nair, S. K. Chakraborty, S. G. Raje and P. U. Zacheriah 1992. Stock assessment of threadfin breams (*Nemipterus* spp.) of India. *Indian J. Fish.*, **39** (1& 2): 9-41.

Pauly D. 1983a. Length converted catch curves. A powerful tool for fisheries research in tropics (Part -I). *ICLARM Fishbyte*, **1** (2): 9-13.

Pauly D. 1983 b. Some simple methods for the assessment of tropical fish stocks. *FAO Fisheries Technical Paper,* No. 243, 52pp.

Appa Rao T. 1989. Fishery of threadfin breams at Waltair with notes on some aspects of biology of *Nemipterus mesoprion* (Bloch). *J. Mar. Biol. Ass. India,* **31** (1&2): 103-109.

Vinci, G. K. 1983. Threadfin breams (*Nemipterus*) resources along the Kerala coast with notes on biology of *Nemipterus japonicus*. *Indian J. Fish.,* **29**: 37-49 (1985)

Vinci, G. K. and A. K. K. Nair 1975. Length-weight relationship in the threadfin breams, *N. japonicus* along the Kerala coast. *Indian J. Fish.,* **21**: 299-302.

Vivekanandan. E and D. B. James 1986. Population dynamics of *Nemipterus japonicus* (Bloch) in the trawling grounds off Madras. *Indian J. Fish.,* **33**:145-54.

Vivekanandan E. 1990. Distribution patterns of threadfin breams along Tamil Nadu and south Andhra coasts. *Indian J. Fish.,* **37**: 269-280.