

Size at Maturity in the Male Crabs of *Portunus sanguinolentus* and *P. pelagicus*

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The onset of sexual maturity in the male *Portunus sanguinolentus* occurred in the size range 81-85 mm carapace width while in *P. pelagicus* it was in the range of 86-90 mm carapace width. 50% sexual maturity was observed in *P. sanguinolentus* and *P. pelagicus* males at 100 and 98 mm carapace width respectively. A highly significant ($P < 0.001$) correlation coefficient (r) values are obtained between chela allometry and carapace measurements.

Determination of size at maturity, serves as an important tool in the studies of population dynamics, resource management and aquaculture. Haley (1969) and Fielding & Haley (1976) have made a detailed study on size at reproductive maturity of Konar crab *Raina vanina* and ghost crab, *Ocypoda quadrata*. The size at maturity of crabs, *Barytelphusa guarini* (Gangotri *et al.*, 1971) and *Paralithodes camtschatica* (Powel & Nickerson, 1965; Powl *et al.*, 1973) have also been extensively studied. Although the species of *Portunus* are considered as the most important amongst the 8 edible Indian crab species (Rao *et al.*, 1973), the aspects of size at maturity are rarely dealt (Radhakrishnan, 1979)

Materials and Methods

The male crabs (with 'V' shaped abdomen) were collected from trawlers and shore seines operated in inshore waters of Karwar ($14^{\circ}46'54''$ N and $74^{\circ}03'00''$ E to $14^{\circ}54'25''$ N and $74^{\circ}19'30''$ E) during June to December 1987. The crabs thus collected were immediately brought to laboratory and washed thoroughly. The body weight was determined to the nearest gram and then gonadosomatic index (GSI) (drained gonad weight as percentage of total body weight) was calculated.

Classification of maturity stages of males was based on the colour of the gonads, GSI and size of the gonads with respect of space

occupied inside the haemocoel (Edwards, 1979; Shanmugham & Bensam, 1980). Size at maturity was determined by tabulating the percentage of crabs in different stages against the carapace width (size) (Edwards, 1979)

Besides gonadal observations, certain morphological characters are also considered as secondary sexual characters to estimate the size at first maturity of male crabs (Hartnoll, 1968; Watson, 1970; Haley, 1973), Hartnoll (1974) while working extensively on brachyurans found that there were some differential growth patterns in chela allometry

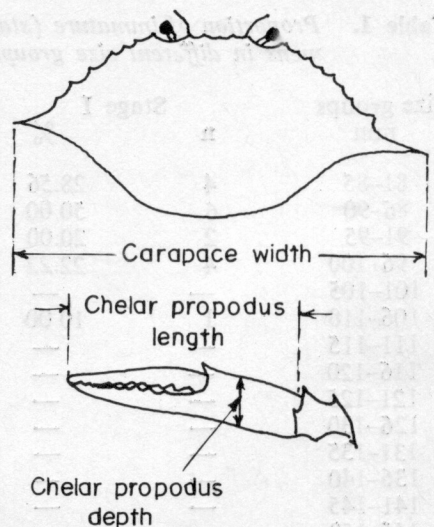


Fig. 1. Morphometric characters

during ontogeny of male crabs and hence these characters were treated as secondary sexual characters. The same measurements as shown in Fig. 1 were made, using dial calipers to determine whether any relation between morphology and maturity existed in *Portunus* spp.

Morphometric data were plotted and the regression lines were fitted by least square method as suming a model of $Y = a + bX$ where X = carapace width and Y the variable being measured. Correlation coefficients (r) were also employed to know the pattern of association of the parameters involved (Snedecor & Cochran, 1967).

Results and Discussion

The minimum size of *P. sanguinolentus* attained maturity was 80.2 mm. The proportion of different stages of maturity between 81 and 150 mm varied drastically (Table 1). In all, out of 166 adult crabs examined only 10.24% of the crabs were immature, showing stage I gonads, while 19.28% were maturing (stage II) and 70.48% (stage III) were mature (Table 1). The percentage of maturity was fluctuating between 28.56 and 90% among 81–125 mm size groups. From 125 mm onwards all the crabs tended to be absolutely mature (100% maturity). The 50% sexual

maturity in *P. sanguinolentus* was noticed at 100 mm carapace width (CW) (Fig. 2).

The minimum size at which *P. pelagicus* possessed the mature gonads (stage III) was 86.80 mm CW. On contrary to *P. sanguinolentus*, the percentage of maturity had gradually increased in *P. pelagicus* till 110 mm, and thereafter there were no adult specimens of *P. pelagicus* which had immature (stage I) gonads (Table 2). Absolute maturity (100%) was noticed attaining 130 mm CW and it continued to remain throughout the size range of 131–185 mm. On an average, out of 149 adult crabs examined 12.75% were immature while 16.21 and 71.14% were maturing and mature respectively. The 50% sexual maturity in *P. pelagicus* was observed at 98 mm CW (Fig. 2).

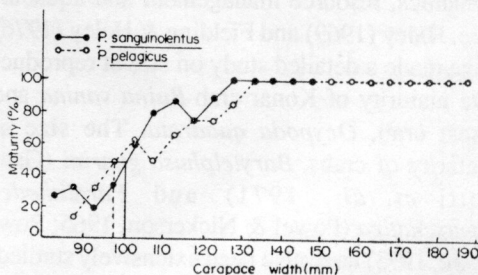


Fig. 2. Percentage of mature males in different size groups with 50% maturity

Table 1. Proportion of immature (stage I), maturing (stage II) and mature (stage III) specimens in different size groups of *P. sanguinolentus*

Size groups mm	Stage I		Stage II		Stage III		Total
	n	%	n	%	n	%	
81–85	4	28.56	6	42.84	4	28.56	14
86–90	6	50.00	2	16.66	4	33.32	12
91–95	2	20.00	6	60.00	2	20.00	10
96–100	4	22.22	8	44.44	6	33.33	18
101–105	—	—	4	40.00	6	60.00	10
106–110	1	10.00	1	10.00	8	80.00	10
111–115	—	—	2	12.50	14	87.50	16
116–120	—	—	2	25.00	6	75.00	8
121–125	—	—	1	10.00	9	90.00	10
126–130	—	—	—	—	11	100.00	11
131–135	—	—	—	—	9	100.00	9
136–140	—	—	—	—	12	100.00	12
141–145	—	—	—	—	14	100.00	14
146–150	—	—	—	—	12	100.00	12
Total & %	17	10.24	32	19.28	117	70.48	166

In Figs. 3 and 4, the depth and length of the chelar propodus are plotted against carapace width for *P. sanguinolentus* and *P. pelagicus* respectively. For each measurement the regression lines were fitted for immature and mature forms. A significant relationship was found ($P < 0.001$) between chela allometry and carapace measurements. The growth of the chela in both immature and mature crabs of both species was generally slower than the body (b values less than the unity) indicating negative allometric growth patterns. Gonadal observations (Tables 1 and 2) and a clear transition between allometric growth of chela and carapace as indicated in Figs. 3 and 4, suggest that the onset of maturity occurred at 81–85 and 86–90 mm CW range in *P. sanguinolentus* and *P. pelagicus* respectively.

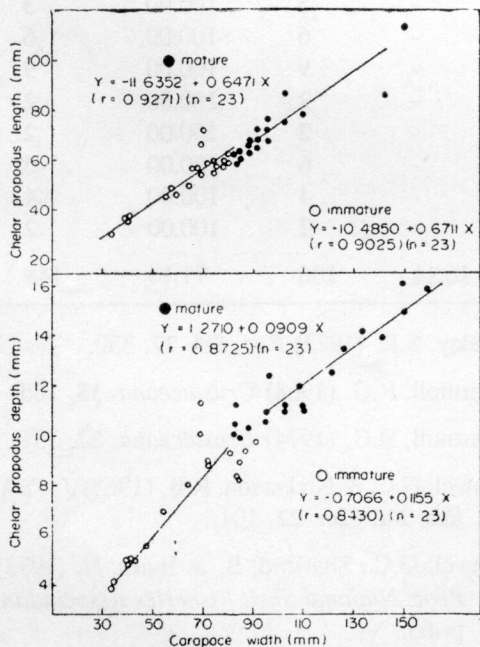


Fig. 3. Relationship between chela allometry and carapace measurement in *P. sanguinolentus*

The growth rate of any organ generally changes during ontogeny and the growth constant is definite within each phase of the growth. Many investigations have encompassed one pre-puberty and another post-puberty phase in decapod crustaceans (Watson, 1970; Brown & Powel, 1972; Hartnoll, 1968). Hartnoll (1974) while reviewing

the existing literature on variations in growth patterns in crabs, observed a precise transition from pre-puberty to the post-puberty phase thereby bringing about the abrupt changes in certain morphological characters such as chela measurements in male crabs at pubertal moult. It is evident from the present results that abnormal increment may have taken place at 81–85 mm CW in *P. sanguinolentus* and at 86.90 mm CW in *P. pelagicus*, depicting a clear transition or break up in the above said parameters (Figs. 3 and 4) and was also further confirmed with the incidence of mature (stage III) gonads in the corresponding size groups. This unusual increment of chela allometry at puberty however seems to have an adaptive significance in mate selection and/or aggressive interactions involved in competition for food and/or space (Hartnoll, 1974). Although it appeared that pubertal moult was indispensable to initiate the gonadal development, unlike that of tanner crabs, *Chionoecetes bairdi* (Brown & Powel, 1972), further moulting after puberty in *Portunus* spp. did not seem to affect the state of maturity, as all the adult crabs examined irrespective of the moult state

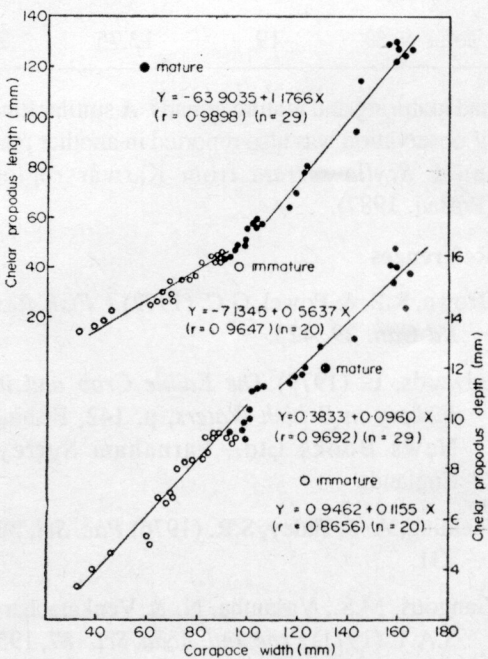


Fig. 4. Relationship between chela allometry and carapace measurements in *P. pelagicus*

Table 2. Proportion of immature (stage I), maturing (stage II) and mature (stage III) specimens in different size groups of *P. pelagicus*.

Size groups mm	Stage I		Stage II		Stage III		Total
	n	%	n	%	n	%	
86-90	8	57.14	4	28.57	2	1.429	14
91-95	6	50.00	2	16.66	4	33.34	12
96-100	2	25.00	4	25.00	4	50.00	8
101-110	2	12.50	2	25.00	10	62.50	16
106-110	1	16.60	2	33.33	3	49.99	6
111-115	-	-	2	33.33	4	66.66	6
116-120	-	-	4	25.00	12	75.00	16
121-125	-	-	2	25.00	6	75.00	8
126-130	-	-	2	14.29	12	85.71	14
131-135	-	-	-	-	2	100.00	2
136-140	-	-	-	-	4	100.00	4
141-145	-	-	-	-	9	100.00	9
146-150	-	-	-	-	3	100.00	3
151-155	-	-	-	-	6	100.00	6
156-160	-	-	-	-	9	100.00	9
161-165	-	-	-	-	2	100.00	2
166-170	-	-	-	-	2	100.00	2
171-175	-	-	-	-	6	100.00	6
176-180	-	-	-	-	4	100.00	4
181-185	-	-	-	-	2	100.00	2
Total & %	19	12.75	24	16.11	106	71.14	149

had maturing and mature gonads. A similar kind of observation was also reported in another portunid. *Scylla serrata* from Karwar region (Prasad, 1987).

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was led to the pond through a sluice provided with 18 meshes such that water in order to prevent entry of predators. Water level in the 1.32 hectare pond was maintained at 0.3 to 0.9 metre depth. Daily exchange of 10% water was ensured except during June-July. Prior to stocking with juveniles the pond was filled with slaked lime at 132 kg/ha to become to eradicate pests. Further, both organic and inorganic were used. Raw cow dung @ 1200 kg/ha and chemical fertilizers namely urea @ 50 kg/ha and 15:15:15 N:P:K:DAP @ 30 kg/ha were used in a monthly schedule to insure and sustain organic food production. The prawns were fed with TOMCO shrimp feed pellets @ 10-20% of body weight of biomass in pond assessed by monthly sampling and food was always ensured in excess of requirements. The feeding was done by spreading them on suspended feeding trays. Monthly sampling of the prawns was done using cast net of 12 mm mesh size. Hydrological data of pond was recorded during the sampling. The salinity was measured in 25 (Barnes) by a 10 ml brand hydrometer containing it into two per thousand relating to standard tables prepared using 15 ml syringe method of salinity analysis. The pH was measured using a digital pH meter having 0.1 accuracy.

The selection of quick growing species is an essential aspect of intensive prawn farming. Among the penaeid prawn species the green tiger prawn, *Penaeus monodon* (Fabricius) and the Indian white shrimp *Penaeus indicus* (M. Edwards) are preferred due to the fast growth to marketable size within short period of 90 to 180 days giving two crops in a year. These species have been reported to tolerate high salinity conditions and achieve reasonable growth within short duration (Rao & Raj 1982). The Gulf of Kutch is characterized by higher salinity compared to other coastal areas of the country. Therefore, in order to study their suitability in farming in ponds fully integrated with solar salt works along the coast, an experimental culture for 180 days was conducted from April 1988 to September 1988, using early juveniles of both species. The observations are reported in this paper.

Materials and Methods

35,989 early juveniles of *P. monodon* and 11,500 early juveniles of *P. indicus* raised from post larvae of the species obtained from elsewhere stocked in a pond within salt works. Sea water pumped in from the mangrove canal and passed through settling tanks