

## Some aspects of biology of catfishes *Tachysurus caelatus* (Valenciennes) and *Osteogeneiosus militaris* (Linnaeus) from Mumbai

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### ABSTRACT

The results of investigations on some aspects of the biology of *Tachysurus caelatus* and *Osteogeneiosus militaris* are presented. The fishes fed on crustaceans followed by fishes, molluscs and polychaetes. Gestating males were found starving. The occurrence of mature females and gestating male parents indicate that *T. caelatus*, spawns during February-June and *O. militaris* during August-April. *T. caelatus* attains 50% maturity at a total length of 40.8 cm and *O. militaris* at 33.0 cm. Females predominant the catch of both these species. Fecundity varied from 44 to 81 ova in *T. caelatus* and 27 to 61 ova in *O. militaris*. The maximum number of incubated eggs recorded from oro - buccal cavity of *T. caelatus* and *O. militaris* was 54 and 56 eggs respectively. The length- weight relationships of these fishes pooled for both sexes are:

*T. caelatus*:  $\text{Log } W = - 5.57881 + 3.24007 \text{ Log } L$ .

*O. militaris*:  $\text{Log } W = - 4.86014 + 2.92293 \text{ Log } L$ .

### Introduction

The annual catfish landing in trawl net at New Ferry Wharf during 1995-2000 vary from 1279 t in 1998 to 1846 t in 1999, with an average of 1573 t at a catch rate of 53.2 kg/unit, contributing 2.57 % to the total fish catch. *Osteogeneiosus militaris* and *Tachysurus caelatus* were the two major species landed in trawl net at N.F. Wharf during the above period. Growth, mortality, recruitment and maximum sustainable yield of *T. caelatus* and *O. militaris* has been studied by Chakraborty *et al.* (1997) from Maharashtra. Available information on the biology of *T. caelatus* in Indian waters is mainly due to the

work of Sekharan and Mojumdar (1973) from Vishakha-patanam, Menon (1984) and Menon and Muthiah (1987) from Mandapam on *O. militaris* and Pantulu (1963) from Hooghly estuary. Biological studies on these fishes from Maharashtra water are not available. Therefore, an attempt is made here to bring information on some aspect of the biology of *T. caelatus* and *O. militaris* based on the study carried out at Mumbai.

### Material and methods

The material for biological investigation was collected by random sampling from landings of commercial trawlers at New Ferry Wharf during 1995 - 2000.

Data on length, weight, sex, stages of maturity in female and food and feeding condition were taken from fresh specimens. The feeding intensity during various months was studied from data on the degrees of fullness of stomachs which were classified as active (gorged, full and 3/4 full), moderate (1/2 full), poor (1/4 full and trace) and empty. Food items were identified upto generic or species level. The relative importance of the items was judged by the "Index of preponderance (Natarajan and Jhingran, 1961). The various maturity stages were recognised for this species as described by Mojumdar (1978). Fecundity was estimated based on all the mature ova present in fish of stages V and VI of ovary. The eggs collected from the mouth of gestating male parents were considered for estimates and ova diameter frequency. Ova diameter were measured by means of a Vernier calliper.

## Results and discussion

### Feeding intensity

Specimens of *T. caelatus* and *O. militaris* with empty stomachs outnumbered those with food during all the months. In the total stomachs examined during all the months feeding intensity in *O. militaris* is seen to be less than that in *T. caelatus*. Venkatraman (1960) also reported five empty stomachs out of the ten stomachs studied in *O. militaris* at Calicut.

In *T. caelatus*, the average volume of food per fish was 3.99 ml and in *O. militaris* it was 0.12 ml. The low feeding activity in *O. militaris* might be due to longer spawning period and large number of males in gestating conditions observed in the present study. The low feeding intensity in *T. thalassinus* and *T. tenuispinis* during their breeding cycle has been also reported by Mojumdar

(1969) and Mojumdar and Dan (1981) respectively.

### Food composition

Crustaceans (56.62 %) formed the principal item of diet of *T. caelatus*. *Acetes* spp. (28.61%) ranked highest followed by *Solenocera* spp. (12.69%), *Nematopalae-mon tenuipes* (11.0%), and penaeid prawns (0.82%) in the crustacean diet. This diet was dominant during January, April, June – July and October to December. Fish (35.11%) represented next important diet of this fish. In order of abundance, they were *Harpodon nehereus* (10.97%), *Trichiurus* spp. (9.1%), *Coilia dussumieri* (8.33%) and *Bregmaceros maccllellandi* (2.38%). Fish diet was maximum during February – March, May and September. Molluscan (35.11%) diet was mainly represented by *Sepia* spp., *Loliolus investigatoris* and *Loligo* spp. The contribution of mollusc was highest in August as compared to crustaceans and fishes. The study indicated that *T. caelatus* is a carnivore.

The index of preponderance values of *O. militaris*, showed that among crustaceans (41.11%), penaeids prawns formed highest component followed by crabs and *Squilla* spp. and *Acetes* spp., *N. tenuipes* etc.). Their highest index value was from February to June. Molluscan (7.78%) diet was represented by cephalopods and bivalves, during April, June and November. Polychaetes constituted major portion of diet in November. The occurrence of high percentage of crustaceans followed by molluscs, teleost and polychaetes in the diet of this species revealed that the fish is a carnivorous feeder and feeds in the bottom. Devanesan and Chidambaram (1953) and Venkatraman (1960) have reported that *O. militaris* is a bottom feeder, feeding mainly on polychaetes,

molluscs, cuttle fishes, crabs, prawns and brittle stars.

#### *Food in gestating males*

The stomachs of male parents of *O. militaris* with gestating eggs in their mouth cavity were noticed without food; their alimentary canals were very thin and wiry. Similar condition was observed in *T. jella* by Chidambaram (1941). The food items whenever present in gut content of male parent of *O. militaris* consisted of *Acetes spp* (51.6% by volume), *Bregmaceros maclellandi* (29.4%), Sciaenids (8.7%), *Nematopalaemon tenuipes* (5.7%) and *Myctophum spp* (4.6%). The food item observed in the guts was in a perfectly fresh condition.

It appears that those male parents found with food items might have fed before taking the fertilised eggs in their mouth for incubation and hatching. However, Gill (1906) has reported that in *Arius* and other allied genera when the male carry the eggs in their mouth for incubation they do not take any food. Chidambaram (1941) also noticed, that during parental care, the male parent of *A. jella* actually starves.

#### *Spawning season*

Mature females (Stage V and VI) of *T. caelatus* occurred from February to June while spent (Stage VII) females were encountered from March to June (Table.1). Males with fertilised eggs in their oro-buccal cavity were observed from March to May. The recruitment of juveniles with length ranging from 50 to 90 mm in May and 60 to 100mm in June was noticed in inshore waters off Versova in trawl and dol net. Further, fishes with mature ovary were not available from July to January. Thus, it could be inferred that this species spawn from February to June off Mumbai. However, March appeared to be the peak month of

spawning since ripe fishes and gestating males were more in this month. Based on the occurrence of spent females and gestating males over a long period, Menon (1979) had concluded that the population as a whole might breed over an extended period from March to August at Mandapam.

In case of *O. militaris*, females with advanced stage (V and VI) maturation were available during January-March and August-October (Table 1). Specimens in stage VII were noticed during August-April. It appears that *O. militaris* spawns from August to April. This is further supported by occurrence of gestating males during January-April and during September – November and by the occurrence juveniles (79-120 mm TL) during April-May, October and December-January in the hand trawl and dol net operated at near shore water off Versova. From studies on ova diameter frequency and relative condition factor, Pantulu (1963) has reported that this species spawns in Hooghly estuary from August to May.

#### *Size at first maturity*

Females in stages III – VII of maturation were considered as mature for this purpose. Females of *T. caelatus* above 30.0 cm showed mature ovary while 50% of females were found to be mature at 40.8 cm. Hence; this length was taken as the length at first maturity (Fig. 1).

Similarly, in *O. militaris* the smallest mature females were recorded at 22.0 cm (Fig.1). The size at which 50% of females matured was 33.0 cm. This may be considered as the size at which first sexual maturity is attained. Pantulu (1963) observed 50% maturity in *O. militaris* from Hooghly estuarine

TABLE 1 : Percentage occurrence of *T.caelatus* and *O.militaris* in different stages of maturation and number of gestating males during various months.

Species	<i>T.caelatus</i>					<i>O.militaris</i>					
	No. of females examined	I & II	III & IV	V & VI	VII	No. of females examined	I & II	III & IV	V & VI	VII	No. of gestating males
January	14	85.7	14.3	—	—	36	91.7	2.78	2.78	2.78	1
February	32	50.0	37.5	12.5	—	55	60.0	25.5	12.7	1.82	6
March	66	15.2	40.9	42.4	1.5	50	54.0	30.0	8.0	8.0	42
April	78	30.8	48.7	19.2	1.3	40	87.5	2.5	—	10.0	2
May	104	44.2	40.4	13.5	1.9	41	92.7	7.3	—	—	—
June	75	67.7	18.7	9.3	5.3	37	97.3	2.7	—	—	—
July	12	100.0	—	—	—	12	58.3	41.7	—	—	—
August	22	100.0	—	—	—	52	40.4	42.3	15.4	1.9	—
September	6	100.0	—	—	—	35	40.0	37.1	14.3	8.6	1
October	31	100.0	—	—	—	64	81.3	7.8	4.7	6.2	1
November	26	100.0	—	—	—	102	97.1	—	—	2.9	1
December	28	96.4	3.6	—	—	84	98.8	—	—	1.2	—

system at 24.0 cm and 100% maturity at 31.4 cm.

*Sex ratio*

The ratio of males to females in the population of *T.caelatus* during the period of investigation was 1:1.7, showing unequal distribution of sexes. This may be due to differential behaviour of males, which probably move in separate shoals after spawning towards shallow water (Menon *et al.* 2000). Monthwise sex ratio showed that females occurred in high percentage during February-June and October. It may be pointed out that dominance of females coincided with the spawning period. Mojumdar (1978) also reported variations in sex ratio of *T.thalassinus* during spawning period.

The overall male to female ratio in *O.militaris* was 1:0.95, indicating more or less equal distribution in this fish but females outnumbered males during May and July - December.

The sex ratio in various size groups in *T. caelatus* showed the proportion of males were higher in most of the size groups upto 32-33cm. Further, males were not recorded above 48-49cm sizes. Similarly, in case of *O.militaris* males were predominant in most of the length groups upto 32-33cm and then their percentage declined and were not represented in size group of 44-45cm. The sex ratio in relation to the different size groups of *T.caelatus* and *O.militaris* showed that the number of adult males at higher length declined and were absent

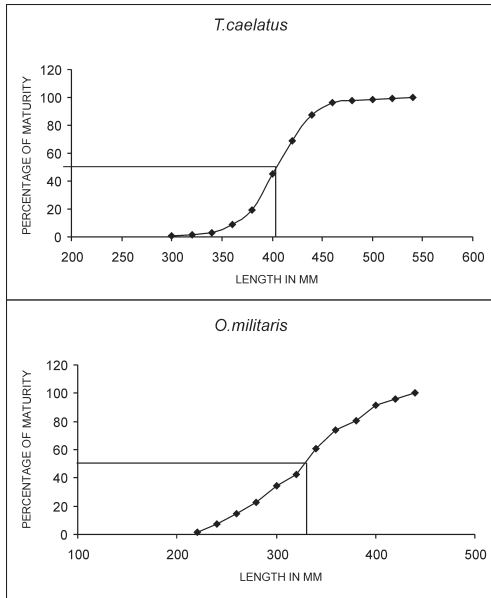


Fig.1. Size at sexual maturity of *T. caelatus* and *O. militaris*.

after a certain length, indicating the possible oral gestation mortality among adult males in both the species. Dan (1977) also noticed absence of males and excess of females at higher length groups and suggested possibility of oral gestation mortality in adult males of *T. tenuispinis*.

#### Fecundity

Fecundity studies were based on 27 mature females of *T. caelatus* in the size range of 372-552 mm and weight range of 667-1500 g. The estimated fecundity ranged from 44 to 81 eggs with an average of 63 eggs per fish.

A total of 25 ripe females of *O. militaris* ranging from 263-450 mm in total length and 184-815 g weight were studied. Fecundity varied from 27 to 61 eggs with average of 45 eggs. The number of eggs observed by Pantulu (1963) and Menon (1979) in this fish was 20-55 eggs and 30-70 eggs respectively. The result showed that average fecundity varied

considerably in both the species in different length and according to the weight of fish and ovary weight. Vasudevappa and James (1980) also could not find any relationship between fecundity and length and fecundity and weight of fish in *T. dussumieri*.

#### Number and size of incubating eggs in mouth of gestating males

Four male specimens of *T. caelatus* were examined. The maximum number of incubated eggs found in oro-buccal cavity of a male was 54 from a fish measuring 442 mm in total length. The size range of incubating eggs was 11.0-15.6 mm with model size at 14.0 mm diameter (Fig. 2). Sekharan and Mojumdar (1973) studying the diameter frequency of the eggs collected from the mouth of the same species, reported of eggs (11-15mm diameter) with unimodal distribution. Silas *et al.* (1980) estimated a maximum of 56 gestating eggs from mouth of an allied species, *T. maculatus*.

A total of 51 gestating males of *O. militaris* in the size range of 241-354 mm were examined for this purpose. The number of incubating eggs in the mouth showed wide variation from 2 to 56 eggs (Fig.3). The correlation between number of gestating eggs and fish length was very poor ( $r = 0.13$ ). The wide fluctuation in number of incubating eggs in the oro-buccal cavity of males may be due to accidental loss of some of the eggs at the time of capture and consequent struggle in the net. Silas *et al.* (1980) also reported similar phenomenon in *T. maculatus*. Day (1878) also reported that male of *O. militaris* carry 15 to 20 eggs in their mouth.

The diameter of gestating eggs of *O. militaris* was found to range from 8.6 to 13.6 mm with distinct mode at 11.0 mm (Fig 2). Menon (1984) also noticed a mode



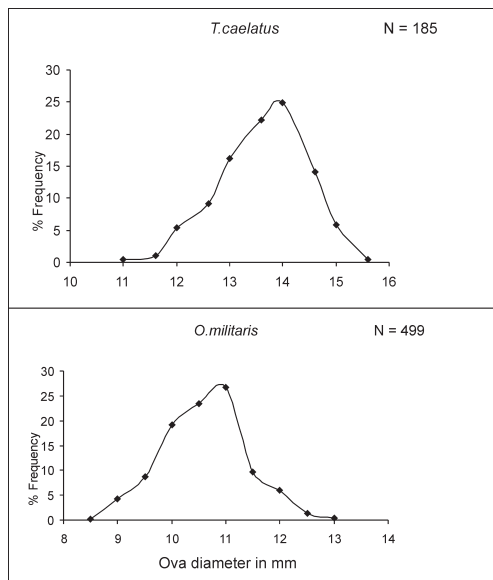


Fig.2. Frequency polygon of the incubating eggs in the mouth of *T. caelatus* and *O. militaris*.

at 11.0 mm, in eggs collected from the oro-buccal cavity of male of this species. Eggs with embryonic streaks in this fish were 10-13.0 mm and mode at 11.6mm.

In the present study, the maximum number of ripe eggs observed in the mature ovary of *T. caelatus* was 81 and *O. militaris* was 61 but the highest number of incubated eggs in the mouth of gestating males of the two species was 54 and 56 respectively. It indicated that males might be taking limited number of eggs in their oro-buccal cavity, probably to accommodate the young ones until their release, so as to achieve high survival rate. Muthiah and Rao (1985) estimated highest fecundity of a related species *T. dussumieri* as 207 eggs (average 190 eggs) and they observed that males could hold 100 or more developing eggs in their oro-buccal cavity perhaps ensuring a high hatching and survival rate.

The low fecundity in *T. caelatus* (44-

81 eggs) and *O. militaris* (27-61 eggs) might be associated with parental care. Similar conclusion was made by Dan (1977) based on low fecundity in *T. tenuispinis* (29-82 egg) and other catfishes viz; *A. jella* (30-40 eggs, Chidambaram, 1941) and *O. militaris* (18-63 eggs, Pantulu, 1963).

#### Length-weight relationship

The regression equation of 210 males of *T. caelatus* ranging from 132 to 413 mm in total length and 45.0 to 1125.0 g in weight and 366 females ranging from 135 to 418 mm in length and 50.0 to 1760.0 g in weight was used. Analysis of Covariance (Snedecor and Cochran, 1967) showed the value of slope do not differ significantly at 5 % level. Hence, a common logarithmic equation for length-weight relationship for both the sexes was derived as follows:

$$\text{Log } W = -5.57881 + 3.24007 \text{ Log } L; (r^2 = 0.93343)$$

To estimate the length-weight relationship of *O. militaris*, a total of 963 specimens consisting of 443 males in the size range of 148-423 mm and weight range 28.0-656.0 g and 520 females in the size range of 122-455 mm and weight range 40.0-780.0g were used. As there was no significant difference in regression coefficient at 5 % level and covariance by using 'F' test for males and

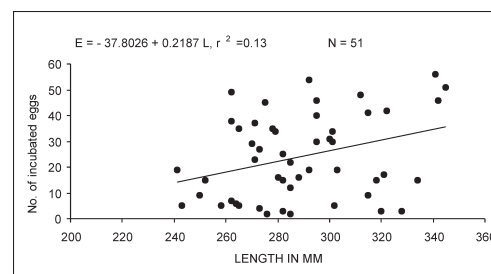


Fig.3. Relation between total length and number of incubating eggs in the mouth of male *O. militaris*.

females the data for both the sexes were pooled and a single regression equation was derived as

$$\text{Log } W = -4.86014 + 2.92293 \text{ Log } L; \\ (r^2 = 0.93364)$$

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