

POPULATION DYNAMICS OF *ORATOSQUILLA NEPA*
IN THE TRAWLING GROUNDS OFF MADRAS*

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ABSTRACT

Oratosquilla nepa (Latreille) is one of the important species of stomatopods landed by the trawlers at Madras as by-catch. The estimated Bertalanffy parameters of growth (L_{∞} , K and t_0) respectively for males are 96 mm, 2.4871 and -0.07929 . Mortality rates were calculated separately for males and females. As the 'b' values for males and females were not significantly different, the combined length-weight relationship could be expressed as $\log W = -4.8665 + 2.9661 \log L$. The length at first maturity was 73.2 mm for females. Maximum breeding activity was seen during March followed by June, October, January and December. Estimates of total stock and standing crop are presented in the paper.

INTRODUCTION

STOMATOPODS though treated as by-catch and not used for human consumption, are of considerable economic importance since they are mainly dried and used as poultry feed. Furthermore, the flesh of the stomatopods is said to have medicinal value. Work on the stomatopod resources was taken up for the first time from Madras in 1981. Of about a dozen species that occur in the catches at Madras, six species are present as by-catch, some of which are highly seasonal. The landings of stomatopods on the east coast are more than those of the west coast. At Madras, annually 15 tonnes of stomatopods are landed on an average and during the years 1981-'84 ranged from 11 to 27 tonnes. *Oratosquilla nepa* is the most common forming 35% of the catch.

So far there has been no work on the population dynamics of stomatopods from India. Hence, the present communication.

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MATERIAL AND METHODS

Regular samples of stomatopods were collected from Kasimedu landing centre where all the trawlers operating off Madras unload their catches. Miscellaneous catch taken from the cod end of the nets, locally known as *Kasadu*, are piled in heaps. On the day of sampling all the species of stomatopods present in a particular heap are collected without any bias. After bringing them to the laboratory they are separated specieswise and

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weights taken and percentage calculated. Specimens belonging *Oratosquilla nepa* were separated and the data on total length (measured from the tip of the rostrum to the longest spine in the telson), weight, sex, stages of maturity were noted when the specimens were fresh. Data on the catch and effort from the commercial trawlers operating off Madras were recorded. The length data obtained on each observation day were raised to get monthly length composition of the catch. Landings of *O. nepa* were abundant once during the months of January and February; for a second time during August and then during the months of October and December.

The parameters of growth were estimated by using von Bertalanffy equation:

$$l_t = L_{\infty} (1 - e^{-K(t-t_0)})$$

Where

- L_{∞} = asymptotic length
- K = the growth coefficient
- t_0 = the theoretical age

L_{∞} was estimated from the Ford-Walford plot (Ford, 1933; Walford, 1946) of l_{t+1} against l_t on the basis of length attained at intervals of three months.

Total mortality rate (2) was estimated following the Beverton and Holt (1957) method using the equation:

$$Z = \frac{K(L - \bar{l})}{\bar{l} - l_c}$$

Where L_{∞} and K are the parameters of von Bertalanffy growth equation; \bar{l} is the mean length in the catch; and l_c is the smallest length of members that are fully represented in the catch samples. In the present study $l_c = 58$ mm and individuals less than 58 mm were not considered for calculating \bar{l} values.

The following equation was used for estimating natural (M) and fishing (F) mortality rates (Widrig, 1954):

$$Z = M + qf$$

where

q = the catchability coefficient

f = the fishing effort

$$F = qf$$

Finally, the total stock $Y = C/U$ and the standing $Y = C/F$ where C is the estimated catch in tonnes and U is the rate of exploitation

$$U = \frac{F(1 - e^{-Z})}{Z}$$

were determined (Beverton and Holt, 1957).

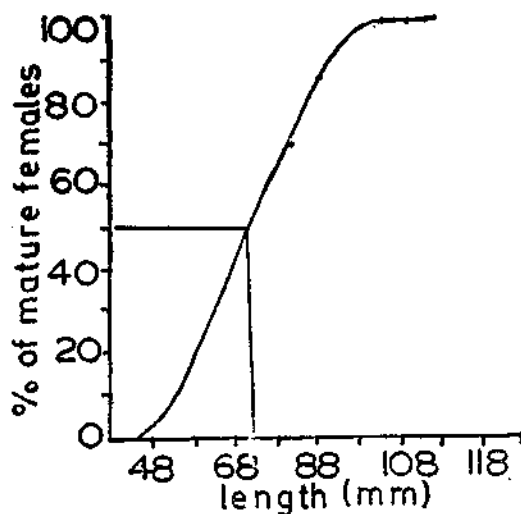
RESULTS AND DISCUSSION

Sex composition: The results presented here are based on the examination of more than 3,500 specimens collected from the commercial catch. Males were always in slightly lesser proportion during all the months and formed 40% in the pooled data for five years whereas females formed 60%.

Maturation and spawning: From an examination of 810 females in the length range of 46-110 mm. It was found that *O. nepa* bred throughout the year with maximum breeding activity during March followed by June, October, January and December. To determine the length at first maturity only specimens in stage III and above were considered (Fig. 1). Mature females were rare in specimens less than 60 mm in length. The length at first maturity was estimated at 73.2 mm.

TABLE 1. Stages of maturity in percentage for *O. nepa* females during (Pooled) 81-84

Month	Stages			No. of Specimens
	II	III	IV & V	
January	42.81	34.51	22.68	167
February	43.99	41.66	14.35	23
March	26.53	28.57	44.90	112
April	41.66	50.00	8.34	48
May	56.52	43.48	—	110
June	44.44	27.44	28.12	70
July	42.85	38.96	18.19	44
August	47.43	33.33	19.24	86
September	31.51	46.90	21.59	89
October	39.92	24.40	35.68	108
November	33.64	51.40	14.96	71
December	36.29	33.68	30.08	122

FIG. 1. Percentage frequency of mature females of *O. nepa* in relation to length.**Length-Weight relationship**

A sample of 187 males ranging from 46 to 100 mm total length and 288 females ranging from 46-110 mm formed the basis for the study. The relationship was calculated sepa-

rately for each sex by the method of least squares using the formula $\log W = \log a + b \log L$, where W is weight in g, L length in mm and a and b are constants. The regression equations are:

$$\text{Males ; } \log W = -2.226907 + 1.623622 \log L$$

$$\text{Females ; } \log W = -2.023819 + 1.50877 \log L$$

The significance of difference of b values between sexes was tested by the analysis of co-variance (Snedecor and Cochran, 1967). The difference was not significant at 5% level. Therefore pooling all the data, a common relationship was obtained thus:

$$\log W = -4.8665 + 2.9661 \log L$$

Growth

A total of 3526 specimens of *O. nepa* in the length range of 46-110 mm were measured during the period 1981-'84 and the modes in the length frequency distribution of each month were plotted for males and females. It was possible, with the data on hand, to obtain four growth curves for males (Fig. 2) and five growth curves for females (Fig. 3). The lengths attained at quarterly intervals read off from each curve (starting from the minimum modal length) were used to estimate the von Bertalanffy parameters of growth and they were:

	Males	Females
L_{∞}	96 mm	114 mm
K	2.9871	2.7173
t_0	-0.1838	-0.0729

Based on these values the sizes obtained at age one, two and three years have been calculated and presented in Table 2.

Estimation of mortality rates

The total mortality rates (Z) of males ranged from 1.6686 to 3.8011 with an average of

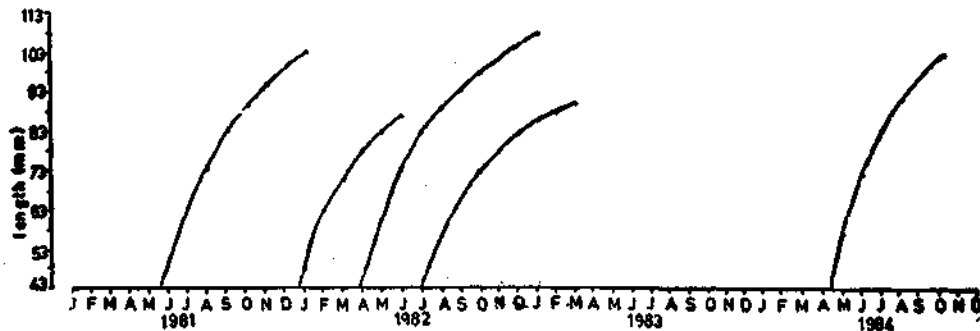


FIG. 2. Growth in length of *O. nepa* on the basis of modal progression in males.

TABLE 2. Estimated size in mm of *O. nepa* at different ages

Age in months	Males	Females
12 ..	92.23	107.82
24 ..	95.81	113.59
36 ..	95.99	113.97

2.5749 ; and for females from 3.0379 to 5.6751 with an average of 4.2515 (Table 3). The values of Z for males and females were plotted against the corresponding fishing effort. The estimated natural mortality (M) was 0.0559 for males and for females it was 1.4553. The value of mean size (\bar{l}), total mortality (Z) and total effort are given for males and for females respectively in Table 3.

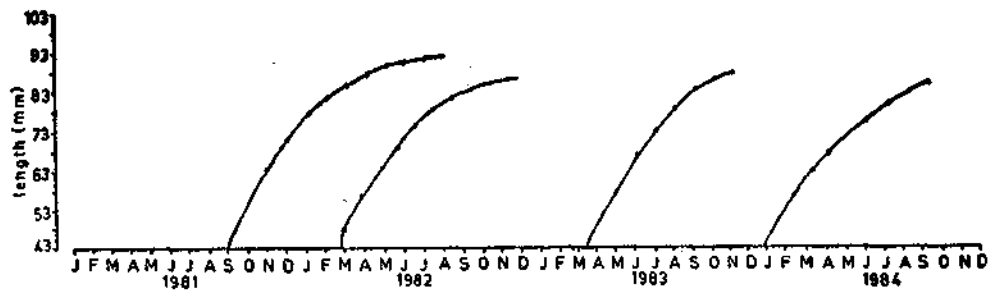


FIG. 3. Growth in length of *O. nepa* on the basis of modal progression in females.

It can, therefore, be concluded that the males and females of *O. nepa* reach a length of 92.23, 95.81, 95.99 and 107.82, 113.59 and 113.97 mm at the end of 1, 2 and 3 years respectively.

The mean lengths of males and females ranged from 75.03 to 99.50 mm and from 75.97 to 82.53 mm respectively. The average mean length for males was found to be higher.

Fishery

and standing crop at Madras for the period

The magnitude of landings of *O. nepa* at Madras is far less when compared to the prawn respectively. 1981-1984 were 50.75 and 15.83 tonnes respectively.

TABLE 3. Mean length (\bar{l}), total mortality (Z) for males and females and the fishing effort during the years 1981-'84

Years	Units	\bar{l}	Male (Z/K)	Z	\bar{l}	Female (Z/K)	Z
1981	17156	82.83	0.5586	1.6686	82.53	1.2625	3.4306
1982	32186	75.03	1.2725	3.8011	75.97	2.0885	5.6751
1983	21110	79.30	0.8169	2.4402	80.66	1.4492	3.0739
1984	29475	79.50	0.8000	2.3897	80.58	1.4579	3.9616
Average	24982	84.16	0.8620	2.5749	79.59	1.5645	4.2515

fishery. In the by-catch fishermen discard a lot of stomatopods and this is not accounted in the estimation. The estimated values of

The average estimated annual catch of *O. nepa* was only 35.57 tonnes when the existing F values for males and females were 2.5180

TABLE 4. Estimation of total stocks and standing crop of *O. nepa* (Male)

Year	Catch in tonnes (C)	F	Z	U	Total stock (Tonnes C/U)	Standing crop (C/F)
1981	27.0	1.6127	1.6686	0.7843	34.4	16.74
1982	14.5	3.7452	3.8011	0.9632	15.05	3.87
1983	11.4	2.3843	2.4402	0.8920	12.78	4.78
1984	13.8	2.3338	2.3897	0.8870	15.55	5.91
Average	16.67	2.5190	2.5749	0.8816	19.46	7.83

total annual stock (Y/U) and average standing crop (Y/F) for males and females are presented in Tables 4 and 5. The average annual crop

and 2.7860 respectively. If the present fishing effort along the Madras Coast is reduced naturally the catches also will go down below the standing crop values.

TABLE 5. Estimation of total stocks and standing crop of *O. nepa* (Female)

Year	Catch in tonnes (C)	F	Z	U	Total stock (Tonnes C/U)	Standing crop (C/F)
1981	32.12	1.953	3.4306	0.5571	57.67	16.26
1982	10.18	4.2198	5.6751	0.7410	13.73	2.11
1983	13.20	2.4826	3.9379	0.6182	21.35	5.31
1984	20.12	2.5062	3.9616	0.6206	32.42	8.02

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