

# SOME OBSERVATIONS ON THE FISHERY AND BIOLOGY OF *NEMATOPALAEMON TENUIPES* (HENDERSON) AT BOMAY

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## ABSTRACT

*Nematopalaemon tenuipes* is caught by 'dol' nets throughout the year at Sassoon Docks and from October to May at Versova, and also by trawlnets from March to September, from 15-40 m depth zone. The fishery shows wide annual fluctuations. The species spawns not less than 5-6 times in its whole life span. The females with berry in late stages migrating to slightly deeper waters, particularly during March-November, result fluctuations in sex ratio. The number of eggs carried by a berried female of size 45-61 mm varied from 510 to 3250, depending on its size. The estimated total mortality coefficients in males and females are found to be 4.70 and 3.73 at Versova while it is 4.16 and 3.36 at Sassoon Docks.

## INTRODUCTION

*Nematopalaemon tenuipes*, a palaemonid shrimp, is commercially very important in Maharashtra, and ranks second only to *Acetes indicus* in abundance. Kunju (1979) has studied growth, breeding and sex ratio of this prawn from Bombay. The present study, conducted during 1966-75, forms a continuation of these earlier studies and highlights the fluctuations in fishery together with some information relating to length-weight relationship, spawning frequency, fecundity, migration and mortality.

## MATERIAL AND METHODS

Two important 'dol' net (stake net) landing centres, viz., Versova and Sassoon Docks, were visited once a week for regular observations. To estimate the catch, each boat-net combination was taken as a unit. On an average, 20% of the units landed on the observation day were recorded for estimating the catch for the day. The catch per unit of effort (c.p.u.e) was also calculated to assess abundance.

Random samples were collected from the commercial landings of 'dol' nets at Sassoon Docks and Versova. The mesh size of the net at cod end varied from 10 to 12 mm (stretched). The samples were analysed for sex, total length, weight, and maturity stages of female. For fecundity only fertilised eggs carried on pleopods were taken into consideration. For this purpose, 36 females were

collected at random. All eggs were removed and weighed in a chemical balance after recording the length of each prawn. From each egg mass a subsample was taken, weighed and the number of eggs counted, from which the total number was computed.

The methods employed in estimating the mortality rates and spawning frequency are given in the appropriate sections.

#### FISHERY

*N. tenuipes* is caught throughout the year in dol nets except during the southwest monsoon, i.e. June-September, at Versova. However, fishing operations are continued on a minor scale during the above period also at Sassoon Docks. The mechanised boats operate the dol net at Versova and trawlnets at Sassoon Docks in the depth range of 15-40 m. At Sassoon Docks, the non-mechanised boats operate dol nets in shallow waters (10-15 m depth).

The estimated total annual catch of *N. tenuipes* varied from 156.4 t to 512.7 t at Versova. At Sassoon Docks, it varied from 180.3 t to 488.0 t (Table 1). The bulk of the catch was obtained during April-May at both the centres. It contributes to an average of 24.2% and 28.4% of the total prawn landings by dol nets at Versova and Sassoon Docks respectively. The peak period of the fishery was observed in May, whereas the lean season was during November-December.

TABLE 1. Yearly catch of *N. tenuipes* in tonnes, c.p.u.e in kg and effort in boat days at Versova and Sassoon Docks.

Year	VERSOVA			SASSOON DOCKS		
	catch	c.p.u.e	effort	catch	c.p.u.e	effort
1969-70	232.4	48.1	4246	180.3	10.6	17950
1970-71	442.7	54.8	8074	348.6	16.0	21839
1971-72	512.7	89.1	5749	448.0	27.7	17501
1972-73	492.5	77.1	6390	—	—	—
1973-74	156.4	29.6	5280	—	—	—
1974-75	231.9	44.0	5261	—	—	—

At Versova, the maximum (512.7 t) and minimum catches (156.4 t) were recorded during 1971-72 and 1973-74 when the effort showed little variation (5749 and 5280 boat days, respectively). However, only moderate catch of 442.7 t was obtained during 1970-71, when the effort was the highest (8074 boat days). Though the effort at Sassoon Docks was considerably higher than at Versova, comparatively the catches were poor (Table 1). From these observations it would seem that there is no correlation between the catches and the effort.

## LENGTH-WEIGHT RELATIONSHIP

The length-weight relationship was derived separately for each sex using the formula,  $W = aL^n$ , where  $W$  is the weight of the prawn in mg,  $L$  is the length in mm. and  $a$  and  $n$  are constants. The logarithmic transformation of the formula gives a linear relationship. The constants  $a$  and  $b$  were estimated by the usual method of least squares. The relationships among males and females are given by the following equations.

$$\text{Males : } \log W = -1.8675 + 2.8681 \log L$$

$$\text{Females : } \log W = -2.0441 + 2.9761 \log L$$

Since there was no difference between these two equations when tested statistically, a common equation was worked out:

$$\log W = -2.2452 + 3.1043 \log L$$

The estimated values of weight (log) for males, females and pooled were plotted against their respective lengths (log) and regression lines were fitted to the data (Fig. 1) which indicated high degree of correlation among the measures of length and weight.

To know the degree of association the coefficient of correlation,  $r$ , was estimated. The  $r$  values were 0.9973 and 0.9972 for males and females, respectively, and 0.9978 for the pooled data.

## SPAWNING FREQUENCY

*N. tenuipes* is a perennial spawner with peak spawning during March-April and July-October (Kunju 1979). To find out the frequency of spawning, the sizewise distributions of mature (late maturing and mature) and berried prawns in the different months during 1970-71, at both Versova and Sassoon Docks, were pooled monthwise and presented in Table 2. It could be seen that the principal spawners were belonging to the size groups 51 mm, 54|57 mm and 57|60 mm (mid point of size groups given) during April-May, June-July and August-September respectively. Since the monthly growth in females is 3.7 mm, it is suggested that the prawns spawning during April-May at 51 mm is likely to spawn at 54|57 mm in June-July and 57|60 mm in August-September in succession. As the immature ovary takes about 2 months to become fully mature, it appears that these prawns are spawning in alternate months during the peak period. Since the smallest female with fully matured ovary measured 38 mm in length, it is likely that the prawn may be spawning at least 2 times before reaching 51 mm size and one or two times beyond 60 mm length. Therefore, it is suggested that the species possibly spawns at least 5-6 times during its entire life span.

## MIGRATION

It is known that many of the species belonging to the group Palaemonidae living in shallow waters migrate; and these migrations are correlated to changes in maturity, salinity, temperature and food availability (Kubo 1956; Kunju 1956; Rajyalakshmi 1961).

It is seen from the present study that females of *N. tenuipes*, in their later stage of berry, migrate to deeper waters for hatching the young, whereas males stay back in the fishing ground forming the mainstay of the fishery, resulting in considerable fluctuations in sex ratio. While berried prawns were caught in fewer numbers in stakenets operating in shallow waters at Sassoon Docks, large number of them were collected by trawl and stakenets operating at a depth of 30-40 m during July-October. This clearly indicates that berried prawns

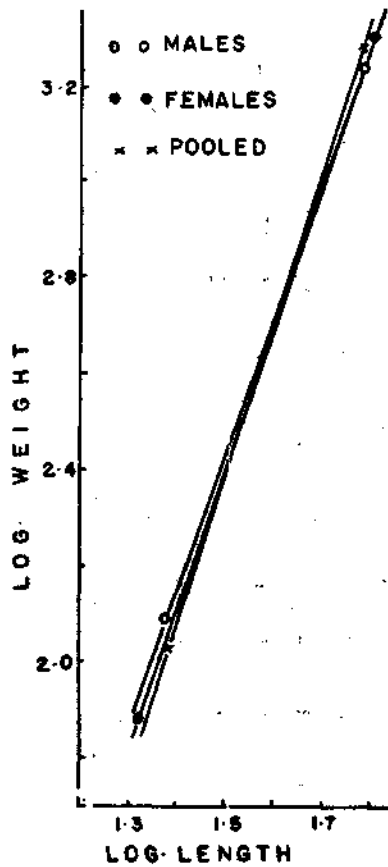


FIG. 1. Logarithmic relation between length and weight in *N. tenuipes*.

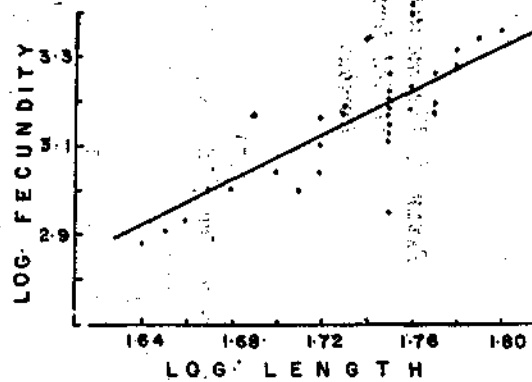


FIG. 2. Logarithmic relation between length and fecundity in *N. tenuipes*.

TABLE 2. *The monthly distribution (numbers) of late maturing, mature and berried females of N. tenuipes pooled together in different sizes at Bombay.*

Size groups in mm	1970								1971												
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
41-43		2	1	2		1	1			1	2	2		2							1
44-46	4	5	3	3	1	—	1			3	6	4	4	7	2					1	3
47-49	10	26	2	5	1	2	2	3	14	21	15	5	12	12	1	4	1	—		2	
50-52	18	37	10	9	3	5	3	3	15	31	17	8	8	13	1	13	10	4		—	
53-55	18	31	10	7	3	17	18	—	18	68	11	2	12	20	5	9	14	8		—	
56-58	8	17	14	8	8	24	25	5	8	63	15	3	6	23	17	40	38	8			
59-61	5	9	8	4	13	27	35	4	14	21	8	2	7	8	11	17	35	5			
62-64	4	2	3	1	10	15	13	4	1	15	—	—	4	8	4	17	44	4			
65-67		3	2	3	3	4	6			1	5	1		2	3	6	1	20			
68-70				1	2						2				1	3		4			
71-73										1					1						

TABLE 3. *Estimates of total instantaneous mortality coefficients of N. tenuipes at Versova and Sassoon Docks from 1969-70 to 1974-75.*

Year	(up to 40 mm) 1-6 months ( $n_0$ )	(41-58 mm) 7-12 months ( $n_1$ )	13 months (above 58 mm) and above ( $n_2$ )	$\log_e \frac{n_1}{n_2}$
<b>MALE</b>				
<b>VERSOVA</b>				
1970-71	35678	62855	548	4.64
1971-72	50535	172264	602	5.31
1972-73	177876	141070	854	4.15
1973-74	3307	41655	2220	—
1974-75	94776	116560	—	—
Average				4.70
<b>S. Docks</b>				
1969-70	1416	44676	4574	3.36
1970-71	14634	51205	1549	4.96
1971-72	58194	61074	357	—
Average				4.16
<b>FEMALE</b>				
	1-6 months (up to 46 mm) ( $n_0$ )	7-12 months (47-64 mm) ( $n_1$ )	13 months and above (above 64 mm) ( $n_2$ )	$\log_e \frac{n_1}{n_2}$
<b>Versova</b>				
1970-71	59230	112395	2459	3.48
1971-72	160931	113276	3463	4.03
1972-73	220539	136380	2006	3.68
1973-74	8766	91730	3452	—
1974-75	70134	141033	—	—
Average				3.73
<b>S. DOCKS</b>				
1969-70	2464	14348	2612	2.51
1970-71	21432	56071	1163	4.21
Average				3.36
1971-72	67273	35257	832	—

migrate to deeper waters for spawning. Though Kunju (1979) observed the existence of sexual segregation, he made no mention regarding the possible reason for the same. Further, the bulk of the adult population is found to migrate out of the fishing grounds by late October or early November and reappear during February or March. Karande (1969) has observed low temperature conditions in the upper layers of the inshore area at Bombay during November-February. It is possible that these conditions are unfavourable for this species and therefore

they leave the inshore waters. However, it is noticed that juveniles (8-28 mm) are recruited to the fishery in fairly large numbers during November-February.

#### FECUNDITY

Fecundity-length data were grouped into 5 mm size intervals and the relationship between the size of the prawn and fecundity was found out by using the formula,  $F = aL^n$ , where, F is the fecundity in numbers, L is the size of the prawn in mm and a and n are constants. The logarithmic transformation of the formula gives a linear relationship. The constants a and b were estimated by the usual method of least squares. The relationship between fecundity and size of the prawn is given by the following formula.

$$\log F = -1.4683 + 2.6702 \log L;$$

where, F = the number of eggs; L = the total length of prawn. The values of fecundity were plotted against their respective lengths and a regression line was fitted to the data (Fig. 2).

#### MORTALITY

The total instantaneous mortality coefficient, Z, has been calculated between 7-12 months and 13 months and above, since prawns below 6 months are not fully representative. The age composition data is analysed for estimating Z by employing the formula,

$$Z = \log_e \frac{n_1}{n_2}$$

where,  $n_1$  and  $n_2$  are number of prawns per unit of effort in the same fishing season in different age groups, i.e., 7-12 months and 13 months and above, respectively (The number of prawns in each size group was estimated by using the sample weight and the estimated catch in weight on each observation day. Later these data were raised to monthly catch weight. The number of prawns during different seasons was obtained by pooling the data from September to August which is taken as a fishing season in the present study). It is seen that Z varied from year to year (Table 3). The total instantaneous mortality coefficients for males and females are 4.70 and 3.73 at Versova and 4.16 and 3.36 at Sassoon Docks respectively.

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