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Some aspects on the biology of *Nemipterus japonicus* (Bloch) from Veraval in Gujarat

P.P.MANOJKUMAR
Calicut Research Centre of Central Marine Fisheries Research Institute, Calicut, India

ABSTRACT

The length weight relationship of *Nemipterus japonicus* from Veraval waters is derived to be Log W= -4.7338 + 2.9902 Log L (r =0.9786). Mature females appear in the fishery at 140 mm. The size at first maturity was estimated at 183 mm. Spawning occurs mainly from November to December and in February. The females marginally dominated the fishery and the sex ratio between males and females was 1:1.01. The fecundity ranged from 14212 to 46387 and it increased depending upon the size of the fish. Fishes with empty stomach occurred in high percentage. This species is a carnivore and feeds on *Acetes* spp., penaeid prawns, crabs, squilla, squids, juvenile fishes and fish larvae in the order of preference.

Introduction

Threadfinbreams are commercially important constituent of demersal finfish resource contributing considerably to the total marine landings in India. Along the north west coast of India, it forms a major catch in multi-day fishing boats, which operate up to a depth of 120 m. *Nemipterus japonicus*, *N. mesoprion* and *N. delagaoe* of the family Nemipteridae are the most common species of threadfinbreams found in the trawl fishery at Veraval, of which the former two species are available throughout the year in large quantities and the latter occurs mainly in the last quarter of the year. *N. japonicus* constitutes 78 % of the threadfinbream landing. They are landed throughout the year, except during June to August due to ban on monsoon trawling. Krishnamoorthy (1971 and 1974), Murty (1984), Vinci (1982) and Rao (1989) studied the fishery and biology of different species of threadfinbreams. The present investigation deals with the biology of *N. japonicus* from trawl landings at Veraval.

Material and methods

Specimens of *N. japonicus* collected from the trawl landings during January 1994 to December 1995 formed the material for the study. A total of 1257 specimens were used for biological study. Data on the length, weight, sex, maturity and food and feeding were collected The length at first maturity was estimated by considering females in the stage III and above as mature. The spawning period was determined from the occurrence of females in different stages of maturity in different months. Month wise sex ratio was determined by

dividing the number of females with the number of males. The fecundity was determined by gravimetric method following the formula F = W/W1 x number of ova in the sample, where F is fecundity, W and W1 are total and sample weight of ovary in gram respectively. In the present study fecundity estimation was made using 61 females in the stage IV and V. Due to seasonal occurrence of *N. japonicus* in the catch, the biological data of corresponding months of 1994 and 1995 were pooled for the study.

Results

Length weight relationship

Linear regression of length weight relationship was separately calculated for males and females as:

Males: Log W = -4.8391+2.9932 Log L (r=0.9992)

Females: Log W = -4.6382 + 2.9872 Log L (r = 0.9581)

The regression coefficient of males and females were analysed using analysis of covariance (Snedecor and Cochran, 1967). Since there was no significant difference in the regression of coefficients of the sexes, the data on both sexes were pooled and a common equation was calculated as follows.

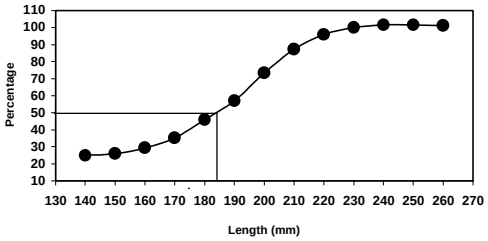

Fig.1. Percentage distribution of mature females of *N. japonicus* in relation to length

Log W = -4.7338 + 2.9902 Log L. (r=0.9786)

Length at first maturity

Mature females commenced to appear at 140 mm length and the mature females dominated up to the 260-269 mm with gradual increase in the length of fish. Fig.1 shows that the length at first maturity is 183 mm.

TABLE 1. *Percentage occurrence of various maturity stages of females of* N. japonicus

Months	No. of samples observed	Stages of maturity						
		I	II	III	IV	V	VI	VII
January	165	23.26	11.63	44.19	11.63	9.30	-	-
February	147	-	29.73	51.35	5.41	-	-	13.50
March	150	11.11	50.00	16.67	11.11	11.11	-	-
April	185	78.79	3.03	18.18	-	-	-	-
May	126	36.36	51.51	6.06	6.06	-	-	-
June-August		No sample due to ban on trawling						
September	82	60.00	40.00	-	-	-	-	-
October	143	62.07	17.20	-	20.69	-	-	-
November	135	-	13.04	4.35	43.48	30.43	-	8.70
December	124	-	15.79	15.79	36.84	15.79	10.53	5.26

TABLE 2. *Month wise sex ratio of* N. japonicus

Months	No. of sample	No of male	No. of female	Sex ratio (M:F)	Chi-square values
January	165	78	87	1:1.12	0.4909
February	147	66	81	1:1.22	3.6174
March	150	80	70	1:0.88	0.6666
April	185	88	97	1:1.10	0.4378
May	126	68	58	1:0.85	0.7936
June-August	No sample due to traditional ban on monsoon trawling				
September	82	42	40	1:0.95	0.0487
October	143	70	73	1:1.04	0.2571
November	135	68	67	1:0.99	0.0074
December	124	64	56	1:0.88	0.5333
Pooled	1257	624	633	1:1.01	0.0644

Spawning period

The mature females occurred in the fishery from October to February with fully mature and partially spent females in higher percentage in November - December, which clearly indicate that the spawning period of this species is in November - December. A secondary peak in spawning was observed during February (Table 1).

Sex ratio

The females out numbered males in the commercial catches. Percentage of males was low in most of the months except in March, May, September, November and December. The sex ratio was different from the expected ratio 1:1 in almost all the months showing the predominance of females in the catches (Table 2). The chi- square values indicated that there was no significant variation at 5% level.

Fecundity

The mature ovaries of *N. japonicus* contain maturing and mature ova. It has been found that the number of eggs released increased with the age and size of the fish (Fig. 2). The fecundity was found to increase with age up to 240 mm after that there was no further increase in the fecundity in relation to the increase in the size of the fish. The average fecundity estimates varied from 14212 to 46357 eggs. The relationship calculated between body length and fecundity and body weight and fecundity was found to be

$F = -2.45621+3.00111 \text{ Log } L$ ($r = 0.9018$)

$F = 1.91883+1.14744 \text{ Log } W$ ($r = 0.8912$)

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

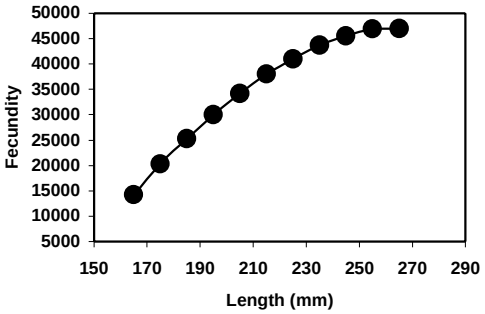

Fig. 2. Relationship between total length and fecundity of *N.japonicus*

Food and feeding

The percentage occurrence of various distensions of stomach to the total number of stomachs was compared with the monthly average volume to arrive at the intensity of feeding. The percentage of month wise fluctuation in occurrence of empty stomach is given in the Table 3. Fishes with empty stomachs formed 52.43 %. Poorly fed fishes occurred throughout the year except in April and December.

The diet of *N. japonicus* is constituted mainly by crustaceans i.e. *Acetes* spp., penaeid prawns, crabs, *squilla,* deep sea prawns, juveniles of fishes such as flatheads, lizardfishes and fish larvae (Table 4).

Acetes spp. ranked highest among the food organisms and it formed 60.40% of the total volume of stomach contents. Highest consumption of *Acetes* spp. occurred during March-April and September-October. *Acetes* spp. is dominant group of crustaceans available along the north west coast of India and its rich stock enable *N. japonicus* to feed on it voraciously. *Acetes indicus* was the main species found in the stomach throughout the year. Penaeid prawns represented by *Parapenaeopsis* spp. and *Metapenaeus* spp. ranked second among the food items in the stomach and formed 13.39 % of the total volume. Highest percentage of prawns was recorded during January and February. Its percentage occurrence was high when the volume of *Acetes* spp. was low and vice versa. Squilla contributed 6.62 % of the total volume of food. Highest volume occurred in December (16.30%) and lowest in April (0.89%). Crabs formed 5.09 % of the total volume of food and were present during January-February, April-May and December. Highest volumes of crabs were observed in May (15.21%). *Portunus pelagicus* was the main species of crab found in the stomach. Deep-sea prawns were observed only towards the end of the fishing season in peak summer in May (14.54%).

Juvenile squids formed 4.46% of total volume of stomach contents. Except in January (16.33%) and September (10.61%) it was rarely a major component of the food items. Among fishes, juveniles of *Platycephalus* spp. ranked first and formed 3.82 % of the total

TABLE 3. *Monthwise feeding intensity (%) of food of* N. japonicus

Months	Sample No	Empty	Trace	1/4 full	1/2 full	3/4 full	Full	Gorged
Jan.	165	59.39	4.24	12.73	7.88	7.27	8.48	1.21
Feb.	147	65.99	5.44	12.24	3.40	6.12	6.80	-
Mar.	150	64.67	4.00	9.33	11.33	3.33	7.33	-
Apr.	185	29.73	8.11	21.08	12.97	7.57	20.54	2.16
May	126	59.52	8.73	25.40	3.97	-	2.38	0.79
		June to August no data due to ban on trawling						
Sep.	82	52.44	4.88	21.95	6.10	3.66	10.98	-
Oct.	143	53.85	4.90	16.78	11.89	7.69	4.90	1.40
Nov.	135	42.96	2.96	22.96	10.37	11.11	9.63	0.74
Dec.	124	47.58	2.42	17.42	9.71	5.65	9.63	0.88
Annual	1257	52.43	5.17	17.42	9.71	5.65	9.63	0.88

TABLE 4. *Percentage occurrence of food items of* N. japonicus

Months	Food items present in the stomach									
	Acetes spp.	Penaeid prawns	Crabs	Squilla	Squids	Juvenile *Platycep-halus*spp.	Juvenile *Saurida* spp.	Fish larvae	Deep sea prawns	Other items
Jan	38.21	21.69	7.32	8.21	16.33	-	2.10	4.62	-	1.52
Feb	32.18	27.98	13.86	11.04	-	14.94	-	-	-	-
Mar	81.08	7.41	-	-	-	-	11.51	-	-	-
Apr	68.41	11.66	2.21	0.89	-	-	-		-	-
May	62.14	-	15.21	8.11	-	-	-	-	14.54	-
	June to August no data due to ban on trawling									
Sep	78.28	6.21	-	-	10.47	-	2.32	2.72	-	-
Oct	72.71	11.44	-	4.41	8.32	3.12	-	-	-	-
Nov	64.21	15.32	-	10.61	2.70	-	6.22	0.94	-	-
Dec	46.47	18.81	7.21	16.32	2.32	2.61	6.28	-	-	-
Annual	60.40	13.69	5.09	6.62	4.46	3.82	3.51	0.92	1.62	0.17

volume of food. Their presence was noticed during the months of February (14.94%), April (16.83%) and December (2.61%). Juveniles of lizardfish, *Saurida undosquamis* were present in the gut in some months, which formed 3.51% of the total volume. Highest volume of this species was noticed in March. Other items observed were mainly larvae of eels, carangids and other fishes.

Discussion

Eggleston (1970), recorded difference in the length-weight relationship between sexes of *N. virgatus* from the south China coast and Krishnamoorti (1971) and Murty (1984) in *N. japonicus* from Visakhapatnam and Kakinada respectively. However, Vinci and Nair (1975) and Hoda (1981) did not find any difference in the length-weight relationship of male and female *N. japonicus* from Cochin and Pakistan coast. Raje (1996) obtained similar results in the case of *N. mesoprion* from Gujarat coast. The present study agrees with Vinci and Nair (1975) and Hoda (1981).

The minimum size at maturity of this species is 165 mm (Krishnamoorthy, 1971). According to Murty (1984), the length at first maturity of this species is 125 mm at Kakinada in the east coast. The results of the present study show that there is some variation in the size at the first maturity of *N. japonicus* off Gujarat.

Krishnamoorthy (1971) observed that *N. japonicus* spawns off Waltair during September-November, but according to Dan (1980) it spawns twice a year, during December-February and June-July at Waltair. Eggleston (1973) noticed extended spawning from May to October in south China Sea. Murty (1984) observed difference in the occurrence and abundance of gravid and ripe females of *N. japonicus* in different years at Kakinada extending from August to April with peaks during February and December. The occurrence of juveniles of *N. japonicus* over an extended period supported this conclusion. At Veraval two peaks in the spawning was noticed, the primary peak in November-December and a secondary peak in February.

Eggleston (1973) and Krishnamoorthy (1974) reported that in the case of *N. japonicus*, females dominate the males and also the size of the females is smaller as found in the south China Sea. Krishnamoorthy (1971) and Murty (1984) reported the sex ratio in relation to length groups and observed that males out numbered females. In the present observation the sex ratio was slightly deviated from the expected ratio of 1:1 showing domination of females in the commercial catches, but not at a significant level.

According to Dan (1980) the average fecundity ranged from 13000 to 58000 eggs in *N. japonicus* within the length range of 138-205 mm from Waltair. Murty (1984) reported that the first and second batch fecundities range from 10372 to 62622 and 12677 to 76538 respectively and the total annual fecundity from 23049 to 139160 in fishes in the length range of 134 to 199 mm at Kakinada. Fecundity varies with length and weight and the relation is direct (Dan, 1980; Murty, 1984). Madan Mohan and Velayudhan (1986) and Raje (1996) reported similar results in *N. delagaoe* and *N. mesoprion* respectively. The present study also shows that the fecundity increases with increase in the size of fish.

According to Kuthalingam (1965) *N. japonicus* is cannibalistic and feeds 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 of crustaceans, molluscs, annelids and echinoderms. More or less similar type of feeding was reported in *N. japonicus* by Vinci (1982) and Rao *et al.* (1991) from the sea off Vizhinjam and Vishakapatnam respectively. The present study reveals that *N. japonicus* is a carnivore feeding mainly on *Acetes* spp., penaeid prawns, crabs, squids, juvenile fishes, squilla and fish larvae.

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