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Some observations on the biology of *Nemipterus mesoprion* (Bleeker) from Veraval (Gujarat)

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ABSTRACT

The length-weight relationship in *Nemipterus mesoprion* is calculated to be log W= -10.7134 + 2.9124 log L. The Kn values were calculated separately for males and females in relation to months and size groups. Females attain 50% maturitj' at 134 mm. This species appears to spawn from September to March. The fecundity estimates range from 5,344 to 64,369 ova in the size range 104-198 mm. The males dominated the commercial catch and the male to female ratio was 2.57:1. Empty stomachs occurred in high percentage in both males and females. This species is a demersal carnivore feeding on crustaceans, fishes, molluscs and annelids in the order of preference.

Introduction

Nemipterids form an important constituent of the dem ersal finfish resource of Veraval (Gujarat). *Nemipterus mesoprion* ranked second, constituting 16% of the Nemipterid landings during 1982-'86. The fishery is seasonal and landed chiefly by trawlers. Some aspects of the biology of this species from the east coast of India (Murty, 1981 and Appa Rao, 1989) have been studied. There is no published account on this species from the northwest coast of India and the present investigation deals with some observations on the biology of this species from Veraval.

Material and methods

The material for the study was collected by random sampling from the commercial trawl nets operated off Veraval from November 1983 to March 1987. The details of length, weight, sex, stages of maturity in females and food and feeding conditions were taken from fresh specimens. The various stages of maturity were allotted according to Dan (1977). The ovaries in stage V were preserved in 5% formalin for fecundity studies. The food of this species was determined by volume and the frequency of occurrence of each food item and the index of preponderance was calculated following Natarajan and Jhingran (1961). Due to the seasonal occurrence of *N. mesoprion* in the catch, the biological data of corresponding months in different years were pooled for the present study.

Results

Length-weight relationship

A total of 1,043 specimens were used

for this study. Out of the total, 740 were males ranging from 67 to 225 mm in length and weighing 4.4 to 158.5 g and 303 were females ranging from 72 to 202 mm length and weighing 6.0 to 102.Og. The length-weight relationship was estimated logarithmically by the least square method and the regression equations for both the sexes were:

Male: Log W = -4.7250 + 2.9434 Log L

Female: Log W = -4.5218 + 2.8572 Log L

The analysis of covariance by the method of Snedecor and Cochran (1967) showed that there was no significant difference at 1% level between sexes (Table 1) and the common equation was:

Log W= -10.7134 + 2.9124 Log L.

Murty (1981) also did not find any difference in the length-weight relationship of males and females *of N.mesoprion* from Kakinada.

Relative condition factor

The relative condition factor Kn was calculated employing the formula Kn = $\frac{W_o}{WL} \times 100$ as suggested by Le Cren (1951).

The mean Kn values during the different months showed (Fig.l) that the females of *N.mesoprion* attained

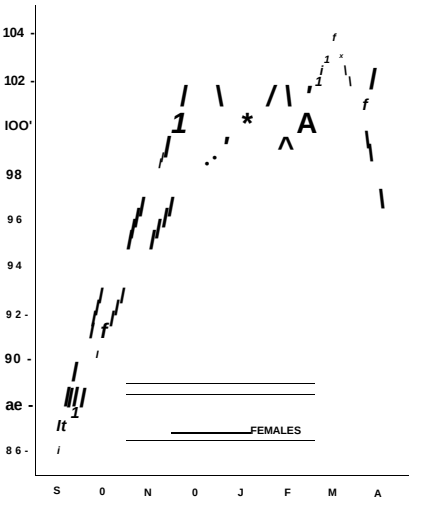

Fig. 1. Mean Kn values of *N. mesoprion* in different months.

TABLE 1. *Analysis of covariance for testing length-weight relationship of males and females of* N. mesoprion

Source of variation	DF	Regression coefficient	Deviation from regression DF	SS	MS
Within males	739	2.9434	738	20.4213	0.02767
Within females	302	2.8572	301	14.8091	0.04920
			1039	35.2304	0.03390
Pooled (within)	1041	2.9192	1040	35.2808	0.03392
Difference between slopes			1	0.0504	0.05040
Between	1				
Total	1042	2.9124	1041	35.6353	0.03423
Between adjusted means			1	0.3545	0.35450

Comparison of slopes : F= 1.4867 (df = 1,1039). Not significant.
Comparison of elevation : F = 10.4510 (df = 1,1040). Significant at 1% level.

peak condition upto March and males up to April. The relative condition factor Kn in relation to various length groups (Fig.2) showed an increasing trend upto 160 mm in females and 170 mm in males. From this length onwards the mean Kn values fell in both the sexes. The peak recorded at 160 mm in females and 170 mm in males is probably due to accumulation of fat prior to spawning and subsequent fall may be due to spawning.

Size at first maturity

To determine the size at first maturity, the females ir stages III-VI were considered to be mature. The percentage occurrence of different stages of maturity was calculated for each 10 mm interval and are presented in Fig. 3. The smallest mature specimens (Stage V) were recorded at 100 mm. The size at which 50% of the fish matured was 134 mm and this may be considered as the size at which first sexual maturity was attained.

Murty (1981) reported the length at first maturity of females *N.mesoprion* as 100 mm from Kakinada.

Spawning

To determine the spawning period only females of *N.rmsoprion* were taken into account. The psreentage frequency of various maturity stages of females is presented in Table 2. Specimens in stage VI were available from September to February and occurrence of fish in stage V and VI from September to March with higher percentage in September and next to that in November and December. It appeared that this species spawn off Veraval from September to March with primary peak in September and secondary peak in November and December. The occurrence

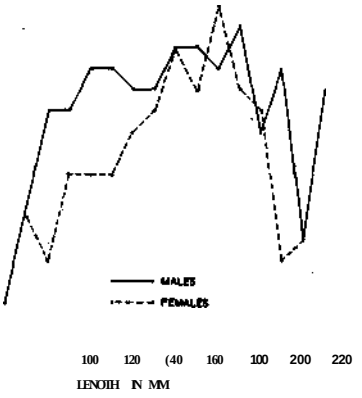

Fig. 2. Mean Kn values of AT. *mesoprion* in relation to different size groups.

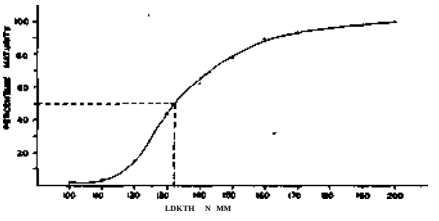

Fig. 3. Percentage frequency distribution of mature females of *N. mesoprion* in relation to length,

of equal number of males and females during September probably suggest the congregation of both the sexes for spawning, supporting the conclusion regarding the primary peak observed in September.

Murty (1981) reported that spawning period in this species in the sea off Kakinada occurred during December - April period with peak in January.

Sex ratio

The observed sex ratios in each month and different size groups were tested against an expected ratio of 1:1 by the method of Chi-square. A total of

TABLE 2. *The percentage frequency of various maturity stages of females of* N. mesoprion *for the period 1983 to '87*

Months	No. of specimens examined	Percentage of maturation stages					
		I	II	III	IV	V	VI
Sep.	17	11.76	-	-	17.65	52.94	17.65
Oct.	48	6.25	12.50	35.42	18.75	18.75	8.33
Nov.	42	2.38	9.53	4.76	23.81	28.57	30.95
Dec.	26	7.68	-	3.85	34.62	46.15	7.70
Jan.	61	1.64	1.64	16.39	42.62	22.95	14.76
Feb.	70	15.71	15.71	2.86	24.29	38.57	2.86
Mar.	27	40.74	3.70	3.70	22.23	29.63	-
Apr.	9	100.00	-	-	-	-	-

1,073 specimens were examined for this purpose of which 773 were males and 300 females. The male to female ratio was 2.57:1 showing significant departure due to preponderance of males. Appa Rao (1989) also observed the predominance of males in the catches of *N. mesoprion* from Waltair.

The sex ratio in relation to different months (Table 3) showed that Chi-square values were significant in all the months except in September where males and females were almost equal in number.

TABLE 3. *Month-wise Chi-square test for* N. mesoprion *from 1983 to '87*

Months	No. of specimens	Males	Females	Chi. square	
Sep.	35	18	17	0.03	NS
Oct.	120	72	48	4.80	**
Nov.	255	213	42	114.62	**
Dec.	146	120	26	60.52	
Jan.	176	115	61	16.57	
Feb.	217	147	70	27.32	
Mar.	82	55	27	9.56	
Apr.	42	33	9	13.71	
Pooled	1073	773	300	208.51	

NS = Not Significant.
** = Significant at 1%.

The analysis of sex ratio (Table 4) in different size groups revealed a preponderance of males in all length groups

TABLE 4. *Size-wise sex ratio* o/'N.mesoprion, *based on pooled data from 1983 to '87*

Size-groups (in mm)	No. examined	No. of male	No. of female	Chi-square
60-69	3	3		3.0
70-79	5	1	4	1.8
80-89	9	8	1	5.4*
90-99	27	21	6	8.3*
100-109	56	45	11	20.6**
110-119	59	43	16	12.4**
120-129	82	49	33	3.1
130-139	165	91	74	1.8
140-149	165	116	49	27.2**
150-159	181	130	51	34.5**
160-169	103	79	24	29.4**
170-179	87	73	14	40.0**
180-189	41	34	7	17.8**
190-199	47	40	7	23.2**
200-209	28	25	3	17.3**
210-219	9	9		9.0**
220-229	3	3		3.0
230-239	2	2		2.0
240-249	1	1		1.0
Mean length (in mm)		150.36	142.03	

* = Significant at 5% level. ** : Significant at 1% level.

except 70-79 mm group. It can be observed that in the size group 130-139 mm the sex ratio was more or less equal. Females were not recorded above 210-219 mm and mean length of males in the present study was found to be greater than that of females. So it appears that females are smaller in size than males off Veraval. It has been also reported that in *Nemipterus virgatis* and *N. japonicus* the females are generally smaller in »ize than males as found in South China Sea and off Waltair by Egglaston (1970) and Krishnamoorthi (1976) respectively.

Fecundity

The fecundity of 36 females in stage V ovaries, ranging in size between 104 and 198 mm and weight between 17.0 and 95.5g was estimated. The maximum fecundity of *N.mesoprion* was 64,369 from a fish measuring 198 mm in total length and minimum 5,344 from a fish of 104 mm. Though there were slight variations ir average values of fecundity (Table 5) with those of length, weight of fish and weight of ovary, it generally increased with length, actual weight of fish and weight of ovary. Similar results in fecundity study were reported in related species of *N.japonicus* (Dan, 1977 and Murty, 1984) and *N.delagoae* (Madan Mohan and Velayudhan, 1986).

Food and feeding

The feeding intensity was determined by the degree of distention of the stomach and the amount of food contained in it, from which a classification was made as active (gorge and full), moderate (3/4 full and 1/2 full), poor (1/4 full and trace) and empty, and also on the basis of average volume of food per fish.

Feeding intensity : For this purpose a total of 1,073 specimens of *N.mesoprion* were examined, of which 773 were males and 300 females. The percentage of empty stomachs in males was 54.99 and in females it was 59.44 of the total stomachs examined. The incidence of empty stomachs was higher

TABLE 5. *Estimated average fecundity in various length groups of* N.mesoprion

Size group (mm)	Average length of fish (mm)	Frequency (N)	Average wt. of fish (g)	Average wt. of ovary (g)	Average fecundity (No. of ova)
100-109	104	1	17.0	0.290	5,344
110-119	113	1	19.5	0.600	10,800
120-129	128	2	31.7	0.626	22,258
130-139	135	6	35.9	0.796	17,947
140-149	146	7	44.0	1.250	31,884
150-159	154	9	51.4	1.520	32,865
160-169	165	5	64.2	2.130	43,410
170-179	175	2	92.0	2.880	57,430
180-189	181	2	93.25	1.960	55,642
190-199	198	1	95.5	2.182	64,369

in males during all the months and also in females except in December (Table 6). The occurrence of empty stomachs in higher percentage in both the sexes indicated no regular periodicity in the intensity of feeding in different months. Mohan and Velayudhan (1984) observed 925 empty stomachs (66.64%) out of the 1,388 stomachs in *N. delagoae.*

In males, the average volume of food per fish was 0.39 and in females 0.27 ml (Table 6). The average volume of food in males ranged from 0.08 ml (April) to 0.77 ml (December). In females, it ranged from 0.05 ml (March) to 0.70 ml (December). It appeared that feeding intensity was slightly more in males than in females in most of the months. Similarly Krishnamoorthi (1971) also observed that in any particular month the feeding intensity was more in male than in female of *N.japonicus.*

Food Compostion and seasonal variation : According to the index of preponderance (Table 7) of various food items in stomachs of *N.mesoprion, Acetes indicus* and *AJohni* formed the most dominant food item followed by fishes, prawns, other crustaceans, molluscs and annelids.

Acetes were present in the diet in almost all the months with the highest consumption in September and the lowest in April. Fishes were the second important item, which was composed mainly of juveniles of *Nemipterus japonicus, N.mesoprion,* sciaenids, *Myctophum* spp. and *Harpodon nehereus,* their availability being maximum in March and minimum in February. Prawns, were represented by *Solenocera* spp. *Parapenaeopis* spp., and *Metapenaeus* spp. The maximum value of preponderance for these species was recorded in January and the lowest in November. The other crustacean food was comprised mainly of crabs and squilla. It was maximum during April and minimum in November. Molluscs were constituted by *Loligo* spp., *Sepia* spp. and gastropods and were found to be more during November and less in January. The annelids present in the gut were represented by *Neries* spp. in November and February. Digested matter was composed of fish scales and bones, crustacean appendages, mucus and large quantity of mud.

The present investigations reveal that *N.mesoprion* is a demersal carnivore, whose diet is mainly composed of crustaceans, fishes, molluscs and annelids. More or less similar type of feeding habits were also observed in *N.japonicus* (Krishnamoorthi, 1971 and Vinci, 1982), *N.delagoae* (Mohan and Velayudhan, 1984) and *N.mesoprion* (Appa Rao, 1989) from the Sea off Andhra-Orissa, Kerala, Vizhinjam and Waltair respectively. Cannibalism was observed in this fish as in the case of *N.japonicus* (Kuthalingam, 1965).

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TABLE 6. *Month-wise feeding intensity in percentage and average volume of food per fish in males and females of* N. mesoprion *during 1983-87*

Months	Number of specimens examined	Males				Females				Average volume of food (in ml) per fish	
		Condition of stomach (%)				Condition of stomach (%)					
		Active	Moderate	Poor	Empty	Active	Moderate	Poor	Empty	Males	Females
Sep.	35	5.56	27.78	11.11	55.55	5.88	5.88	17.65	70.59	0.50	0.25
Oct.	120	15.79	5.26	21.05	57.89	13.64	2.27	20.45	63.64	0.47	0.49
Nov.	255	11.85	9.95	20.38	57.82	12.20	12.20	21.96	53.66	0.34	0.32
Dec.	146	15.93	9.73	30.97	43.36	12.50	6.25	50.00	31.25	0.77	0.70
Jan.	176	15.31	15.31	28.57	40.81	3.86	7.69	29.49	58.96	0.38	0.21
Feb.	217	6.21	8.84	25.85	59.19	1.43	7.14	18.57	72.86	0.23	0.12
Mar.	82	5.45	3.64	16.36	74.55	7.41	3.70	33.33	55.50	0.19	0.05
Apr.	42	-	-	39.39	60.61	-	22.22	22.22	55.56	0.08	0.17
Pooled	1,073	11.05	9.46	24.50	54.99	6.92	7.23	26.42	59.44	0.39	0.27

TABLE 7. *Month-wise index of preponderence of various food items of* N. mesoprion *during 1983-'87*

Months	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Pooled for 1983-'87	Grading
Acetes sp.	97.82	87.19	69.75	84.85	1.15	0.74	4.36	0.44	54.04	I
Fishes	-	5.37	4.58	11.55	3.79	1.74	34.28	-	7.84	III
Prawns	-	-	0.13	0.10	83.05	2.70	17.44	11.56	5.91	IV
Other crustaceans	-	0.29	0.04	1.08	1.56	4.04	6.54	21.34	1.92	V
Molluscs	-	1.28	3.02	0.44	0.03	0.28	-	-	1.00	VI
Annelids	-	-	1.31	-	-	0.35	-	-	0.18	VII
Digested matter	2.18	5.87	21.17	1.98	10.42	90.15	37.38	66.66	29.11	II

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