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

J. REEBY, P. N. PRASAD and M. S. KUSUMA
Department of Marine Biology, Karnatak University P.G. Centre, Kodibag, Karwar - 581 303.

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 carapase width. 50% sexual maturity was observed in *P. sanguinolentus* and *P. pelagicus* males at 100 and 98 mm carapase 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°46'54" N and 74°03' 00" E to 14°54'25" N and 74°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

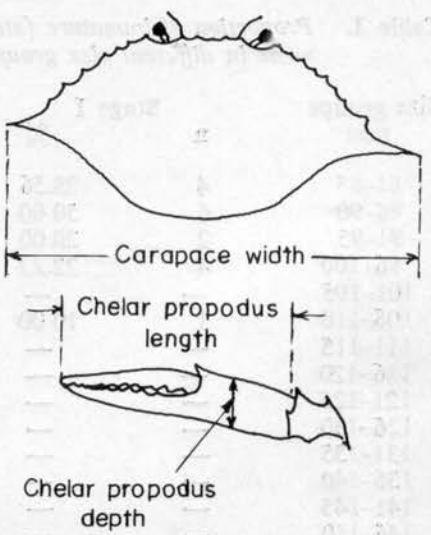

Fig. 1. Morphometric characters

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 $Y = a + b X$ 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 nature 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). Absoute 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).

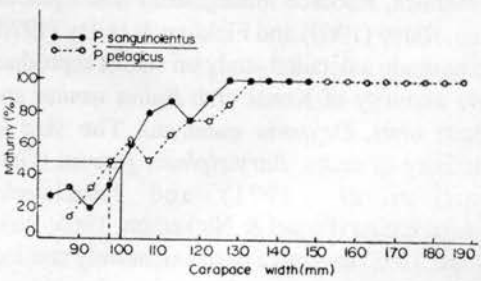

Fig. 2. Percentage of mature males in different size groups with 50% maturity

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 carpace 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.

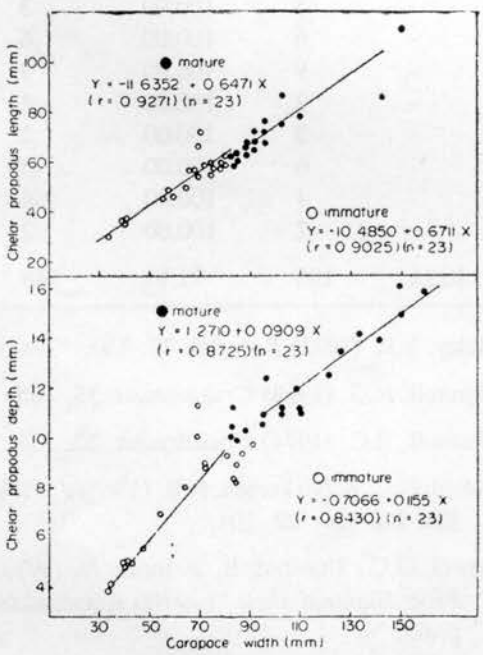

Fig. 3. Relationship between chela allometry and carapace measurement in *P. sanguinolentus*

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, *Chinoecetes 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

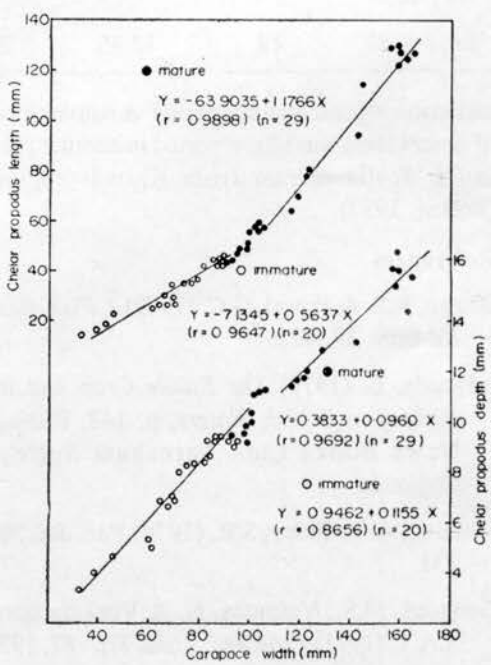

Fig. 4. Relationship between chela allometry and carapace measurements in *P. pelagicus*

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

Size groups	Stage I		Stage II		Stage III		Total
mm	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).

References

Brown, R.B. & Powel, G.C. (1972) *J. Fish. Res. Bd Can.* **29**, 423.

Edwards, E. (1979) *The Edible Crab and its Fishery in British Waters*, p. 142, Fishing News Books Ltd., Farnaham Surrey, England.

Fielding, A. & Haley, S.R. (1976) *Pac. Sci.* **30**, 131.

Gangotri, M.S., Vasantha, N. & Venkatachari, S.A.T. (1971) *Proc. Ind. Acad. Sci.* **87**, 195.

Haley, S.R. (1969) *Crustaceana* **17**, 285

Haley, S.R. (1973) *Pac. Sci.* **27**, 350.

Hartnoll, R.G. (1968) *Crustaceana*, **15**, 165.

Hartnoll, R.G. (1974) *Crustaceana*, **27**, 131.

Powel, G.C. & Nickerson, R.B. (1965) *J. Fish. Res. Bd. Can.* **22**, 101.

Powel, G.C., Shafford, B. & Jones, N. (1973) *Proc. National Shell Fisheries Association*, p. 63.

Prasad, P.N. (1987) *Studies on Some Biological Aspects of the Mud Crab Scylla serrata (Forskal) of Karwar*, p. 252 Ph.D. Thesis submitted to Karnatak University.

Radhakrishnan, C.K. (1979) *Studies on the Portunid Crabs of Porto Novo (Crustacea: Decapoda: Portunidae)* p. 290 Ph.D. Thesis submitted to Annamalai University.

Rao, P.V., Thomas, M.M. & Rao, G.S. (1973) *Proc. Symp. Living Resources of Seas Around India,* p. 581, spl. publ. CMFRI, Cochin.

Shanmugam, S. & Bensam, P. (1980) *Ind. J. Fish.* **27,** 102.

Snedecor, G.W. & Cochran, W.G. (1967) *Statistical Methods,* p. 435, Oxford & IBH Publishing Co., New Delhi.

Watson, J. (1970) *J. Fish. Res. Bd. Can.* **27,** 1607.