

SOME BIOLOGICAL ASPECTS OF *NEMIPTERUS MESOPRION* (BLEEKER, 1853) FROM SAURASHTRA REGION, GUJARAT WITH SPECIAL REFERENCE TO FEEDING BEHAVIOUR

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ABSTRACT

Threadfin bream (*Nemipterus mesoprion*) biology and feeding behavior were studied based on the samples collected from March, 2013 to February, 2014 along the Saurashtra coast. Threadfin bream fishery in coastal region Saurashtra is exploited by trawls and gillnets throughout the year with its peak during September to December. The highest length of the fish caught was 264 mm and its mean was 152 mm. Its overall sex ratio was 1.18. It spawned round the year with the peak during September to February. The size at first maturity was 140 mm. Its absolute fecundity was 12,144 to 63,998/kg body weight. The estimated size of ova ranged from 0.60 to 0.68 mm. Gonado-somatic index was the highest in October. Fishes with empty stomach occurred in high percentage. Fish in all size groups preferred Penaeid prawns, *Acetes* spp., deep-sea prawns, anchovies, scads, lizard fishes and whitefish were the major diet component. Copepods, squilla, and crabs were the main diet of juveniles and pre-adult fishes. Teleosts and crustaceans were dominant in the food and the adults were cannibals. The spawning season as well as their seasonal abundance are indicated. An attempt is also made to estimate the potential of *N. mesoprion* in the commercial fishing grounds off Saurashtra region.

INTRODUCTION

Nemipterus mesoprion belonging to the family *Nemipteridae* is locally known as "Lal machala". Threadfin breams are carnivorous, subsisting mainly on crustaceans (small prawns, stomato pods and crabs) and teleosts (Murty *et al.*, 2003). *Nemipterids* form an important constituent of the demersal finfish resource of Veraval, Gujarat (Raje 1996). The species are exploited mainly from 40-100 m depth, by a variety of gears. However, the major contribution comes from multiday trawl nets (Zacharia 1998). It is an important commercial value as good protein source for mankind (Diana and Manjulatha 2012). In processing industries the catch is mainly used to produce the surimi based products as well as production of fish meal and in domestic market it is also consumed fresh as well as salt dried (Sen *et al.*, 2014). threadfin bream landings by multi day trawlers in Gujarat have been observed as 50,745 t (7.19%) with a catch rate of 6.33 kg h⁻¹, during 2013 (CMFRI 2014). There is considerable information available on *N. mesoprion* caught off Saurashtra coast regarding its sex ratio, maturity, spawning season, food and feeding habits. However, the paper deals with the population attributes and feeding behavior and the maturity status of the species in different seasons, which will be helpful in knowing the status and profile of body components, as it is used for surimi based products.

MATERIALS AND METHODS

The present study was conducted along the coastal waters at Veraval (21°35' N, 69°36' E), which is situated along the

western coast of Gujarat, India. The study was conducted from March 2013 to February 2014 i.e., for one year. From the fishes stratified into multi stage size groups, 25 *N. mesoprion* were collected randomly from different areas on a weekly basis. Month wise sex ratio of the species was determined and Chi-square test was performed to test the homogeneity of male and female distribution (Narsimham 1994) in the population. Maturity was observed based on the stages of gonad given by James *et al.* (1978) and the size at first maturity was determined by plotting the percentage of sexually matured specimens (stage III and above) against their standard body length. The distribution of ova diameter in each sub-sample of the ovary taken from the anterior, middle and posterior regions of the ovary was studied under a Stereo zoom microscope (Narsimham 1994). Fecundity was determined following the gravimetric method by preserving ovaries in 5% formalin. Fecundity was worked out by raising the number of ova in all the sub samples of the matured and ripened ovary (stage V and VI) to the total ovary weight. The ovary sub samples were obtained from the anterior, middle and the posterior regions of the ovary (James *et al.* 1978). Gonado Somatic Index (GSI) was determined by the formula given $GSI\% = \text{Weight of ovary} \times 100 / \text{Weight of fish body}$ (Kapil *et al.*, 2011). The relative importance of various food items in the stomach was calculated by the Index of Relative Importance (Pinkas *et al.*, 1971). The IRI was used as it takes into account the frequency of occurrence as well as the number and volume of each food item providing a definite and measurable basis for grading different food items. The

feeding intensity was assessed based on the distension of their stomach and the volume of food contained in it and was classified as full, $\frac{3}{4}$ full, $\frac{1}{2}$ full, $\frac{1}{4}$ full, trace and empty.

RESULTS AND DISCUSSION

Sex ratio

Sex ratio was calculated in every month for males and females of *N. mesoprion* (Table 1). The overall sex ratio was 1.13. The sex ratio determined for the population of the species from Veraval indicated the dominance of females in April, May, September, December, 2013 and in January, February 2014 whereas the males dominated in October, November, 2013 and in March 2014. Differential growth rates of sexes are well known in threadfin brems (Fischer and Whitehead 1974).

Maturity, spawning and length at maturity

Sexual maturity of individuals was studied by observing the different developmental stages of ova, which were distinguished by microscopic and macroscopic stages of ovary. Immature stages (I & II) were observed in all the months except in April, whereas mature stages (III, IV, & V) were observed in all the months. But, spent condition (VI & VII) was observed only in February.

N. mesoprion spawned throughout the year with the peak in September-January (Table 2). This is supported by the fact that the spawning percentage was higher during September, October, November December and January and whereas it was the least in March. Higher gonado-somatic index of 1.92 to 1.62 during the former five months and the ova of largest size of 414 μm observed in September are also in conformity with the spawning season.

The size at 50% of *N. mesoprion* matured in the population was 134 mm. Individuals with this body length were observed in all the months except in March. The size at which 25% and

Table 1: Sex ratio of *N. mesoprion*

Sr. No.	Month	Sex ratio
1	March, 2013	0.66
2	April	1.21
3	May	1.35
4	September	1.28
5	October	0.88
6	November	0.76
7	December	1.10
8	January, 2014	1.90
9	February	1.01
	Average	1.13

Table 2: Percentage spawning of females of *N. mesoprion*

Sr. No.	Month	% Spawning females	Total No. of female observed
1	March, 2013	7.27	59
2	April	10.77	71
3	May	4.76	66
4	September	75.14	54
5	October	88.34	48
6	November	59.90	39
7	December	54.44	71
8	January, 2014	30.90	76
9	February	13.45	61

75% of the fish matured in the population was 124 and 144 mm respectively. So the length at first maturity was 134 mm.

It is known that Indian threadfin brems are fractional spawners having extended spawning periods (Murty 1981; Vivekanandan and James 1986). Past studies indicate that the peak spawning was during December-April at Kakinada (Murty 1981); February-March at Chennai (Vivekanandan 1991); June-August at Mumbai (Murty *et al.* 1992); September -March at Veraval (Raje 1996) and August- November at Mangalore (Zacharia and Nataraja 2003). The length at first maturity of *N. mesoprion* was 134 mm off Veraval (Raje 1996), 115 mm off Mangalore, (Zacharia and Nataraja 2003), 115 mm off Madras (Vivekanandan 1991) and 100 mm off Kakinada (Murty 1981). The present result falls within the range of available values.

Fecundity

Absolute fecundity of *N. mesoprion* ranged from 6,150 during March to 64,204 in November (Table 3). The fecundity per gram of body weight was the highest in October (654) and the last of in May (90). The average fecundity per gram body weight was 334. The average fecundity determined for the study period of one year was 29,324. There were two peaks in the fecundity *i.e.*, the first in November and the second in October.

Fecundity has changed with the length and weight of the fish, and the relation has been direct (Murty, 1984). Raje (1996) has reported similar results in *N. delagoe* and *N. mesoprion* respectively

Ova diameter

The estimated size of the ova of *N. mesoprion* ranged from 364 to 414 μm (Table 4). The mean size of the ova was higher in September (414 μm) and December (407 μm) and the least in April (364 μm). The percentage frequency of the ova diameter was estimated and it revealed that the maximum number of ova were in the size category of 380-389 μm .

Fully matured ova (stage VI) of two size categories were observed by Zacharia and Nataraja (2003). The first batch has measured from 0.60 to 0.66 mm in diameter, whereas the second category of ova measured 0.54 to 0.61mm. The presence of yolked ova of different size categories in matured ovary has indicated multiple spawning (Clark 1934). For calculating fecundity, both these categories were taken into account.

Gonadosomatic index (GSI)

Month wise GSI was calculated (Table 5) and it was found to be higher in September, October and November (1.92, 1.14, 1.62 respectively), whereas it was lower in February (0.44),

March (0.58) and May (0.28).

The GSI of males have attained the highest values in September (0.42) and May (0.49) while it has reached the least value in February (0.25). The fish has attained its peak spawning period during September-November along the Malabar Coast (Manojkumar 2007). This confirms that the breeding of this species in the present study site and elsewhere were high in September.

Table 3: Fecundity per gram body weight of *N. mesoprion*

Month	Fecundity/g body weight	Fecundity
March, 2013	122	6150
April	168	12128
May	90	14828
September	301	24504
October	654	56104
November	432	64204
December	451	55619
January, 2014	277	22231
February, 2014	131	8154
Average	291	29324

Table 4: Variations in ova diameter of *N. mesoprion*

Sr. No.	Month	Mean ova diameter (μm)
1.	March, 2013	378.33
2.	April	364.00
3.	May	366.33
4.	September	414
5.	October	402
6.	November	380.94
7.	December	407
8.	January, 2014	400.36
9.	February, 2014	368

Table 5: GSI of *N. mesoprion*

Sr. No.	Month	GSI
1	March, 2013	0.58
2	April	0.68
3	May	0.28
4	September	1.92
5	October	1.14
6	November	1.62
7	December	1.08
8	January, 2014	0.72
9	February	0.44

Table 6: Index of relative importance of *N. mesoprion*

Prey groups	IRI									
	Mar-13	Apr	May	Sep	Oct	Nov	Dec	Jan-14	Feb	Average
Digested matter	5	20.34	7.79	1.33	2.54	2.53	7.26	2.05	17.12	7.33
Acetes	44	25.46	65.16	66.54	61.94	79.02	59.12	71.28	19.54	54.67
Deep sea prawns	1.25	-	7.63	1.36	9.94	3.12	-	-	6.98	5.1
Crab	9.14	2.75	1.03	-	-	-	-	0.79	14.45	5.6
Fishes	12.45	31.13	5.01	27.69	21.17	11.15	30.31	20.97	20.12	20
Mysids	0.62	1.02	0.58	-	-	1.89	-	-	2.06	1.23
Cephalopod	21.22	16.05	8.1	0.49	4.41	2.29	2.87	-	14.96	8.8
Stolephorus	4.15	2.05	1.89	-	-	-	-	3.08	1.66	2.6
Silver bellies	2.05	1.04	2.29	2.59	-	-	-	-	-	1.99
Molluscus	0.12	0.16	0.52	-	-	-	0.44	0.21	0.24	0.28
Nemipterus	-	-	-	-	-	-	-	1.62	2.87	2.25

Feeding intensity

Most of the specimens were found with empty stomachs. There was very low number of stomach with one half and three fourth full stomach contents. As the guts were examined based on the month of its collection, the results revealed that the presence of empty stomachs were the highest (69%) in December whereas it was the least in February (16.02%). The numbers of stomachs with one half, three fourth and full contents were very less in all months; a maximum of 17.15% and 14.77% were observed during February and September respectively.

The diet off Veraval in Gujarat has comprised mainly of crustaceans viz., *Acetes* spp., penaeid prawns, crabs, *Squilla*, deep sea prawns, juveniles of fishes such as flatheads, lizard fishes and fish larvae (Manoj kumar, 2004). The adaptation is also significant in preventing the escape of the prey (Rao and Rao, 1991). The fish is undoubtedly a carnivore which actively predares by sight, feeding substantially on crustaceans, molluscs, annelids and echinoderms (Krishna moorthi, 1971).

Frequency of occurrence

The most frequent food items present in the diet of *N. mesoprion* was semi digested fish, shrimp and Cephalopods, which were encountered in almost all the months. Cannibalistic nature of the species was observed only in January and February. Silver bellies and *Mysids* were frequent food item during the early months of the study but, it was not available in most of the stomach after September. Crabs and *Stolephorus* were present during January to May. Molluscus was present in the gut From December to May.

Index of relative importance

The IRI percentage of *N. mesoprion* (Table 6) revealed that Fishes (20%) and *Acetes* spp. (54.67%) contributed more than other food items. Semi digested fishes (7.33%), Cephalopods (8.8%), crabs (5.6%) and Deep sea prawns (5.1) were the various food items that were seen major. It is a carnivore having cannibalistic nature as its juveniles (2.25%) was a food item of the adults. It also fed on *Stolephorus* Spp. (2.6%), Silver bellies (1.99%) and *Mysids* (1.23%). The present observations are comparable with similar studies on this species from Vishakapatnam (Rao, 1989) and Mangalore (Zacharia and Nataraja, 2003). Kuthalingam (1965) has reported as a cannibal feeding mainly on *Metapenaeus dobsoni* and *Parapenaeopsis stylifera* followed by fishes, along

the Mangalore coast. According to Krishnamoorthy (1971), this species is highly predaceous and possibly a sight feeder on crustaceans, molluscs, annelids and echinoderms. More or less similar type of feeding has been reported the sea off Vizhinjam (Vinci, 1982) and Vishakapatnam (Rao and Rao, 1991). The present study confirmed that *N. mesoprion* is a carnivore feeding mainly on *Acetes* spp., fishes, penaeid prawns, crabs, squids, juvenile fishes and fish larvae as reported from elsewhere.

Recommendation

The present study confirmed that the closed season is not helpful in conserving the resources of Nemipterids as it breeds during the months of September to December, some methods should be standardized to encourage the farmers for small-scale aquaculture practices. There is an urgent need to formulate policies for the exploitation of marine fisheries resources at Veraval and implement them at the earliest. It is imperative to educate the fishermen for the effective implementation of the measures proposed by the authorities. The management measures suggested is an increase in the cod end mesh size for trawlers; as the juveniles and sub adults of commercial species are over exploited.

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