

**ON THE BIOLOGY OF
TACHYSURUS CAELATUS (VALENCIENNES) FROM VERAVAL**

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ABSTRACT

The length-weight relationship of males and females of *Tachysurus caelatus* can be described by the equation $\log W = -5.6659 + 3.2685 \log L$ and $\log W = -4.7648 + 2.9104 \log L$, respectively. A sex ratio of 1.37 males : 1.00 females was observed. Fecundity in the fish measuring 385 to 402 mm ranges between 44 and 55 ova. It is a demersal carnivorous feeder, feeding chiefly on crustaceans, fish, molluscs and polychaetes.

Keywords: *Tachysurus caelatus*, length-weight relationship, sex ratio, fecundity, food and feeding habit

INTRODUCTION

The biological information available so far on *Tachysurus caelatus* (Valenciennes) is limited the east coast of India. Sekharan and Mojumder (1973) have reported on the size of eggs found in the mouth of two males of this species at Visakhapatnam. Menon and Muthiah (1987) investigated the maturity, spawning period, and food and feeding habit of this species from Mandapam. This species is particularly abundant along the southeast and northwest coasts of India, and grows to about 60 cm (Menon and Bande, 1987). Although *T. caelatus* is one of the most common species, no information on its biology is available from Veraval waters. Hence, the present study was undertaken.

MATERIAL AND METHODS

Samples of *T. caelatus* were collected from the catches landed by trawl and gill nets at the Veraval Landing Centre during July 1985 to December 1986. Fishes were examined in the fresh condition for data on total length, weight, sex and the condition of stomach. After noting the length, the ovaries in Stage-V were preserved in 5% formalin for fecundity estimates. The method as described by Mojumder and Dan (1979) for food analysis of *T. tenuispinis* was followed. To determine the abundance of various food items in the stomach of fish, the index of preponderance method (Natarajan and Jhingran, 1961) was applied.

RESULTS AND DISCUSSION

Length-weight relationship

The length-weight relationship of *T. caelatus* was based on 118 males of 186-453 mm length and 86 females of 207-511 mm length. The relationship was calculated separately for both the sexes by the least square method using the formula

$W = a L^b$ or its logarithmic form: $\log W = \log a + b \log L$; where W = weight in grammes, L = length in millimetres, and a and b are constants.

The logarithmic regression equations obtained were as follows:

Males: $\log W = -5.6659 + 3.2685 \log L$

Females: $\log W = -4.7648 + 2.9104 \log L$

The significance of variation between the regression coefficients was tested (Table 1) by the analysis of covariance (Snedecor and Cochran, 1967). It was found that there was significant difference at one per cent level in slope and elevation. Hence the length-weight relationships in respect of males and females were treated separately.

Sex ratio

A sex ratio of 1.37 males : 1.00 female was found. The observed sex ratio in different months (Table 2) was tested against an expected 1:1 ratio by the chi-square method. Chi-square values of significance occurred in July, August, September and November with a preponderance of males.

Table 1: Analysis of covariance for testing the regression in length-weight relationship of *Tachysurus caelatus*

Source of variation	DF	Regression	Deviation from regression		
		Coefficient	DF	SS	MS
Within males	117	3.2686	116	0.32538	0.00280
Within females	85	2.9104	84	0.79164	0.00942
			200	1.11702	0.00558
Pooled (Within)	202	3.1164	201	1.16468	0.00579
Difference between slopes			1	0.04766	0.04766
Total	203	3.1157	202	1.27789	0.00626
Between adjusted means			1	0.11321	0.11321

Comparison of slopes: $F : 8.5412$ ($df = 1, 200$); Significant at 1% level

Comparison of elevation: $F : 19.5526$ ($df = 1, 201$); Significant at 1% level

Table 2: Monthwise chi-square test for *Tachysurus caelatus*

Month	No. of specimens	Males	Females	Chi-square
April	27	13	14	0.03 NS
May	30	6	24	10.80 *
June	5	—	5	5.00 **
July	42	30	12	7.71 *
August	23	17	6	5.26 **
September	15	13	2	8.07 **
October	27	17	10	1.81 NS
November	21	15	6	3.86 **
December	1	—	1	1.00 NS
January	13	7	6	0.03 NS
Pooled	204	118	86	5.02 **

* = Significant at 1% level

NS = No Significant

** = Significant at 5% level

Fecundity

The number of mature ova produced by the fish of different lengths is as follows: 385 mm – 44, 390 mm – 49 and 402 mm – 53. The fecundity of this fish reported from Mandapam waters is 30-70 ova (Menon and Muthiah, 1987). The present observation also indicates that the fecundity of *T. caelatus* increases with the increase in size of fish.

Feeding intensity

The feeding intensity was determined as full, $\frac{3}{4}$ full, $\frac{1}{2}$ full, $\frac{1}{4}$ full, trace and empty, depending on the degree of distension of stomach and the amount of food in it. Of the 204 stomachs analysed, 47.1% were empty (Table 3). The incidence of empty stomachs in *T. caelatus* was high in most of the months and varied from 20.0 (June) to 84.6% (January).

Table 3: Monthwise percentage frequency of feeding intensity in *Tachysurus caelatus*

Month	No. of fish	Full	$\frac{3}{4}$ full	$\frac{1}{2}$ full	$\frac{1}{4}$ full	Trace	Empty
April	27	3.7	11.1	22.2	25.9	7.5	29.6
May	30	—	3.3	20.0	20.0	20.0	36.7
June	5	—	20.0	20.0	20.0	20.0	20.0
July	42	—	2.4	4.8	9.5	21.4	61.9
August	23	—	—	—	17.4	26.1	56.5
September	15	20.0	20.0	13.3	—	13.3	33.4
October	27	—	3.7	11.1	7.4	22.2	55.6
November	21	4.7	9.5	14.3	28.6	14.3	28.6
December	1	—	—	100.0	—	—	—
January	13	7.7	—	—	7.7	—	84.6
Pooled	204	2.9	5.4	11.8	15.2	17.6	47.1

Food composition and their seasonal variations

The index of preponderance along with the percentage of volume and occurrence of various food items is given in Table 4. It revealed that crustaceans, fish, molluscs and polychaetes constituted the principal categories of food items of *T. caelatus*.

The month-wise index of preponderance of main food items comprising the diet of this species is presented in Table 5. Crustaceans constituted one of the major food components with an index of preponderance value of 47.0. The crabs (index 43.6) occupied first place by index of preponderance among the crustaceans and

Table 4: Index of preponderance of various food items in the stomach of *T. caelatus*

Food item	Volume (%)	Occurrence (%)	Index of preponderance
Crustaceans:			
Crabs	15.6	20.6	43.6
<i>Squilla</i> spp.	2.8	3.3	1.2
<i>Solenocera</i> spp.	1.2	3.3	0.5
<i>Parapenaeopsis</i> spp.	1.8	0.8	0.2
<i>Acetes</i> spp.	0.4	1.7	0.1
<i>Nematopalaemon tenuipes</i>	0.5	0.8	0.1
Other prawns	1.6	5.0	1.1
Pooled			47.0
Fishes:			
Sciaenids	18.5	6.6	16.7
Ribbonfish	11.2	3.3	5.1
<i>Cynoglossus</i> spp.	6.0	1.6	1.3
<i>Nemipterus</i> spp.	2.9	1.7	0.7
<i>Upeneus</i> spp.	6.0	0.8	0.7
<i>Apogon</i> spp.	1.8	1.7	0.4
<i>Lactarius lactarius</i>	1.5	1.7	0.3
<i>Leiognathus</i> spp.	1.1	1.7	0.3
<i>Coilia dussumieri</i>	2.1	0.8	0.2
Eel	0.6	0.8	0.1
Fish remains	6.9	5.8	5.5
Pooled			31.3
Molluscs:			
Bivalves	4.6	9.1	5.7
<i>Loligo</i> spp.	7.5	1.6	1.6
<i>Sepia</i> spp.	0.8	0.8	0.1
Pooled			7.4
Polychaetes:			
Pooled	0.4	1.7	0.1
Pooled			0.1
Digested matter:			
Pooled	4.2	24.8	14.2
Pooled			14.2

Table 5: Index of preponderance of main food items of *T. caelatus* in different months during 1985-86

Main food item	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Crustaceans	75.09	79.37	76.16	15.47	54.92	0.77	10.31	—	—
Fishes	22.01	17.71	22.23	7.21	—	89.90	87.44	96.92	—
Molluscs	2.23	—	—	47.22	2.97	9.21	0.56	—	83.30
Polychaetes	0.60	0.17	—	—	—	—	—	—	—
Digested matter	0.07	2.75	1.61	30.10	42.11	0.12	1.69	3.08	16.70

also in total food. In addition to crabs, other crustaceans found in the order of preference were *Squilla* spp., prawns, *Solenocera* spp., *Parapenaeopsis* spp., *Acetes* spp. and *Nematopalaemon tenuipes*. The crustacean food items were highest during April, May, June, August and January.

Fish ranked second in the order of preponderance (31.3). In the fish diet, sciaenids (16.7) were dominant, followed by fish remains, ribbonfish, *Cynoglossus* spp., *Nemipterus* spp., *Upeneus* spp., *Apogon* spp., *Lactarius lactarius*, *Leiognathus* spp., *Coilia dussumieri* and elvers of eel. Fishes dominated the diet during September, October and November.

Molluscs formed the third major food item having 7.4 as its index of preponderance. This group was presented by bivalves, *Loligo* spp. and *Sepia* spp. It was found maximum during July and December. Polychaetes represented by various species were lowest in preponderance. These were noticed only during April and May.

These studies on food and feeding habit indicated that *T. caelatus* is a demersal carnivorous fish with a mixed diet of

crustaceans, fish, molluscs and polychaetes in the order of preference. Menon and Muthiah (1987) also reported the carnivorous nature of *T. caelatus* from Mandapam waters, feeding mainly on echinurids, crabs, fishes, prawns and polychaetes.

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REFERENCES

- Menon, N. G. and Bande, V. N., 1987. Marine catfish resources of India. *CMFRI Bull.*, 40: 5-11.

- Menon, N. G. and Muthiah, C.**, 1987. Marine catfish resources of India. *CMFRI Bull.*, **40**: 60-69.
- Mojumder, P. and Dan, S. S.**, 1979. Studies on food and feeding habit of catfish, *Tachysurus tenuispinis* (Day). *Indian J. Fish.*, **26(1&2)**: 115-124.
- Natarajan, A. V. and Jhingran, A. G.**, 1961. Index of preponderance method of grading the food in the stomach analysis of fish. *Indian J. Fish.*, **8(1)**: 54-59.
- Sekharan, K. V. and Mojumder, P.** 1973. On the size of eggs found in the mouth of two males of catfish, *Tachysurus caelatus* (Velenciennes). *J. Mar. Biol. Ass. India*, **15(1)**: 431-433.
- Snedecor, G. W. and Cochran, W. G.**, 1967. *Statistical Methods* (6th edition). Oxford and IBH Publishing Co., New Delhi, 593 pp.