



Research Article

Biological aspects of threadfin bream *Nemipterus japonicus* (Bloch 1791) along coast of Saurashtra, Gujarat

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ABSTRACT

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Biological study of *Nemipterus japonicus* were carried out of to the species landed at Veraval landing center during the period of August 2017 to March-2018. During the study *N. japonicus* were ranged from 79 to 445 mm (TL) in length and 5-512 gm in weight. Study of length weight relationship derived constants $a=0.000207$ and $b=2.43$ for male and $a=0.000102$ and $b=2.54$ for female respectively. The overall sex ratio was 1:1.08 shows dominancy of female in population. *N. japonicus* spawned throughout the year with the peak in December and January. Fifty percent of the individuals of *N. japonicus* in the population attained sexual maturity as their body measured a total length of 240 mm. The Gonado Somatic Index was least in February and it ranged from 0.177 to 1.484.

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INTRODUCTION

Gujarat is leading in Marine fish landing state in India contributed nearly 21% of total Marine fish production of India. Total marine fish landing in Gujarat reaches to 7.74 lakh tonnes worth Rs. 8427 Crore in 2016 consist 38% pelagic, 32% demersal, 22% crustacean and 8% Molluscan resources (CMFRI, 2016). Thread fin bream is known as pink perch is an important constitute of demersal fin fishes of Gujarat. Threadfin bream contributed 15.12% to the total demersal landing in Gujarat. The fishery was supported predominantly by *Nemipterus japonicus* (59.75%) and *N. randalli* (40.25%). Along with the increasing capacity of trawlers to stay over, the target area is expanded from 50 M depth to 200 M depth which lead to increase the production of Threadfin bream from 20 k to 116 k tonnes from early eighties to 2000 respectively (Murty, 2003).

Available information on spatio-temporal distribution of *N. Japonicus* from east coast is limited to confined waters of Tamilnadu and South Andhra Pradesh (Vivekanandan, 1990) and Gujarat coast (Selvaraj *et al.*, 2007). Detailed study of fishery and population characteristics of *N. japonicus* in Saurashtra is restricted to Khileri *et al* (2017), Kizhakudan *et al* (2008), Manojkumar (2004), Vivekanandan (2001 a,b) and Raje (1996, 2002).

MATERIALS AND METHODS

Samples were derived from the multiday trawlers landed at Veraval Fishing Landing Centre, Gujarat. One such multiday trawler operated basing Veraval fishing harbour was selected for the study and one sample per haul was selected for biological analysis purpose and the Geo reference data for each hauling (i.e. The shooting points, hauling points and the speed of trawling, etc.), were taken by the GPS fitted in the trawler and the depth of the area of fishing was measured using the fish finder fitted on board. Biological data were collected from August-17 to March-18.

Length weight relationship for the male and female were calculated separately by formula proposed by Le Cren (1951) slopes of the regression lines for males and females were ascertained by ANOVA (Snedecor and Cochran, 1967). A total of 179 (86 Male and 93 females) in length range of 124-445 mm and weight range of 17-512 gm in male and length range of 79-360 mm and weight range of 5-358 gm in female were used for determination of Length weight relationship. Length and weight were measured to the nearest 0.1 cm and 1 g respectively using scale and an electronic weighing machine. Monthly sex ratio of males and females was estimated by confirming the sex after dissecting the specimen and the homogeneity where checked by using Chi-square method (Snedecor and

Cochran, 1967). Ovarian development was observed and the status of gonad were categories into seven categories i.e. 1- Immature, 2- early maturing, 3- maturing, 4- mature, 5-ripe, 6-spawning and 7-spent. The size at first maturity was determined by plotting the percentage of sexually matured specimens (stage III and above) against their standard body length. 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). Sexual maturity of individuals was studied by observing the different developmental stages of ova, which were distinguished by microscopic and macroscopic stages of ovary.

RESULTS

Length composition

During the study *N. japonicus* were ranged from 79 to 445 mm (TL) in length. Total 803 specimens were collected from a multiday trawler for the study. The mean total lengths of the species caught in the months of January (252 ± 58 mm) and December (246 ± 44 mm) were higher, while those caught in February (196 ± 42 mm) was smaller (Fig. 1).

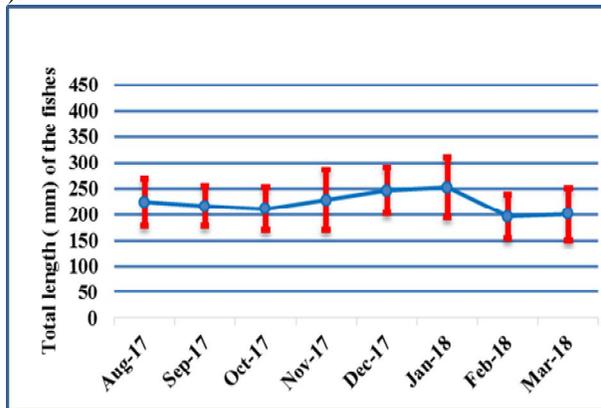


Fig-1 Monthly variations in the mean body length and its range

Length weight relationship

A total of 179 (86 males and 93 females) specimens in the length range of 79-445 mm were used for determining the length weight relationship separately for males (Fig. 2) and females (Fig. 3) The equation arrived at was:
 Male: $BW = 0.000207 \times (FL)^{2.43}$ ($r = 0.86$)
 Female: $BW = 0.000102 \times (FL)^{2.54}$ ($r = 0.89$)

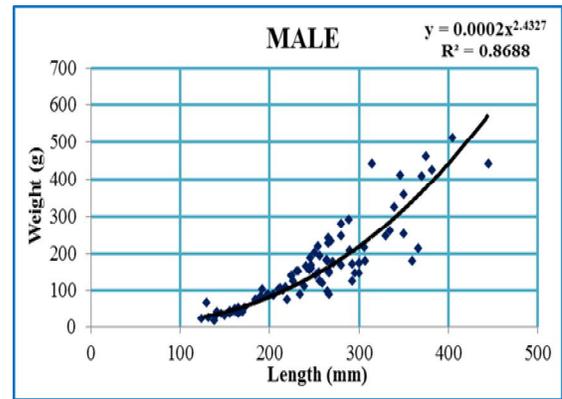


Fig. 2 Length-weight relation of males of *N. japonicus*

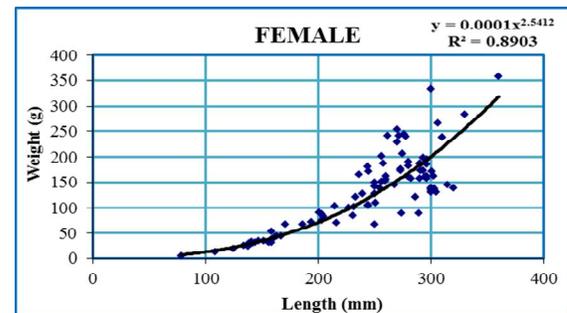


Fig. 3 Length-weight relation of females of *N. japonicus*

Sex ratio

Monthly sex ratio of males and females was estimated. The overall sex ratio was 1:1.08. Results indicated dominance of females in August, October, November, 2017 and February, 2018 (Table 1, Fig. 4).

Table: 1 Seasonal variation in the sex ratio of *N. japonicus*

Season	Number of individuals			Sex ratio (M:F)	Chi square value
	M	F	T		
Post monsoon	33	46	79	1:1.39	2.14
Winter	37	34	71	1:0.91	0.13
Summer	16	13	29	1:0.81	0.31
Annual	86	93	179	1:1.08	0.27

M= Male, F= Female, T= Total

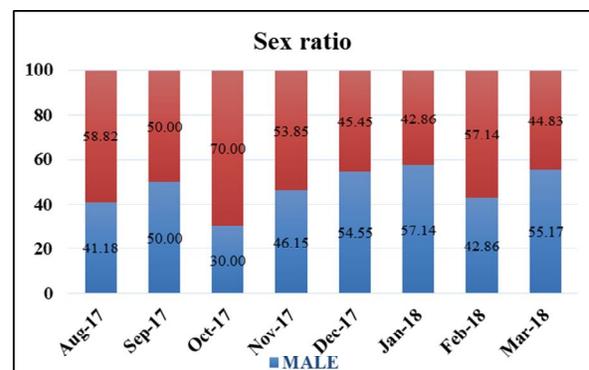


Fig. 4 Monthly variations in the sex ratio of *N. japonicus*

Season wise sex ratio observed was significantly higher during post monsoon compared to that in summer and winter.

Maturation

Immature stages (I and II) were observed in all the months, whereas mature stages (III, IV, and V) were too observed in all the months. But, spent condition (VI and VII) was observed only in the months of September, October, November, December and January.

Fifty percent of the individuals of *N. japonicus* in the population attained sexual maturity as their body measured a total length of 240 mm and the individuals of this size were observed in all the months. Twenty-five percent of fish matured when they attained 174 mm (TL) while 75% of fish matured at 310 mm (TL) (Fig.5).

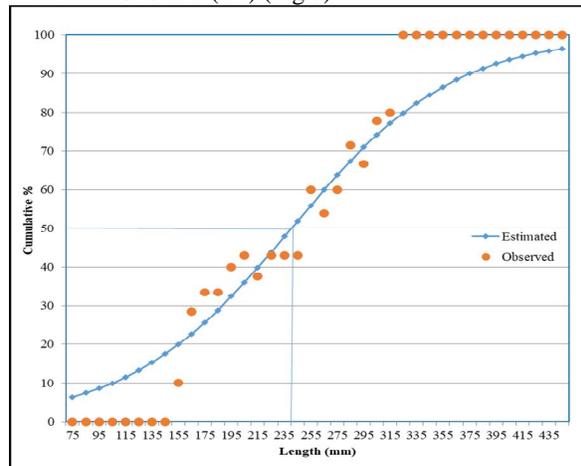


Fig. 5 Length at maturity of *N. japonicus*

Table: 2 Fecundity per gram body weight of *N. japonicus*

Month	Fecundity/gm body weight	Fecundity
Aug. 2017	282	43,133
Sep.	181	24,387
Oct.	451	85,572
Nov.	270	90,222
Dec.	449	109,133
Jan. 2018	238	65,333
Average	312	69,630

Spawning

N. japonicus spawned throughout the year with the peak in December and January (Fig 6). This is supported by the fact that the spawning percentage was higher during August, October, November, December and January and whereas it was the least in March. Higher Gonado Somatic Index of 1.08 to 1.48 during the former five months and the ova of largest size of 385 μm observed in December are also in conformity with the spawning season. *N. japonicus* also shown the second spawning during Month of August.

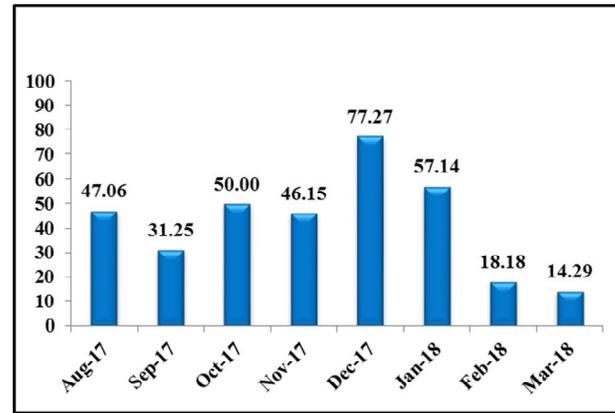


Fig. 6 Monthly variations in the spawning percentage of *N. japonicus*

Fecundity

Absolute fecundity of *N. japonicus* ranged from 14,806 during September to 165,032 in December (Table 2). The fecundity per gram of body weight was the highest in October (451) and the last of in September (181). The average fecundity per gram body weight was 312. The average fecundity determined for the study period of one year was 69630. There were two peaks in the fecundity i.e., the first in November and the second in December.

Ova Diameter

The size of the ova of *N. japonicus* ranged from 101 to 740 μm (Table 4.8). The mean size of the ova was higher in December (385 μm) and November (369 μm) and the least in September (306 μm) (Table 3). The percentage frequency of the ova diameter was estimated and it revealed that the maximum number of ova were in the size category of 301-350 μm .

Table: 3 Variation in ova diameter of *N. japonicus*

Month	Mean ova diameter (μm)
Aug. 2017	335
Sep.	306
Oct.	356
Nov.	369
Dec.	385
Jan. 2018	335
Average	348

Gastro Somatic Index (GaSI)

Present investigated work on *N. japonicus* at Veraval coast noticed that the higher peak in GaSI of both male and female at Veraval coast during the month of September and February with (4.28 ± 1.05) and (3.12 ± 1.21) respectively (Table 4). The minimum GaSI value in male was recorded during the December (1.185 ± 0.255) and in female minimum GaSI value was recorded during August (0.8982 ± 0.0768). The annual mean GaSI value of male (2.002 ± 0.272) was higher than the annual mean GaSI value of Female (1.770 ± 0.381), because during spawning season female prefer less food than the male

Table:4 Monthly variations in mean GaSI of *N. japonicus*

Month	Male	Female
	Mean \pm SE	Mean \pm SE

Aug. 2017	1.802 ± 0.552	0.898 ± 0.077
Sep.	4.28 ± 1.05	1.300 ± 0.785
Oct	1.414 ± 0.356	1.963 ± 0.315
Nov.	1.294 ± 0.293	1.986 ± 0.584
Dec.	1.185 ± 0.255	0.971 ± 0.134
Jan. 2018	1.392 ± 0.214	1.496 ± 0.250
Feb.	1.614 ± 0.484	3.12 ± 1.21
Mar.	3.037 ± 0.603	2.426 ± 0.623
Annual	2.002 ± 0.272	1.770 ± 0.381

DISCUSSION

The mean total length of male were reported higher than female and total length were recorded higher in December and January and lowest in February. The mean size of *N. japonicus* recorded in different months during the present study was considerably higher than 100 mm that has been reported for the same species from the north Tamil Nadu and south Andhra coasts (Vivekanandan, 1990). The fish from the waters of Kerala has had an annual length composition ranging from 75 to 294 mm with a dominant mode at 138 mm (Vinch, 1983). The mean length of female has been 160 mm whereas that of the male has been 170 mm at the Veraval coast (Raje, 1996). The catch of *N. japonicus* from the water off Saurashtra has had an annual length composition ranging from 60 – 390 mm. The mean length ranged from 111.5 to 212.3 mm, and larger individuals were dominant during October – January (Kizhakudan *et al* 2008), which is in conformity with the present study.

During present study the female are outnumbered male. Acharya (1990) observed that the overall male female ratio of *N. japonicus* from Bombay coast was 1:1.01. female is outnumbered male during post monsoon season while during winter and summer male outnumbered female. Amine (2012) and Manojkumar (2004) reported that females of *N. japonicus* have outnumbered males for most size and age classes, which were similar to the present study findings, reported herein above.

During present study the mature stages of gonad were observed though out study period indicates the fractional spawning behavior of *N. japonicus*. *N. japonicus* in stage IV of maturation have existed from May to November in the population (Murty, 1981; Vivekanandan and James, 1986). They have observed females with matured and ripened ova have been available in greater percentage during June-August, indicating the peak spawning season.

During present study the length at maturity was recorded 240 mm total length. Krishnamoorthi (1971) have reported length at first spawning of *N. japonicus* from Andhra- Orissa coast as 160-170 mm and for a second time, about 220 mm. (Gopal and Vivekanandan 1991) have reported length at first maturity of *N. japonicus* from Veraval as 180 mm. The length at maturity of *N. japonicus* has been reported 183 mm at Veraval coast (Manoj kumar, 2004). Rajesh *et al* (2013) reported length at first maturity in male at 165 mm and female at 175 mm from Mangalore coast.

The fish spawns though out the year with peak during December to January which also reflects in the study of GSI which shows higher value during October to January and least during the months of February and March. Acharya (1990) observed that the spawning season of *N. japonicus* off Bombay coast during July to December with peak breeding during November to December. Dan (1977) also observed that the fish breeds twice a year, once in December-February and then in June-July. The ova diameter was also recorded higher during December and November confirms the peak spawning period. 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 peak in fecundity were observed during the month of October- December while as the highest number of ova/gm of body weight was found highest during month of October and December. The number of ova present in *N. japonicus* has ranged from 10,260 to 184,946 (Raje, 2002). The average fecundity if the species has ranged from 13,900 to 58,400 in the individuals having length range of 138 to 205 mm at Waltair (Dan, 1977).

The inverse relationship between GaSI and spawning percentage were observed during the study and these increasing in the GaSI during the post spawning period due to recovered feeding nature from prolonged starvation during spawning season, reproductive stress and availability of prey items at *N. japonicus* feeding habitats.

CONCLUSION

The present investigation revealed that the individuals in the population bred at different periods. Spawners were present almost throughout the year. The intensity of spawning was the highest during October to January. The study suggested that ban of trawling from such area at peak season can aid to decrease the recruitment overfishing in forthcoming period.

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