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Growth of kiddy shrimp, *Parapenaeopsis stylifera* (H. Milne Edwards,1837) along Saurashtra coast

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ABSTRACT

Age and growth of kiddy shrimp, *Parapenaeopsis stylifera* was investigated during September, 1995-May, 2000 from Veraval Fisheries Harbour. The average annual catch of the species during 1996-1999 was 1,940 t, which formed about 45% of the total penaeid shrimp landing. The species was caught throughout the fishing season, with a major peak during October-January. The total length ranged from 56 to 108 mm in males and from 56 to 140mm in females. Males and females of *P. stylifera* attain a total length of 96 mm and 111 mm respectively at the end of one year. The size at maturity of the female is estimated at 93 mm which is attained in 9 months.

Introduction

Parapenaeopsis stylifera, one of the small shrimp species with high commercial value is widely distributed in Indian seas. It is a coastal species but known to occur up to 90 m depth in the western Indian Ocean (Miquel, 1984). In Indian waters *P. stylifera* is most abundant from Gujarat to Kerala coast. Along the southern most part of west coast and in the east coast it is caught in lesser quantity. The species forms about 20% of the penaeid shrimp fishery of the country and biology of the species has been extensively studied from south west coast of India. From the north west coast of India similar studies were carried out by Ramamurty (1994) from Saurashtra waters and Mohamed (1967) and Paralkar (1990) from Bombay waters. In this context, the contributions made by Zupanovic and Mohinuddin (1973) based on their studies in Pakistan waters are also worth mentioning.

Materials and methods

Data on catch, effort and species composition by weight of *P.stylifere* were collected during September, 1995- May, 2000 from Bhidia and 'Old light house' landing centres of Veraval Fisheries Harbour. Collections were made twice a week and monthly estimates were made as per the method described by Alagaraja (1984). Length (total length) frequency data for the calendar years 1996 - 1999 were grouped in 5mm class intervals. For this purpose, "the modal class progression analysis" was used. The modes were traced up to three months and these modes were used for Ford-Walford plot to estimate $L\infty$ and K. The starting mode is taken as l_t and mode after three months is taken as l_{t+1}. l_{t+1}

is plotted against $l_{t.}$ to estimate L∝ and K.

L∝ is estimated from the equation:

L∝ = a/(1-b);

K is estimated with the equation:

$K = \log_e(1/b)$.

The estimation of growth parameters L∝ and K was carried out with ELEFAN I routine available in computer aided FiSAT software package. t_0 was calculated by using Pauly's equation (1979), where

Log (-to) = -0.392 - 0.275 log L∝-1.038 K

The length attained by males and females of *P.stylifera* at age is estimated using von Bertalanffy growth formula (von Bertalanffy, 1938)

$$lt = L\infty\ (1 - e^{-K(t - t_0)})$$

where L∝ is the asymptotic length, K = growth coefficient, t_0 = the theoretical age when the length is zero and *lt,* the length at age.

The minimum size at maturity (50%) of female was found by plotting the frequency of the percentage of maturity (maturing, mature and spent-resting stage) starting from smallest length of mature females.

Results

Fishery

Veraval, one of the biggest fishing harbours of India accounts for about 34% of the marine fish landing of Gujarat state. Trawling season starts from September and extends up to May and in some years up to June. From June to August, fishing is closed for mechanised fishing boats. The maximum landing of *P. stylifera* was observed during post monsoon season (Fig.1) from September to January.

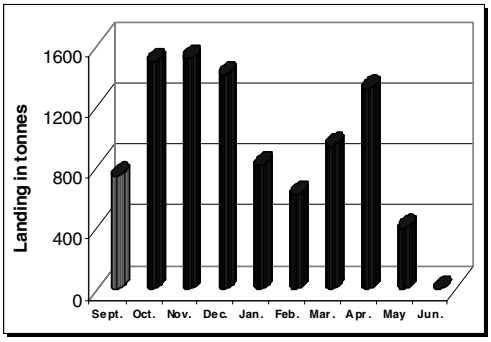

Fig.1. Average monthly landing of *P. stylifera* at Veraval fisheries harbour during 1996-1999

Size distribution

The length ranged from 56 to 108 mm (TL) in males and from 56 to 140 mm (TL) in females. The fishery was mainly supported by males of 85-95 mm size groups and females of 95-110 mm size groups . Detailed monthly length-range and mean sizes are given in Fig.2. Smaller sized shrimps of 56- 70 mm class in males and 56-70 mm size groups in females were seen during May- June and September –November . The annual mean sizes of females of *P. stylifera* during 1996, 1997, 1998 and 1999 were 109.5 mm, 103.4 mm , 102.4 mm and 103.2 mm respectively thus showing a reduction in mean size during the period of study.

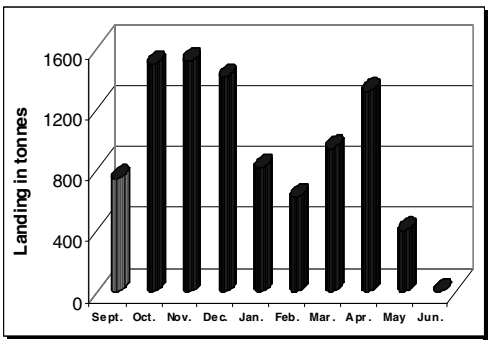

Fig. 2. Estimation of size at maturity (50%) of *P. stylifera* females landed at Veraval fisheries harbour during 1996-1999

Growth parameters

The size group represented in the *P.stylifera* fishery of Saurashtra coast is found to be distinctly different from the size range observed along south west coast of India, where males > 95mm and females > 125mm in total length are very rare in the fishery. Along Saurashtra coast, this size group is regularly represented in the landings. To compare the growth parameters of *P. stylifera* of Saurashtra coast with that of south west coast of India, a detailed study on growth parameters, L∝ (the asymptotic length) and K (the growth coefficient) was undertaken. For this purpose, "the modal class progression method" was used.

Modes selected for growth estimation of females and males of *P.stylifera* by Ford-Walford Plot are

TABLE 1: *Modes selected for growth estimation by Ford-Walford plot in* P. stylifera *females.*

S.No	Initial mode			Final mode		
	Modal length (mm)	Month	Year	Modal length (mm)	Month	Year
1	58	October	1997	93	January	1998
2	73	October	1996	98	January	1997
3	83	September	1998	108	December	1998
4	93	January	1999	113	April	1999
5	98	December	1998	118	March	1999

TABLE 2: *Modes selected for growth estimation by Ford-Walford plot in* P. stylifera *males.*

S.No	Initial mode			Final mode		
	Modal length (mm)	Month	Year	Modal length (mm)	Month	Year
1	58	June	1999	83	September	1999
2	63	October	1997	88	January	1998
3	68	October	1996	93	January	1997
4	73	February	1996	93	May	1996
5	78	December	1998	98	March	1999

TABLE 3: *The estimated growth in length (mm) attained by* P. stylifera *males and females by applying growth parameters obtained from different methods.*

	By Ford- Walford plot		By FiSAT (ELEFAN I method)	
	Female L∝=149 K=1.87 t_0= - 0.0014	Male L∝=145 K=1.43 t_0= - 0.0004	Female L∝=147 K=1.41 t_0= - 0.0014	Male L∝=120 K=1.59 t_0= - 0.0004
Month	Length (mm)	Length (mm)	Length (mm)	Length (mm)
3	56	44	44	40
6	91	74	74	66
9	112	96	96	84
12	126	110	111	96
15	135	121	121	104
18	140	128	129	109
22	143	133	135	113
24	146	137	138	115

given in the Table1 and Table 2. L∝ is estimated at 149 mm for females and 145 mm for males. K is estimated as 0.47 for three months and 1.87 for one year for females. Similarly K value for males was also estimated as 0.36 for three months and 1.43 for one year. By using Pauly's equation (1979), t_0 was estimated to be -0.0014 for males and -0.0004 for females.

The length- frequency data was analysed using ELEFAN I from FiSAT routine. The growth parameters, L∝ is estimated to be 120 mm for males and 147 mm in females and K (annual) as 1.41 and 1.59 respectively.

By assuming that the shrimps follow von Bertalanffy growth pattern, the estimated growth in terms length (mm) for males and females of *P. stylifera* corresponding to age in months are given in Table 3. Considering the observed maximum values for males and females of the species from the landings (140mm for females and 108mm for males) the L∝ value derived from the ELEFAN I is looking more acceptable than those observed from Ford- Walford method. L∝ and K values derived from ELEFAN I routine are taken for the growth estimation of the species for present study. It was estimated that females and males of *P. stylifera* reach a total length of 111mm and 96 mm respectively at the end of one year. The largest female observed in the fishery (140 mm) is having an age of 2 years and the largest male (108 mm) is having an age of 1 ¾ years.

Size and age at maturity

Males in the size range of 56-105 mm were mature. Spawners (late maturing and mature females) were landed throughout the period of trawl fishery with two peaks, one during November-February and another during April – May. In the present study, the size at first maturity (50%) was estimated at 93mm (Fig. 2). As per the present estimate of L∝ and K values, the 50% of the females attain maturity in 9 months.

Discussion

The growth parameters, L∝ and K estimated for males and females in the present study are comparatively higher than the estimates made by Suseelan and Rajan (1987) based on their studies in southwest coast of India. They estimated L∝ and K as 135 mm and 1.05 for females and 108 mm and 1.19 for males of *P. stylifera* respectively which agrees well with the estimates made by Kurup and Rao(1974) and Ramamurty (1980) for the same species along southwest coast of India. The present estimates made by various methods for the growth parameters of *P. stylifera* along Saurashtra coast, consistently showed higher values of L∝ and K than those obtained from southwest coast of India. ELEFAN I method is described as more reliable and highly recommended objective method for studying single species dynamics in a multi species context (Pauly, 1982). During the present study, among the different estimates made for L∝, a value of 147 mm for females and 120mm for males estimated through ELEFAN I method in FiSAT routine is more reasonable considering the largest size of males (108 mm) and females (140 mm) observed in the fishery. It was estimated (through FiSAT routine) that males and females of *P. stylifera* reach a length of 84 and 96 mm respectively at the end of 9 months of the life. Mohamed (1967) stated that along northwest coast of India *P.stylifera* attains a length of 90 to 100 mm within 9 months. In the light of these studies, it can be assumed that *P. stylifera* catch of Veraval during the period of study was

mainly composed of zero year class. Paralkar (1990) estimated much higher $L\infty$ values (160.5mm for females and 132.7mm for males) in Bombay waters and she estimated that *P .stylifera* males and females grow to a length of 71.8mm and 88.4 mm respectively in one year.

Ramamurthy (1994) reported that along northwest coast of India, *P. stylifera* breeds throughout the year with a major peak during August- November and a secondary peak during February –April. Dineshbabu (2003), while studying the biology of the species, observed that spawners were landed throughout the year with two peaks, during November-January and April-May. Mohamed (1967) recorded maximum fresh recruits during September and October in Bombay waters and opined that recruits of November (51-55 mm and 61-65 mm size classes) might have born during May or June and might have completed 5 to 6 months of growth. In the present study fresh recruits of 55-60 mm size group were found to show a minor mode during May-June and September- November. With the present estimates of growth parameters, it can be considered that these recruits have completed 5 to 6 months of growth and may correspond to respective peak spawning seasons of November-January and April-May of the previous year. Along the coast the species is caught throughout the fishing season in appreciable quantity. There were two peaks in the landing, a major peak during October-January and a secondary peak of lesser magnitude during April. Similar observations were made by Kunju (1967) and Ramamurty (1994) in Saurashtra waters, Mohamed (1967) in Bombay waters and Zupanovic and Mohinuddin (1973) in Pakistan waters.

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