RESOURCE CHARACTERISTICS OF THE PENAEID PRAWN
PARAPENAEOPSIS STYLIFERA IN MANGALORE COAST

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ABSTRACT

Some aspects of the population characteristics of the prawn *Parapenaeopsis stylifera* from 1962 in the Mangalore coast are presented. The fishery experienced wide annual variations with two peaks in general, the primary one during April-May, the ancillary being during November-December. The maximum sustainable yield is calculated to be 448 tonnes corresponding to an effort of approximately 32,000 boat days. The fishery was predominantly composed of size groups ranging from 73 to 93 mm and 83to113 mm among males and females respectively. Recruitment of smaller size groups was noticed mostly during November-December and March-April. The maximum number of broods that could be noticed in a season was six. Growth studies indicated that males and females attain a length of 90/95 and 110/125 mm at the end of one and two years respectively. In the case of males, the late 0-year class predominated whereas in respect of females, either the late 0-year or one-year class was found to be predominant. The mean length showed considerable annual variations which appear to be due to natural causes. Females preponderated in all the years except 1962-63. The average annual instantaneous rate of mortality for females between one and two year olds was estimated to be 4.28.

INTRODUCTION

In the earlier accounts, (Ramamurthy et al 1975 and 1978) the assessment of resources of *Metapenaeus affinis* and *M. dobsoni* of the Mangalore coast has been dealt with. Besides these species, *Parapenaeopsis stylifera* is commercially important in this area, constituting nearly a third of the prawn catch. Though this is a medium-sized prawn, a great portion of the catch goes for processing and hence is of economic value. Therefore, the present account reports on the results of the investigations relating to the catch trends and certain biological characteristics of *P. stylifera* over ten seasons from 1962 through 1971 to provide the necessary information for the management of the fishery.

Earlier studies on some aspects of the fishery and biology of this species have been from other parts of the Indian coast (Menon 1953, George 1961, George and Rao 1967, Mohamed 1967, George et al 1968, Rao 1972, Kurup and Rao 1974, Muthu et al 1978 and Kagwade 1980).

Material and Methods

Data on the catch and biological details were collected from the trawl landings according to the methods described by the author (loc.cit.). Trawl fishing remained usually suspended during June-August owing to inclement weather. Occasionally, P. stylifera occurred in the catches of indigenous gear (shore-seine, boat-seine and cast net) at Ullal and Baikampady (near Mangalore) during July-September which has been taken into consideration for length frequency, sex ratio and maturity studies.

Catch and Effort

Though trawling commenced in September in some years, this species remained scarce till October. In certains years, trawling was continued even in June, however the catch return was poor. The indigenous gear landed P. stylifera during July-September but not in appreciable quantities. George et al (1968) attributed the poor catch of P. stylifera during June-October from the inshore regions of Kerala to migration of prawns into the deeper zones as a result of physico-chemical disturbances brought about by the monsoon and upwelling.

The fishery at Mangalore indicated considerable fluctuations during the years as well as within the seasons (Table 1). The landings varied from 131.0 tonnes during 1963-64 to 767.1 tonnes during 1971-72, whereas the catch return per boat day ranged from 6.9 kg. during 1970-71 to 31.9 kg. during 1965-66. The fishery appeared to exhibit two peaks within the season. The primary peak occurred during April-May and the ancillary one during November-December. However, during 1963-64 and 1966-70, the best catch was recorded in January-February.

From the data on CPUE and effort, the estimates of a and b obtained by the method of least squares are as follows:-

$$a = 27.835 \qquad b = -.432$$

Accordingly the estimate of MSY is 448 tonnes corresponding to an effort of approximately 32000 boat days (Fig. 1).

Length Frequency

The length frequency distribution (in 5 mm group intervals) of males and females is represented in figs. 2-5, in terms of percentages based on catch in numbers per boat day. The year classes 1961-71 are designed according to the alphabetical order. The fishery was predominatly composed of size groups 73-93 mm and 83-113 mm in respect of males and females respectively. Entry of smaller size groups was noticed twice - during November-December and March-April.

TABLE 1. *Catch of P. stylifera in tonnes and catch per effort in kg. (in parenthesis) by the trawlers at Mangalore.*
(NF=No Fishing)

| Months	62-63	63-64	64-65	65-66	66-67	67-68	68-69	69-70	70-71	71-72	Average
September	N.F.*	——	N.F.*	N.F.*	N.F.*	N.F.	——	N.F.	14.96 (38.8)	——	1.50 (8.7)
October	——	0.28 (6.1)	0.05 (1.0)	——	N.F.	5.26 (21.4)	—	—	—	—	0.56 (0.7)
November	3.95 (15.2)	2.90 (4.6)	0.44 (1.0)	10.06 (14.3)	7.75 (14.8)	40.22 (26.6)	53.73 (20.6)	2.36 (2.2)	25.00 (10.9)	89.19 (27.8)	23.56 (17.8)
December	8.15 (7.6)	31.61 (20.5)	2.84 (2.6)	19.93 (18.8)	34.00 (19.5)	93.82 (33.2)	43.67 (15.7)	30.53 (20.5)	7.81 (3.2)	50.07 (16.8)	32.24 (17.4)
January	31.54 (27.7)	34.12 (36.9)	1.64 (1.6)	40.47 (23.7)	13.31 (6.8)	79.08 (30.9)	105.93 (26.5)	37.83 (20.0)	12.69 (4.1)	19.47 (8.6)	37.61 (18.2)
February	21.82 (19.8)	25.25 (32.9)	33.75 (34.4)	73.16 (40.0)	47.63 (24.6)	56.60 (21.5)	63.78 (19.6)	74.52 (30.9)	6.66 (3.6)	24.29 (10.0)	42.75 (22.2)
March	31.62 (27.6)	15.09 (17.9)	28.86 (22.4)	55.41 (26.7)	17.82 (6.2)	45.55 (17.1)	34.66 (7.1)	13.31 (3.8)	59.70 (15.1)	147.29 (45.6)	44.93 (17.0)
April	34.68 (68.3)	16.60 (25.0)	68.80 (59.4)	66.16 (32.1)	13.63 (5.7)	26.94 (11.1)	44.09 (12.1)	59.11 (13.5)	36.16 (5.4)	182.76 (36.1)	54.89 (18.9)
May	8.55 (25.1)	5.13 (10.1)	56.04 (56.6)	78.20 (59.2)	27.51 (16.0)	98.84 (35.2)	53.23 (22.6)	9.72 (5.0)	29.59 (8.6)	223.95 (51.3)	59.08 (29.7)
June	N.F.	N.F.	N.F.	N.F.	(0.14 (4.0)	6.91 (34.3)	N.F.	N.F.	N.F.	30.09 (94.0)	3.71 (66.9)
Total	140.31 (25.0)	130.98 (24.0)	192.42 (27.5)	343.39 (31.9)	161.79 (12.3)	453.22 (25.3)	399.09 (16.4)	227.38 (13.1)	192.57 (6.9)	767.11 (28.3)	300.83 (19.2)
% in the prawn catch	18.8	28.0	33.3	32.2	20.9	47.6	24.3	34.5	19.3	47.1	31.1
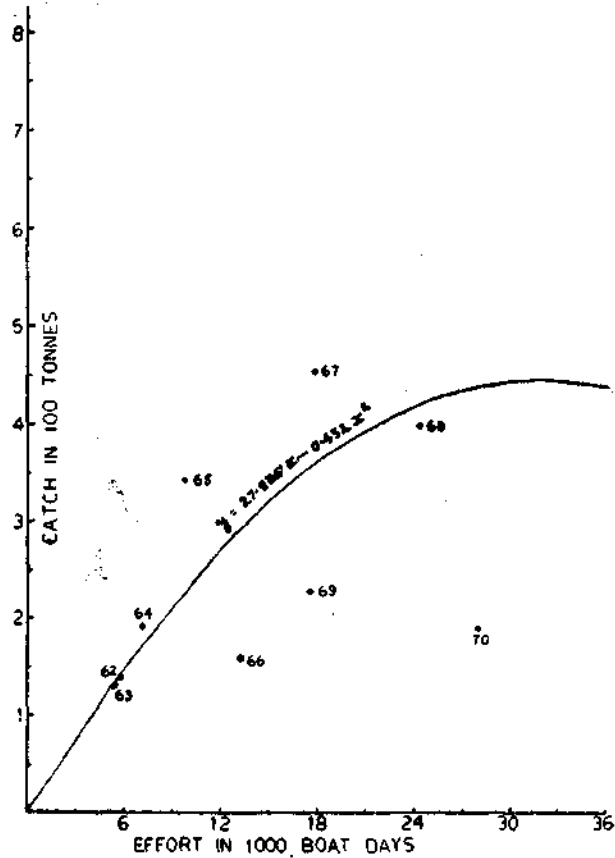
FIG. 1. Yield curve for *P. stylifera.*

Rao (1968) found that this species breeds throughout the year with peaks during December, June-August and October. During the present study also, several broods were encountered in the catches (Fig. 2-5). The maximum number of broods that could be recognised in a season was six. The growth pattern was not uniform as could be expected due to the variable nature of ecological factors. Taking into account the spawning season (*vide infra*) it is reasonable to consider that among males, the brood D6 (73 mm) of September 1965, a product of proceeding year's spawning, attained a length of 88 mm in December 1965 which is one year old. The mode G2 (43 mm) of November 1967 a product of the same year's spawning, grows to 103 mm in April 1969 when it is in the second year of its life. The brood H2 (58 mm) of April 1969 appears to attain a length of 88 mm in November 1969 during the first year of its life. In the case of females, it would be seen that the brood b4 (53 mm) of
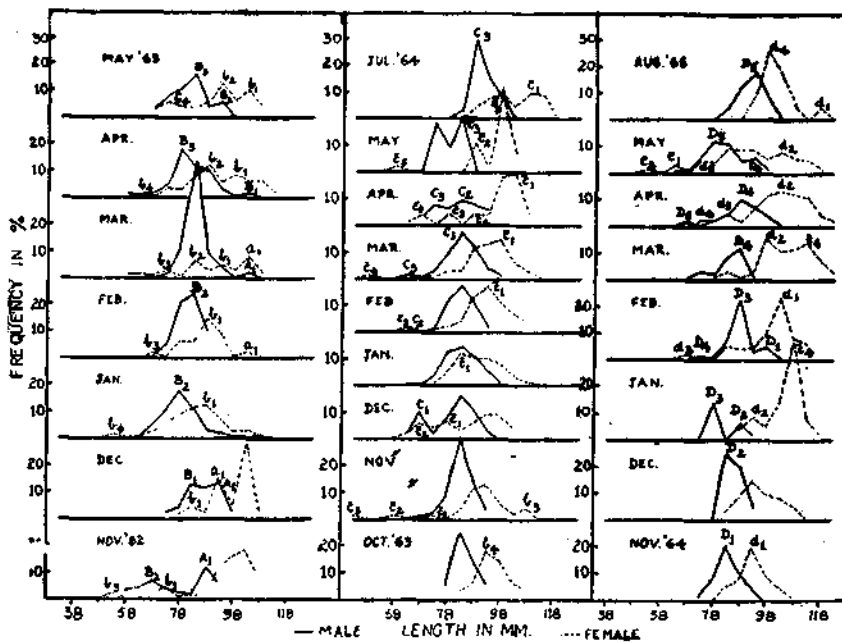
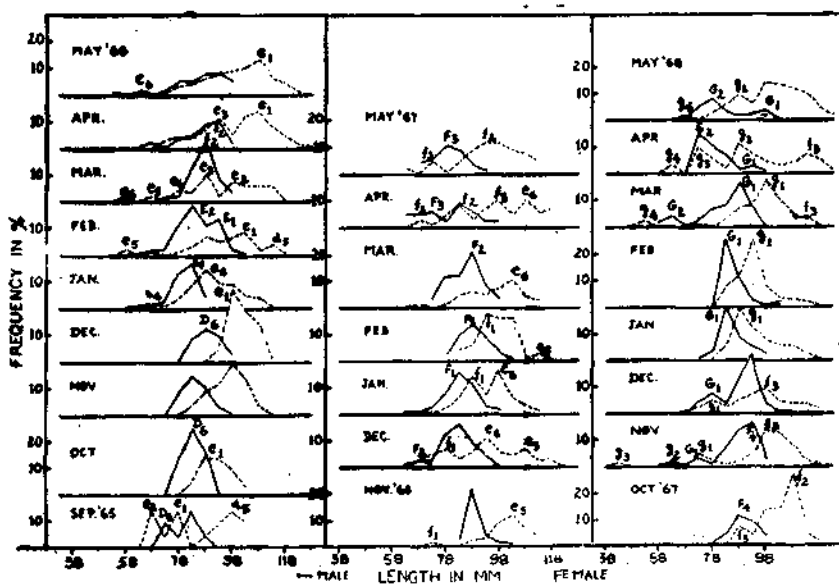FIG. 2. Length frequency of *P. stylifera* during 1962-65.

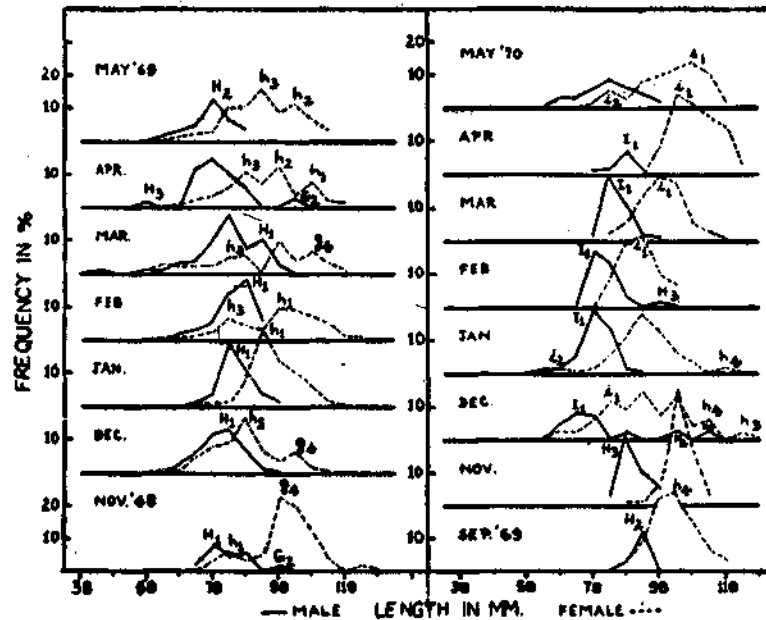FIG. 3. Length frequency of *P. stylifera* during 1965-68.

FIG. 4. Length frequency of *P. stylifera* during 1968-70.

January 1963, a product of previous year's spawning, grows to 93 mm in October 1963 during the first year of its life. The mode g1 (73 mm) of November 1967 reaches a size of 123 mm in November 1968 during the second year. A similar pattern of progression is discernible in respect of broods such as e6, i2, j5 and j6. It would, therefore, appear that the males and females of *P. stylifera* attain a length of 90/95 and 110/125 mm respectively during the first and second year of their life.

Based on the monthly progression of various modes, the following parameters were obtained by applying Von Bertalanffy's equation.

L_∞	113.8 mm	132.7 mm
k	0.16	0.11
t_o	2.87	1.49

The size at different ages has also been estimated and is given in Table 2 together with the average size at the respective ages. These values were found to be more or less similar and thus confirm the length attained at different ages mentioned earlier. The differential growth in sexes is also evident from these values. Kurup and Rao (1974) observed that the estimated size for males and females was 91/98 and 117/123 mm at the end of one and two years respectively.
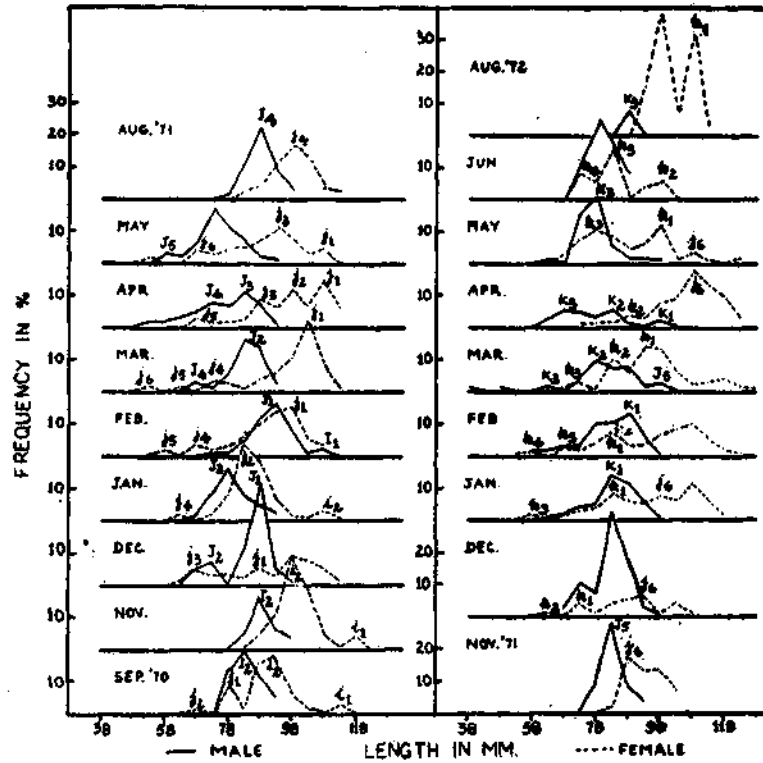
FIG. 5. Length frequency of *P. stylifera* during 1970-72.

AGE COMPOSITION

The abundance of age groups (catch/boat day in numbers) during the different years, according to sexes, is given in Table 3. It is apparent that the fishery in respect of males was constituted by the late 0-year class throughout. In the case of females, it was observed that during 1964-65 and 1966-67 one year class predominated whereas in the remaining years the late 0-year class was dominant.

MEAN LENGTH

The values of mean length for the different years are given in Table 4. During 1963-64, 1966-67 and 1970-71 when the fishery was poor the mean length of males and females varied from 80.5 to 83.4 mm and 87.9 to 95.3 mm respectively, whereas, when the fishery was a success as in 1965-66, 1967-68 and 1971-72, the corresponding values were 79.2 to 85.4 mm and 93.1-96.2 mm. Since the mean length did not bear any relation to the fluctuations of the fishery, it appeared that the changes in mean length were only due to natural variations.

TABLE 2A. *Estimated size (in mm) of* P. stylifera *at different age.*

Age in months	Male		Female	
	Estimated size	Average size (from Table below)	Estimated size	Average size (From Table below)
12	87.4	85.2	90.9	89.5
18	103.7	103.0	111.1	108.0
24	109.9	—	121.5	—

TABLE 2B. *Estimated age in months at various sizes, from the monthly progression of modes.*

Male Average size (mm): 43.0 — — 58.0 63.0 68.0 73.6 78.6 81.3 85.2 89.1 93.8 96.3 98.0 100.5 103.0 — 103.0 — — 100.5

Estimated age in months: 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Female Average size (mm): 43.0 — 53.0 59.4 65.5 68.4 72.6 80.7 84.5 89.5 94.1 96.8 100.1 101.8 107.4 108.0 111.6 114.7 119.7

Estimated age in months: 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

TABLE 3. *Abundance of age groups and mortality rate.*

Year	MALE 0-year (n_0) (upto 90mm)	1-year (n_1) (91-110 mm)	2-year (n_2) (111 mm & above)	Mortality (log en $_1/n_2$)	FEMALE 0-year (n_0) (up to 95mm)	1-year (n_1) (96-120 mm)	2-year (n_2) (121mm & above)	Mortality Log e n_1/n_2
1962-63	2939	165	——	——	1900	683	——	——
1963-64	3414	251	——	——	2291	1778	——	——
1964-65	1161	341	——	——	872	1856	46	3.65
1965-66	2242	670	——	——	2637	1030	10	5.22
1966-67	842	164	——	——	727	790	1	6.93
1967-68	1633	7	——	——	1685	1664	19	3.72
1968-69	1203	127	——	——	1018	1006	11	5.01
1969-70	804	50	9	2.64	883	905	24	3.73
1970-71	560	45	——	——	401	413	——	——
1971-72	3341	232	——	——	2441	1915	76	1.70

Average 4.28

TABLE 4. *Mean Length (in mm) of* P. stylifera.

Year	1962-63	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72
Male	80.9	80.9	85.3	84.8	83.4	85.4	82.4	81.6	80.6	79.2
Female	87.9	91.3	99.3	96.2	95.3	95.9	95.1	96.8	93.9	93.1

TABLE 5. *Sex distribution of* P. stylifera *(Male in percentage).*

Month/ Year	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Annual
1962-63	——	——	38.9	43.3	48.4	60.4	71.9	48.8	46.1	——	——	——	54.6
1963-64	——	49.2	60.4	52.0	48.3	42.2	45.7	40.0	46.6	——	54.4	——	47.4
1964-65	——	——	47.4	60.3	21.9	38.0	31.3	31.0	40.3	——	——	41.7	35.7
1965-66	31.8	54.1	37.6	33.5	39.0	61.9	51.9	31.2	32.4	——	——	——	44.1
1966-67	——	——	32.2	46.4	43.7	37.4	56.0	37.1	34.5	——	——	——	39.8
1967-68	——	28.9	44.4	54.5	41.0	39.0	44.9	36.1	20.3	——	——	——	40.0
1968-69	——	——	20.7	40.9	39.0	47.0	57.2	44.2	30.0	——	——	——	39.5
1969-70	16.1	——	37.7	26.2	42.0	35.6	34.3	12.0	34.6	——	——	——	31.5
1970-71	48.1	——	28.9	57.6	38.5	41.5	40.4	41.8	48.2	——	——	46.6	42.6
1971-72	——	——	48.6	73.1	41.1	49.2	34.4	27.3	47.4	61.0	——	——	44.6

TABLE 6. *Monthwise occurrence of mature females (in percentage) during the diffrent years.*

	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug
1962-63	—	—	—	Nil	50.0	17.6	22.7	49.1	45.6	—	—	—
1963-64	—	30.0	20.0	30.0	19.5	17.0	21.0	27.6	30.7	—	Nil	—
1964-65	—	—	19.5	51.8	27.8	18.2	37.8	27.6	30.7	—	—	7.1
1965-66	13.3	Nil	22.1	43.0	14.1	24.1	13.0	20.7	21.1	—	—	—
1966-67	—	—	41.9	10.6	18.0	52.2	33.3	36.7	45.3	—	—	—
1967-68	—	44.0	14.0	6.4	1.7	15.8	34.3	33.3	25.9	—	—	—
1968-69	—	—	14.3	18.7	16.0	22.0	22.0	28.5	35.7	—	—	—
1969-70	16.1	—	46.5	36.3	21.5	16.7	31.3	30.6	12.2	—	—	—
1970-71	Nil	—	28.0	22.8	14.3	16.4	50.7	41.1	57.0	—	—	—
1971-72	—	—	2.7	10.8	27.8	33.3	9.4	25.0	8.4	—	—	Nil

SEX RATIO AND MATURITY

The proportion of sexes based on the estimated members during the different seasons is given in Table 5. Females were preponderating in all the years except 1962-63. The monthwise distribution of sexes indicated that males were more during December and March in a few years weheras females predominated in all the other months in most of the years. George and Rao (1967) noticed differential sex ratio in the Cochin area suggestive of segregated sex movements for breeding.

Mature females were present in almost all the months (Table 6), thereby indicating the year-round breeding as noticed by Rao (1968). Percentage of mature females was high during November-December and April-May, which represented the peak period of breeding activity. The smallest mature female measured 71 mm during the present study. Kagwade (1980) recorded 76 mm as the minimum size of mature females and 105.5 mm as the size at which 50% of the female population attains maturity in the Bombay waters.

MORALITY RATE

Since the 0-year class was not fully represented in the fishery, the total instantaneous rate of morality could be calculated only between one and two year olds. The estimated values varied considerably from year to year (Table 3). It was of interest to note that among males, the second year group was absent except during 1969-70 when the mortality rate was estimated to be 2.64. For females, the average annual instantaneous mortality rate was calculated to be 4.28.

ACKNOWLEDGEMENTS

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