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Fishery and biology of threadfin bream, *Nemipterus mesoprion* from Mangalore-Malpe

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ABSTRACT

The landings of threadfin breams recorded 8 fold increase during 1989 – 1998 period while the catch rate showed three-fold increase. Maximum catch and catch rate was observed in September-October. *N. mesoprion* has taken over the place of *N. japonicus* by forming 64% of the fishery. The mean size increased from 127 to 164 mm. Significant differences were found in the length-weight relationship between sexes. Males outnumbered females in all the months and the overall sex ratio was M-1: F-0.70, which significantly departs from the expected 1:1 ratio. The minimum size at first maturity of males was 145 mm and female, 125 mm. Spawning was prolonged with peak during August-November. The peak spawning indicated by GSI, is in general agreement with the percentage occurrence of maturity stages in different months. The fecundity ranged from 7,444 to 49,689 eggs. The stomach content analysis revealed that the species feed mainly on crustaceans.

Introduction

Threadfin breams form an important fishery resource along Mangalore-Malpe coast. The average annual catch during 1989-1998 was 4,642 t forming 4.9% of the total fish catch. Ninety percent of threadfin bream catch from Karnataka is landed by trawlers from Mangalore-Malpe. They are landed exclusively by multi-day fleet of trawlers (MDF), which operate beyond 30 m depths, forming over 15% of the landings. The catch trend showed a tremendous increase from 2014 t in 1989 to 11,873 t in 1998. *Nemipterus japonicus* was the dominant species till 1996 and its place was slowly taken over by *N. mesoprion* constituting 64% of threadfin bream fishery. Though adequate information is available on the biology of *N. japonicus*, studies on *N. mesoprion* are limited to the works of Murty (1982), Rao (1989), and Vivekanandan (1991). The present article deals with the biological information collected on the species from the Karnataka waters during 1997-1998.

Materials and methods

The catch and effort data from MDF trawlers operating off Mangalore-Malpe from 1989 to1998 were used for the present study. Species composition and length composition data of *N. mesoprion* were collected from Mangalore and

Malpe fishery harbours twice a week. On each observation day, length (from tip of snout to tip of lower caudal lobe, in nearest mm) and weight measurements (nearest g) of at least 50 specimens were recorded. The length data were grouped into 1-cm class intervals. The length frequencies were suitably weighed to get monthly estimates. Length–weight data of 288 males ranging in length from 87 to 255 mm and 289 females of 82 to 230 mm were used for the study. The relationship was calculated separately for both sexes using the method of least squares.

For determining the length at first maturity, 768 males in the size range of 80- 295 mm and 611 females of 80-285 mm were considered. In males, maturity stages were classified into four stages (immature, maturing, mature and spent), whereas, in females seven stages were identified as per the ICES classification. Males in stage II and above and females in stage III and above were considered mature. The size at first maturity was estimated by finding out size at which 50% of fishes attain maturity. Gonadosomatic index (GSI) was calculated using the formula GSI = weight of gonad/ weight of fish X 100. For finding out the sex ratio, gonads of 606 fishes were examined during different months in 1998. Chi-square test was performed to test the homogeneity of male and female distribution. Fecundity was estimated by counting the mature eggs in stage VI ovaries collected from 20 fishes and preserved in 5% formaldehyde. For food and feeding studies, stomach of 284 individuals of *N. mesoprion* were analysed during 1998 by occurrence method. The number of fish in which each food item occurs is given as percentage of the total number of fish examined (Laevastu, 1965). For finding out the feeding condition, 2098 stomachs were examined. The contents were analysed based on quantity by eye estimation and the percentage occurrence of various food items was estimated based on occurrence of each food item.

Results and discussion

Fishery

Catch and effort

Threadfin bream catch from Mangalore-Malpe landing centres alone

TABLE 1: *Catch of threadfin breams at Mangalore-Malpe during 1989-1998*

Year	MDF effort (actual fishing hours)	Total catch by MDF (t)	Threadfin bream catch (t)	% of threadfin bream in MDF catch	Total Karnataka thread fin bream catch (t)
1989	19538	515812	2014	10.31	3030
1990	15572	482735	1154	7.41	1502
1991	20104	631094	2310	11.49	2400
1992	17681	654050	1702	9.63	2251
1993	19374	793115	2194	11.32	3142
1994	32568	1106422	3185	9.78	5369
1995	41461	1508778	4469	10.78	5684
1996	43594	1550222	7656	17.56	8966
1997	53948	1654706	9863	18.26	11389
1998	45812	1380850	11873	25.92	13359
Average	30965	1027778	4642	13.25	5709

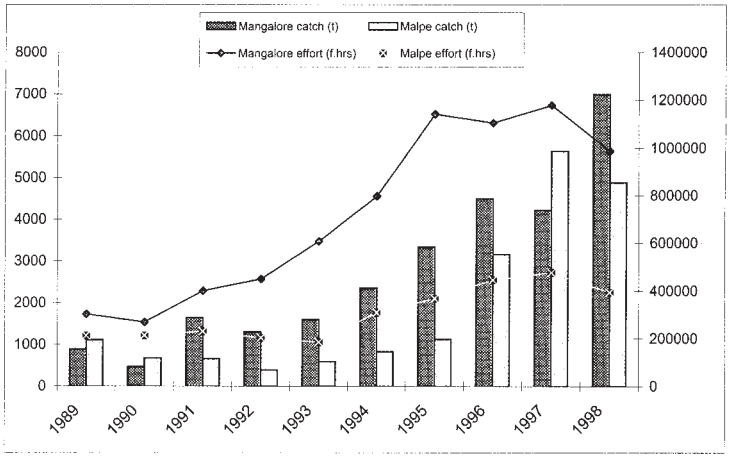

Fig. 1. Catch, and catch rate of threadfin breams in MDF at Mangalore and Malpe landing centres.

constituted 90% of Karnataka landings (Table 1). The threadfin bream landings at Mangalore and Malpe Fisheries Harbours during 1989-'98 are shown in Fig.1. It is seen that there is an increasing trend except in 1990 and 1992. Maximum catch was seen in 1998 (11,873 t) and minimum in 1990 (1,154 t). Threadfin breams which constituted only 10% of the catch in 1989, increased to 26% in 1998 indicating its increasing importance in MDF landings. The contribution of threadfin breams to average annual MDF catch was 15%. The fishing effort also show an almost similar trend except in 1998 where there was a sudden fall in spite of which the catch had increased (Table 1).

The catch and effort data from Mangalore and Malpe landing centres were separately analysed (Fig. 1). The landings at Mangalore showed an increasing trend except in 1990 and 1997. Maximum catch was recorded in 1998 (6,987 t) and minimum in 1990 (474 t). At Malpe the catch showed a downward trend from 1989 to 1992, thereafter it increased to 5,639 t in 1997 but again fell to 4,885 t. The catch rate at Mangalore fluctuated between the lowest of 1.76 kg/hr in 1993 and highest of 7.08 kg/hr in 1998, and showed a three-fold increase during the study period. At Malpe, the catch rate has fallen from 5.25 to 1.93 kg/hr in 1992 and thereafter showed an increasing trend to reach at 12.39 kg/hr in 1998. A comparison of the effort, catch and catch rate reveals that even though more catch was landed at Mangalore, better catch rate was observed at Malpe. This could be due to operation of Malpe based trawlers in the northern areas of Karnataka coast (between Coondapoor and Ankola) where good concentration of threadfin bream is reported by Indo-Danish Fisheries Project (Anon 1995).

Studies on the seasonal abundance (Fig.2) of nemipterids reveal the occurrence of two peaks in the annual land-

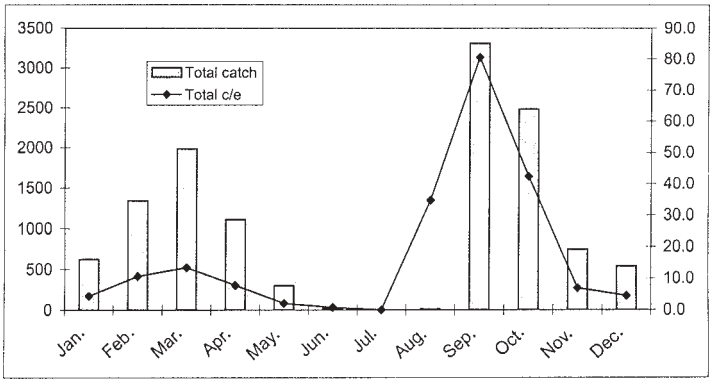

Fig. 2. Seasonal abundance of threadfin bream at Mangalore-Malpe pooled for the years 1989-1998.

ings. The primary peak in catch and catch rate (kg/hr) was observed in September-October and the secondary peak during March.

Over the years since their introduction, the MDF trawlers have extended their fishing activities from 70 m to the present depth of 130 m. Though the extension of fishing ground was initially aimed to tap the prawn resources, this has also resulted in landing of appreciable quantities of threadfin breams, rock cods and cuttlefishes especially during September-November. The exploratory surveys conducted by IDFP, FSI and CMFRI along this coast have indicated rich abundance of threadfin breams dominated by *N. mesoprion* in depths beyond 100 m. An earlier study (Zacharia '1998) has found *N. japonicus* as the dominant species forming 77% of the catch during 1988-'95. *N. mesoprion* which formed less than 10% in early '90s when trawling was confined to shallower depths has become the dominant species by late '90s (Fig.3).

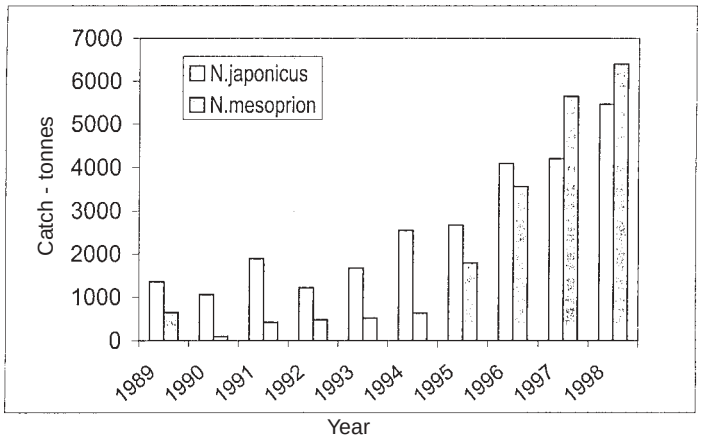

Fig. 3. Species composition of threadfin breams during 1989-1998

Biology

Length composition & mean size

The length frequency data for 1989-1998 indicated that there was more exploitation of smaller fishes (size range 50-222 mm) during 1989-1993 period compared to 1994-1999. The analysis of mean size (Table 2) also revealed a similar trend as the size increased from 127 mm in the initial period to 164 mm. The change in the size range and mean size could be correlated with the increase in the depth of operation of MDF from 50-60 m in the initial period to 100-130m.

Length-weight relationship

The relationship was estimated separately for males and females and are given as

Males: Log W = -4.64163+2.89452 Log L (R=0.992)

Females: Log W = -4.7832+2.96284 Log L (R=0.988)

The significance of variations between the regression lines was tested by the analysis of co-variance (Snedecor & Cochran, 1967). The slope did not show significant difference at 5% level but elevation showed significant differences at one percent level. (Table 3). However, Murty (1982) has calculated the length-weight relationship of *N. mesoprion* from Kakinada and found that there is no significant difference in the length-weight relationship between males and females. The t test showed that the regression coefficient in male (value of t = 3.072; df = 293) was significantly different from 3, whereas in females (t =1.056; df = 270) no significant difference was noticed.

TABLE 2: *Length range and mean size of* N. mesoprion *exploited from Mangalore-Malpe during 1989-1998*

Year	Length range (mm)		Mean size (mm)
	Minimum	Maximum	
1989	50	200	127.5
1990	50	250	131.5
1991	50	225	125.6
1992	60	230	133.0
1993	60	222	118.3
1994	80	230	164.9
1995	50	230	140.3
1996	100	270	147.2
1997	100	260	175.3
1998	100	250	164.4

TABLE 3: *Comparison of regression lines of male and female* N. mesoprion

	df	Regression coefficient	Deviation from regression		
			df	SS	MSS
Males	292	2.895	291	1.796	0.00617
Females	269	2.963	268	1.754	0.00655
Total			559	3.550	0.00635
Pooled	561		560	3.574	0.00638
Difference			1	0.024	0.02374
Total	562		561	3.665	0.00653
Between adjusted means			1	0.091	0.09135

Comparison of slope: (df 1, 560) F=3.74 (Not Significant at 5% level)
Comparison of elevation: (df 1, 561) F= 14.31 (Significant at 1% level)

TABLE 4: *Monthly sex ratio of* N. mesoprion *during 1998*

Month	No of fish examined	Males	Females	Sex ratio M:F	Chi square value
January	88	32	56	1:1.75	6.55
February	83	49	34	1:0.69	2.71
March	49	36	13	1:0.36	10.80 **
April	71	49	22	1:0.44	10.27 **
May	132	77	55	1:0.71	3.67
June	0	0	0	-	-
July	0	0	0	-	-
August	12	4	8	1:2.00	1.33
September	183	101	82	1:0.81	1.97
October	101	57	44	1:0.77	1.67
November	255	163	92	1:0.56	19.77 **
December	69	38	21	1:0.82	0.71

** < 0.01

TABLE 5: *Length-wise sex ratio of* N. mesoprion *during 1998*

Length group (mm)	Total	Males	Females	Sex ratio M:F	Chi-square value
80-89	1	1		1:0.00	1.00
90-99	1	0	1	0:1.00	1.00
100-109	3	1	2	1:2.00	0.33
110-119	3	2	1	2:1.00	0.33
120-129	2	1	1	1:1.00	0.00
130-139	9	6	3	1:0.50	1.00
140-149	30	16	14	1:0.88	0.13
150-159	65	34	31	1:0.91	0.14
160-169	156	84	72	1:0.86	0.92
170-179	189	98	91	1:0.93	0.26
180-189	175	87	88	1:1.01	0.01
190-199	164	112	52	1:0.46	21.95**
200-209	106	73	33	1:0.45	15.09**
210-219	66	40	26	1:0.65	2.97
220-229	30	21	9	1:0.43	4.80
230-239	18	15	3	1:0.20	8.00**
240-249	13	13		1:0.00	13.00**
250-259	2	2		1:0.00	2.00

** < 0.01

Sex ratio

The month-wise sex ratio for the year 1998 is shown in Table 4. Males outnumbered females in all the months except January and August and the overall sex ratio was 1:0.70. The chi square test showed that at P=0.01 level, the distribution of sexes in the catches was significantly different from the binomial distribution. The sex ratio in different length groups (Table 5) shows that above 230 mm females were not present. Differential growth rates of sexes are well known in threadfin breams (Eggleston, 1973; Fischer and Whitehead, 1974) and this may be the reason why females are not represented above 230 mm in the present study.

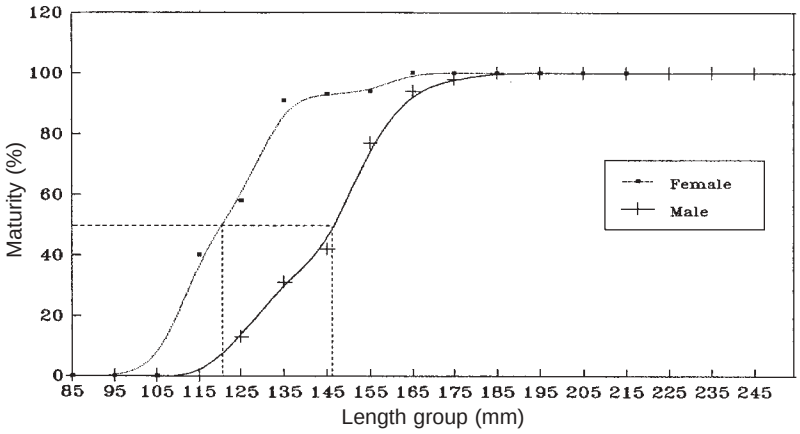

Fig. 4. Size at first maturity of *N. mesoprion*.

Size at first maturity

The percentage distribution of maturity stages in different size groups of males and females are shown

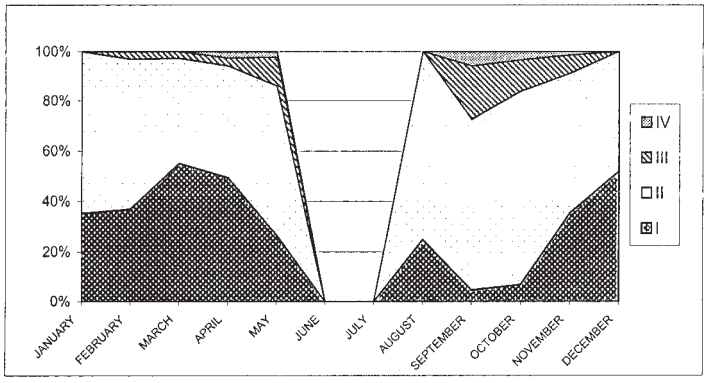

Fig. 5. Distribution of maturity stages in different months for males of *N. mesoprion*

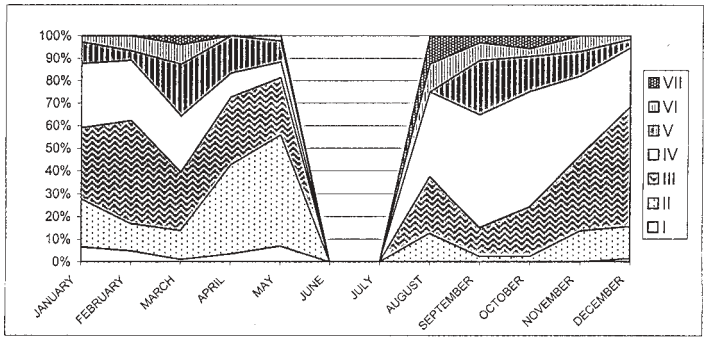

Fig. 6. Distribution of maturity stages in different months for females of *N. mesoprion*

in Fig. 4. It is found that 50% of males attain maturity at 146 mm and females at 120 mm. Mature males were recorded at 125 mm and mature females at 115 mm. Murty (1982) has estimated the length at first maturity of female *N. mesoprion* off Kakinada as 100 mm and Vivekanandan (1991) off Madras as 115 mm.

Spawning season & gonado-somatic index

Mature males and females occurred in most of the months (Fig 5 & 6), with the highest percentage during August-November followed by January-May. This suggests a prolonged spawning season for *N. mesoprion* along Mangalore-Malpe coast. Murty (1982) has reported this species as a fractional spawner, spawning in two batches off Kakinada extending from December to April with peak in January. According to Murty *et al.* (1992), spawning of *N. mesoprion* off Cochin takes place during June-September with a peak in June, throughout the year with peak during June-August along Bombay coast, October-March with peak during December-February along Veraval coast. Vivekanandan (1991) observed intense spawning during February-March followed by another mild spawning during August-October for this species along Madras coast.

The gonado-somatic index (GSI) during the different months (Fig. 7) showed

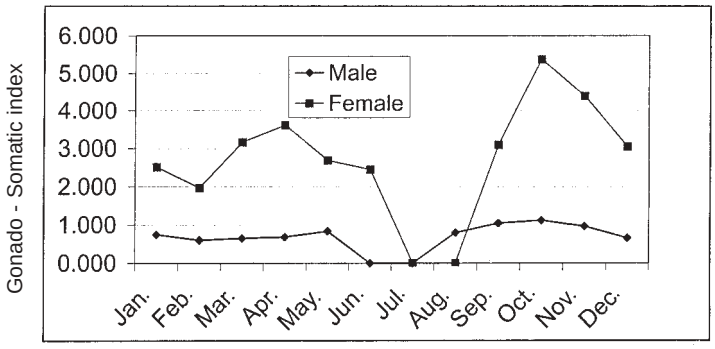

Fig. 7. Gonado-somatic index (GSI) of *N. mesoprion* during different months

TABLE 6: *Feeding nature of* N. mesoprion *during 1998*

Food items	Juvenilles		Males		Females	
	No.	%	No.	%	No.	%
Acetes	3	19	23	19	28	19
Prawn	5	31	31	26	36	24
Squilla		0	14	12	9	6
Crabs		0	14	12	18	12
Squid	4	25	18	15	22	15
Anchovies	3	19	13	11	22	15
Saurida sp.		0	11	9	14	9
Eels	1	6	4	3	2	1
Decapterus sp.	1	6	9	8	13	9
Platycephalus		0	12	10	13	9
Silverbellies		0	5	4	8	5
Nemipterus sp.		0	6	4	2	1
L.lactarius		0	7	6	2	1
No. of stomachs examined	16		120		140	

that GSI increased from August and attained a peak in October-November and decreased in February indicating September-December as the main spawning period. The GSI value again showed increase from March and decrease in May indicating another spawning period in March-April. The trend is almost similar in both sexes. The peak spawning indicated by GSI is in general agreement with percentage occurrence of maturity stages in different months.

Fecundity

In the fully mature ovary (stage VI) two sizes of mature ova were seen. The first batch which is fully mature, measured from 0.60 to 0.66 mm in diameter, whereas the second one measured 0.54 to 0.61mm. The presence of yolked ova of different sizes in mature ovary indicates multiple spawning (Clark, 1934). For calculating fecundity both these ova were taken into account. The fecundity ranged from 7444 eggs to 49689 eggs in fishes of 128-215 mm length range and weight, 50-142 g. The relationship calculated between body length and fecundity, body weight and fecundity was found to be

$F = -2.74558 + 3.21205 \log L$; $r^2=0.0.718$

$F = 2.29812 + 1.13734 \log W$; $r^2=0.36384$

where F = fecundity, L = total length (mm) and W= body weight (g)

The correlation coefficient between fecundity and body length was significant at 1% level, whereas the coefficient between fecundity and body weight was significant at 5% level indicating that the rate of egg production in relation to weight of fish is much lower than that of length of fish.

Food and feeding

The analysis of stomach contents showed that 12.6% of individuals had full stomachs and 68% empty stomachs (Table 6). High percentage of empty stomachs was seen during January, February, April, May, September, November and December. More presence of *Acetes*, prawn, *Squilla* and crabs in the stomachs

TABLE 7: *Stomach condition and diet composition of* N. mesoprion

Month	No. of fish examined	STOMACH CONDITION (%) Full	Haff full	¼full	Empty	FOOD ORGANISMS (%) *Acetes* sp.	Prawn	Crab	Squid	Anchovies	*Saurida* sp.	*L.lactarius*	*Platycephalus* sp.	*Nemipterus* sp.	*Leiognathus* sp.	Digested matter
January	88	10	7	13	70	50	38	15	15	12	0	12	0	0	0	12
February	83	8	4	10	78	17	61	6	6	22	6	0	0	6	0	17
March	49	18	12	16	53	39	43	4	13	9	4	0	0	0	9	17
April	71	13	10	13	65	36	40	20	16	12	8	8	0	0	0	8
May	132	15	16	6	63	20	41	12	14	12	10	0	6	0	0	18
June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
August	13	8	15	23	54	50	67	67	17	17	17	0	0	0	0	0
September	183	7	9	5	79	46	23	23	13	10	5	0	8	0	0	5
October	101	18	27	5	50	44	32	32	10	8	6	6	4	0	0	16
November	245	14	9	6	71	31	42	42	14	11	4	2	3	2	0	7
December	59	15	7	10	68	16	26	26	26	16	5	0	5	0	0	5
Total no.	1024	129	115	83	697	34	38	11	14	12	6	3	3	1	1	11

indicates that the species is a carnivore feeding mainly on crustaceans. The present observations corroborate the results of Rao (1989). The detailed analysis of stomach of juveniles, males and females (Table 7) show that all feed mainly on crustaceans.

Acknowledgement

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