Indian J. Fish., 36 (4) : 299 - 305 (1989)

SOME OBSERVATIONS ON THE BIOLOGY OF THE BLOCHED CROAKER *NIBEA MACULATA* (SCHNEIDER, 1801) FROM MANDAPAM

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Abstract

Some aspects of the biology of *Nibea maculata* from Mandapam waters are studied. Regression coefficients in the length-weight relationships of females and males of *N. maculata* show significant difference between them and both significantly differ from the cubic value. The spawning season is from April to August and the females appear to perform two spawning acts during this period. Relative condition factor is apparently related to the reproductive cycle. Females and males attain first maturity at 185 and 167 mm, respectively. Fecundity show wide fluctuations from 21,584 to 475,043 with high correlation to ovary weight. Overall sex-ratio shows predominance of females.

Introduction

Sciaenids are among the commercially important fishes landed by trawlers along the Tamilnadu coast. They contributed to 5.1% of total landings by trawlers in the state during 1985-'86 (Anon., 1989). One of the major constituents of the sciaenids in the Gulf of Mannar is the bloched croaker, *Nibea maculata*.

Though the biological studies of several sciaenid fishes from Indian waters were undertaken (Rao, 1963; Devadoss, 1969; Jayaprakash, 1976; Murty, 1979, 1980; Rao, 1985 a & b), information on these aspects in *Nibea maculata* is not available. The present study was therefore undertaken from Mandapam region.

Material and Methods

Biweekly samples were collected from the commercial trawlers operating from Mandapam, Pamban and Rameswaram landing centres from March, 1988 to February, 1989. Data on total length (from tip of the snout to the tip of the longest ray of the caudal fin) and weight (nearest to 0.1 g) were recorded separately for females and males and length-weight relationship was calculated using the formula log W = log a + b log L, where W is weight in g, L the total length in mm and 'a' and 'b' constants. The significance of difference between the regression coefficients of the sexes was tested using Analysis of Covariance (Snedecor and Cochran, 1967). To test whether the regression coefficient departs significantly from 3, 't' test was conducted.

The relative condition factor, Kn (Le Cren, 1951) was estimated using the equation Kn = W/w' where W represents observed weight and w' the weight calculated from the length-weight relationship.

Seven maturity stages were fixed as described in *Johnius dussumieri* by Devadoss

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(1969). The ovaries were preserved in 5% formalin. About 300 ova each from a total of 21 ovaries were measured at a magnification where each micrometer division is equal to 0.0167 mm. The material for the study was taken from the middle portion of the right ovary. While measuring, ova less than 4 md were not taken into consideration.

Results and Discussion

Length weight relationship

The study is based on 234 females of the length range 107-246 mm and 141 males ranging in length from 98 to 210 mm. The equations (Fig. 1) obtained are:

Females: $\log W = -5.7721 + 3.3981 \log L$; $r=0.9928$

Males : $\log W = -5.5374 + 3.2896 \log L$; $r=0.9874$

The Analysis of Covariance revealed significant difference in the regression coefficients of the sexes (Table 1), thus necessitating separate regression equations for females and males. The 't' test (females $t = 14.77$; $df = 232$; males $t = 6.46$; $df = 139$) showed that regression coefficient in both sexes are significanlty different from 3.

Maturation and spawning

Fig. 2 shows the frequency polygons of ova diameter measurements of *Nibea maculata* in stages IV-VI. Stage IV ovary shows two modes, one at 12 md consisting of immature translucent ova and early maturing ova and the other at 28 md consisting of late maturing ova. The first mode has further advanced to 16 md in stage V ovary, which shows two more modes; a smaller one at 28 md and a more pronounced one at 36 md consiting of mature opaque ova. Obviously certain fast growing ova got separated from the batch of ova that formed a single mode at 28 md in

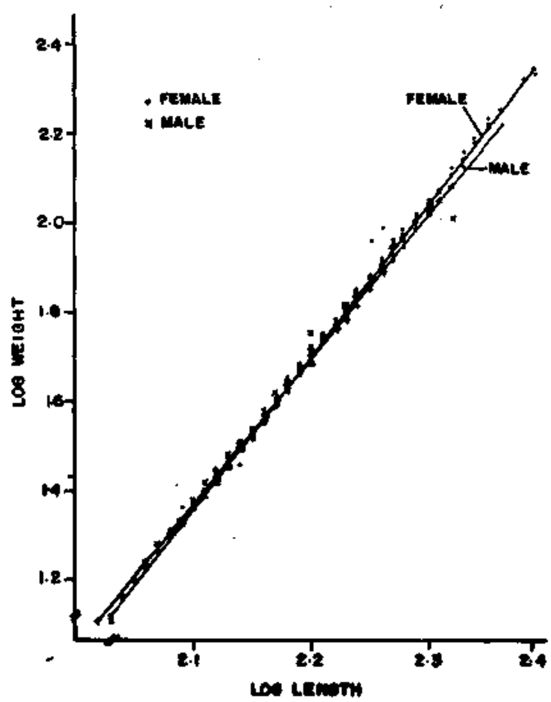

FIG. 1. Length-weight relationship in *Nibea maculata*.

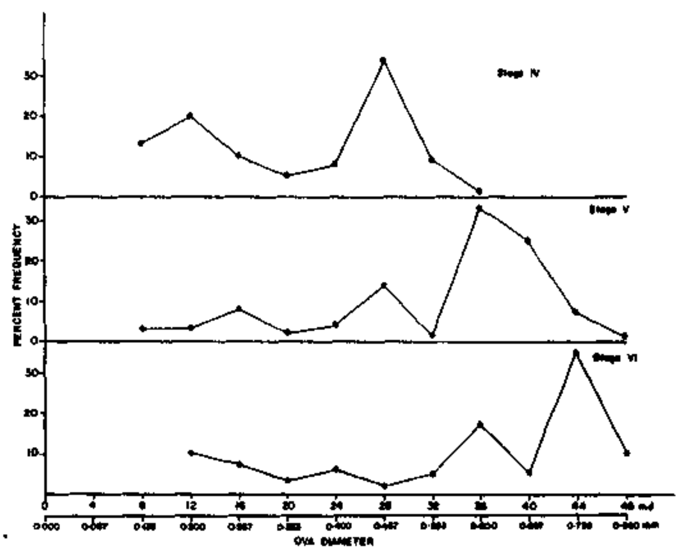

FIG. 2. Ova diameter frequency polygons of stages IV, V & VI of *Nibea maculata*.

Table 1. *Comparison of regression lines of female and male* Nibea maculata *by ANOCOVA*

	df	x^2	xy	y2	Deviation from regression		
					df	SS	MS
Within							
1. Females	233	1.0772	3.6605	12.6206	232	0.181629	0.0007828
2. Males	140	0.6298	2.0718	6.9911	139	0.175674	0.0012638
3. Total					371	0.357303	0.0009630
4. Pooled W	373	1.7070	5.7323	19.6117	372	0.361986	0.0009730
5. Difference between slopes					1	0.004683	0.0046830
6. Between B	1	0.2005	0.6835	2.3446			
7. W + B	374	1.09075	6.4158	21.9563	373	0.377014	0.0029686
8. Between adjusted means					1	0.015028	0.0150280

Slopes $F = \frac{0.0046830}{0.0009630} = 4.8629$ (Significant at 5% level).

Elevation $F = \frac{0.0150280}{0.0009730} = 15.4450$ (Significant at 1% level).

stage IV, by the time the ovary has passed on to stage V.

The modes at 28 md and 36 md in stage V have further developed to 36 md and 44 md, respectively in stage VI ovary. Presence of two modes, one each in mature and ripe ova in stage VI may indicate that *N. maculata* spawns twice during a single but extended spawning season. A similar observation was made in *Atrobucca nibe* by Murty (1980) who rules out the possibility of two separate spawning seasons in that species since the second batch of ova which are destined to be released are mature and opaque and "it may not take more time for these ova to become ripe and be released". *Johnius dussumieri* is another sciaenid which exhibits two spawning acts during an extended spawning season (Murty, 1979).

Percentage occurrence of different maturity stages of both sexes during different months is depicted in Fig. 3. Advanced maturity stages were noticed during April to August, with ripe running fishes occurring in April, May and August. It may therefore be inferred that spawning season of *N. maculata* is rather prolonged and it extends from April to August in Mandapam waters, with peak spawning in April, May and August. Murty (1979) has reported March-August as the spawning season of *Johnius dussumieri* at Kakinada.

Length at first maturity

The study is based on 171 females and 121 males. The percentage occurrence of *N. maculata* in different stages of maturity was calculated for each 10 mm interval and plotted in Fig. 4. Fishes belonging to stages IV–VII were considered as mature.

It is seen that all the females below 160 mm were immature and 50% were mature at 185 mm. All fishes above 220 mm were mature. In males, the mature fish appeared for the first time at 145 mm and 50% were mature at 167 mm. All the males above 195

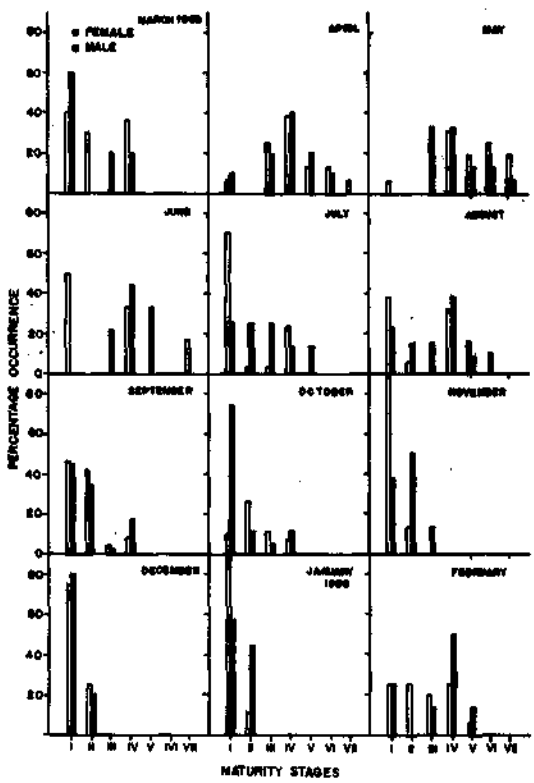

FIG. 3. Monthly occurrence of different maturity stages of *Nibea maculata*.

mm were mature. From these observations, it may be concluded that the length at first maturity for females and males are, respectively, 185 mm and 167 mm.

Gonadosomatic index

Gonadosomatic index (GSI) was calculated using the equation GSI= Weight of the gonads/ Weight of fish X 100. The gonads were weighed nearest to 0.1 mg and the fish nearest to 0.1 g. GSI showed high values in April, May and August which corroborates with the observation that peak spawning takes place during these months. Monthly variations of GSI in females and males showed almost a similar pattern (Fig. 5).

Realative conditin factor (Kn)

The seasonal fluctations in the relative condition of both sexes are depicted in Fig. 6. The relative condition factor was highest in March and plummeted in April. Low Kn values were noticed in May, June and August while minimum value was observed in September. During October to February, the relative condition factor remained high. The low Kn values of *N. maculata* in May, June and August may be attributed to the increased metabolic strain of spawning. It is known that in fishes the 'relative condition' may be influenced by reproductive cycle (Le Cren, 1951). The lowest value of Kn noticed in September could be related to some other physiological changes in the body other than maturation or feeding or to a sampling error.

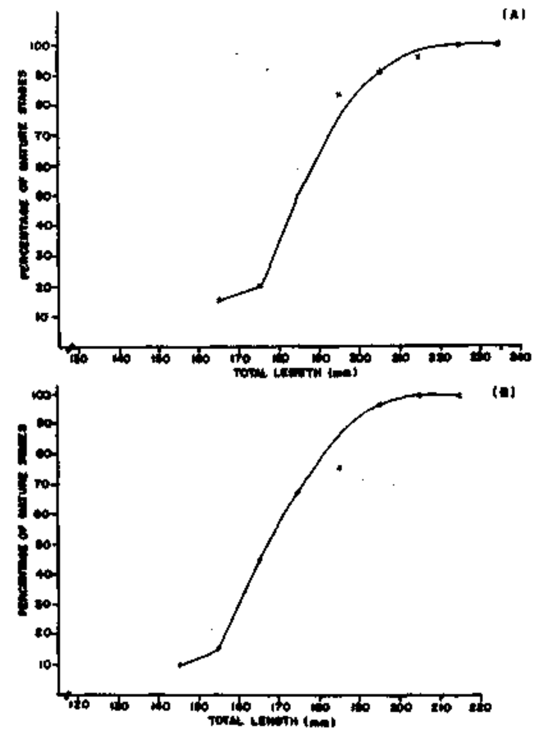

FIG. 4. Length at first maturity of female (A) and male (B) *Nibea maculata*.

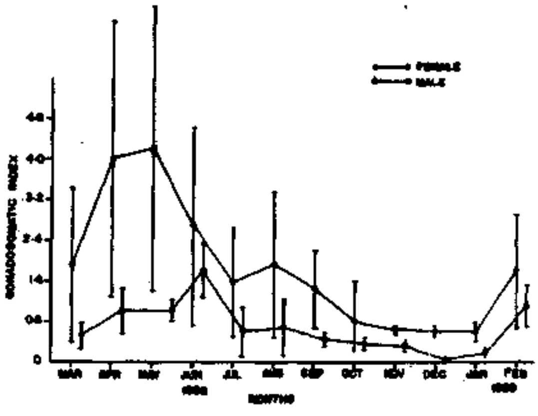

Fig. 5. Monthly variations in gonadosomatic index values of female and male *Nibea maculata*. (Vertical lines indicate standard deviation).

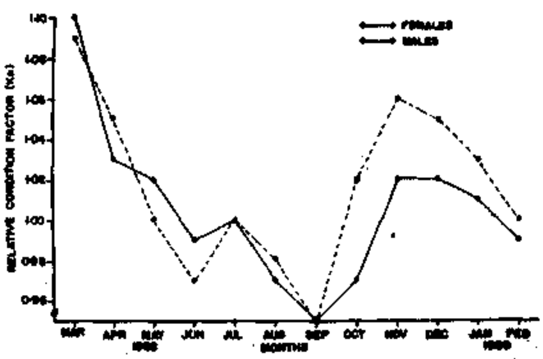

Fig. 6. Mean Kn values of *Nibea maculata* in different months.

The relatively higher Kn values during October to February are apparently due to post-spawning recovery.

In Fig. 7 are plotted mean Kn values of females and males separately at 10 mm length groups. In female, the relative conditon factor showed maximum value in 110-120 mm size group and abrupt fall to the minimum value in 180-190 mm size group. In male, Kn registered maximum value in 100-110 mm size group and a decline to minimum value in 160-170 mm size group. The point of inflexion on the curve showing a decrease in Kn value with increasing length is reported to be a good indication of the length at which

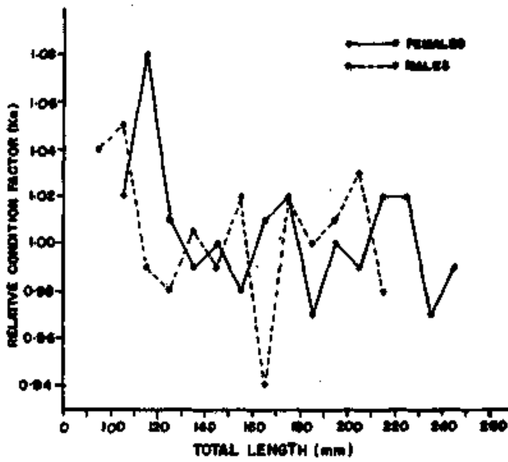

Fig. 7. Mean Kn values of Nibea maculata at different lengths.

sexual maturity starts (Hart, 1946). The points of inflexion for female and male *N. maculata* were 185 and 165 mm, respectively, which agree with length at first maturity values obtained for both sexes in the present study.

Fecundity

A total of 21 females of length range 176-245 mm in the penultimate stage of maturity were examined for this. Fecundity was determined by first weighing the whole ovary and then weighing a small portion sampled from the middle of the right ovary (both nearest to 0.1 mg). All mature ova in the sample were counted and the fecundity was estimated by the formula,

F= Weight of the ovary /Weight of the sample X Number of eggs in the sample

Fecundity showed wide fluctuations from 21,584 to 475,043 (Table 2) and its correlation with length and body weight was poor as indicated in the following equations:

$$\log F = -6.8282 + 5.0485 \log L;\ r^2 = 0.31$$

$$\log F = 1.0719 + 1.8179 \log W;\ r^2 = 0.46$$

TABLE 2. *Fecundity of* Nibea maculata

S. No.	Total length (mm)	Body weight(g)	Ovary weight(mg)	Observed Fecundity
1.	176	80.0	292.6	70,419
2.	181	74.8	132.5	23,526
3.	184	84.5	311.3	47,959
4.	184	90.5	573.8	104,479
5.	186	84.5.	251.7	26,842
6.	189	88.2	250.8	29,594
7.	191	91.8	185.5	21,584
8.	191	87.8	258.6	39,824
9.	191	107.4	573.8	124,346
10.	195	106.5	158.8	31,573
11.	196	104.4	224.2	44,142
12.	198	103.2	257.1	33,785
13.	198	103.0	451.0	109,260
14.	199	113.6	435.4	79,660
15.	201	110.0	411.4	53,999
16.	201	116.2	406.4	76,093
17.	202	116.2	419.5	79,929
18.	206	117.8	317.9	28,011
19.	207	131.3	646.3	96,071
20.	240	190.0	546.1	79,736
21.	245	240.0	2327.0	475,043

Fecundity showed high correlation with ovary weight as shown below:

$$\log F = 0.7924 + 1.1173 \log w; \; r^2 = 0.86$$

Sex ratio

During all the months, females outnumbered males (Table 3) and the overall sex ratio was male : female = 1 : 1.66, which significantly ($P < 0.01$) departs from the expected 1 : 1 ratio. Sex ratio in different length groups (Table 4) shows preponderance of males upto 149 mm and that of females from and above 150 mm. These features of the sex ratio in *N. maculata* may be the result of differential growth rates of sexes as suggested by Qasim (1966).

TABLE 3. *Month-wise sex ratio of* Nibea maculata

Month	Number of fish	female	`male	Chi-square
March, 1988	16	11	5	2.25
April	26	16	10	1.38
May	31	16	15	0.03
June	21	12	9	0.43
July	38	30	8	12.74 **
August	32	19	13	1.13
September	53	24	29	0.47
October	46	27	19	1.39
November	24	16	8	2.67
December	23	20	3	12.57 **
January,1989	41	27	14	2.06
February	24	16	8	2.67

** = Significant at 1% level

TABLE 4. *Sex ratio in different length groups of* Nibea maculata

Length groups(mm)	Number of fish	female	male	Chi-square
90-99	2	–	2	4.00 **
100-109	3	1	2	0.34
110-119	9	3	6	1.00
120-129	22	12	10	0.18
130-139	44	14	30	5.82 *
140-149	53	22	31	1.52
150-159	49	35	14	9.00 **
160-169	44	32	12	9,10 **
170-179	46	32	14	7.04 *
180-189	40	32	8	14.40 **
190-199	31	25	6	11.64 **
200-209	17	12	5	2.88
210-219	7	6	1	3.57
220-229	4	4	–	4.00 *
230-239	1	1	–	1.00
240-249	3	3	–	3.00

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

ACKNOWLEDGEMENTS

The author wishes to express thanks to Dr. P.S.B.R. James, Director, C.M.F.R.I., for encouragement and to Dr. P.V. Rao and Dr. V. Sriramachandra Murty for going through the manuscript critically and offering useful suggestions.

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