

# Spawning Biology of Two Marine Portunid Crabs, *Portunus (Portunus) sanguinolentus* (Herbst) and *Portunus (Portunus) pelagicus* (Linnaeus) from the Karnataka Coast

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## Abstract

The mean size at sexual maturity in males and females at the 50% level were 97 mm and 92 mm in *P. (P.) sanguinolentus* and 105 mm and 99 mm in *P. (P.) pelagicus*. Peak mating activity was observed during December-March in the former and during December-February in the latter species. The spawning season is prolonged from August to May with peak activity during December-February in *P. (P.) sanguinolentus*. In *P. (P.) pelagicus* the spawning season is extended from August to May with maximum intensity during January-February and September. An individual female may spawn atleast 2-3 times in a spawning season. Spawning population was mainly supported by sizes ranging 100 - 130 mm in the former and 100-160 mm in the latter species. Peak hatching was observed during December-May in *P. (P.) sanguinolentus* and during March-May *P. (P.) pelagicus*.

## Introduction

The information on the spawning biology of *Portunus (Portunus) sanguinolentus* and *P. (P.) pelagicus* is rather fragmentary and limited to the works of Menon (1952), Prasad and Tampi (1953), Chhapgar (1956), George and Nayak (1961), Ryan (1967), Pillay and Nair (1970, 1971, 1976), Sukumaran *et al.*, (1986), Sumpton *et al.*, (1989, 1989a), and Campbell and Fielder (1986). The present study gives an account on the spawning biology of *P. (P.) sanguinolentus* and *P. (P.) pelagicus* from the Karnataka coast on the central west coast of India.

## Material and Methods

Weekly samples of *P. (P.) sanguinolentus* and *P. (P.) pelagicus* caught by different type of gears were taken from Mangalore, Malpe and Karwar - three important fish landing centres in Karnataka during 1992-94 and analysed for carapace width, weight, sex and maturity conditions. For describing the gross maturity stages of ovary, the following stages were recognised. 1) immature virgins, 2) immature resting 3) early maturing, 4) late maturing, 5) mature and 6) spent.

The gonado-somatic index (GSI) was determined by the following formula:

$$\text{GSI} = \frac{\text{weight of the gonad}}{\text{weight of the crab}} \times 100.$$

The size at which 50 % of the crabs found to be mature was taken as the size at sexual maturity. The preponderance of the fully mature and spent females, high values of GSI and the occurrence of ovigerous females in the monthly samples were considered for determining the spawning season, the frequency of spawning and the spawning ground. The developmental stages of eggs on pleopods were grouped into three stages based on gross examination and tabulated monthwise to determine

the time of hatching. It is generally difficult to ascertain the peak mating season of crabs in the natural population. Hence, the mating period could be determined from the occurrence of soft females since mating takes place between hard shelled male and a soft shelled female in portunids and moulting is closely associated with reproduction.

## Results and Discussion

### Size at sexual maturity

It is found that the smallest crab with fully mature ovary measured 78 mm and 82 mm in *P. (P.) sanguinolentus* and *P. (P.) pelagicus* respectively. However, the 50 % level of maturity was attained at a mean size of 92 mm in the former and 99 mm in the latter species.

In males, the smallest mature crab measured 83 mm in *P. (P.) sanguinolentus* and 88 mm in *P. (P.) pelagicus* and the 50 % level of maturity was observed at a mean size of 97.0 mm in the former and 105.0 mm in the latter species. At 130.0 mm cw and above, all males were fully mature including crabs undergoing moult. Sumpton *et al.*, (1989) found that the smallest sexually mature male and female *P. (P.) pelagicus* measured 83.0 mm and 73.0 mm respectively in the Australian waters.

In the present study the smallest crab in berry measured 81 mm cw in *P. (P.) sanguinolentus* and 89 mm cw in *P. (P.) pelagicus*. The smallest berried female of *P. (P.) sanguinolentus* observed by Menon (1952) measured 78 mm cw, whereas George and Nayak (1961) found that the smallest berried crab measured 84 mm cw at Mangalore. In an earlier study, Sukumaran *et al.*, (1986) found that the smallest ovigerous female measured 78 mm cw in the South Kanara waters. The smallest ovigerous female of *P. (P.) pelagicus* observed by

Prasad and Tampi (1953) from Mandapam and Pillay and Nair (1971) from southwest coast of India, measured 92 mm and 95 mm respectively.

### Mating

Soft females of *P.(P.) sanguinolentus* and *P.(P.) pelagicus* were available most of the months in varying proportions with maximum abundance during December-March in the former species and April-May in the latter suggesting peak mating activity during these months. Sumpton *et. al.*, (1989a) reported that April-May is the major mating period in *P.(P.) sanguinolentus* in the Queensland waters of Australia.

### Spawning season

The spawning season is prolonged from November to May, peak activity was recorded during December-February in *P.(P.) sanguinolentus* as evident from high incidence of mature and spent crabs along with maximum values of GSI during this period. The maximum abundance of ovigerous females during the above period was in accordance with the above observation (Table 1). The recruitment of younger juveniles of *P.(P.) sanguinolentus* (20-50 mm cw) into the fishery from October to July with maximum intensity in December-April also suggests prolonged breeding cycle of this species from August to May.

In the case of *P.(P.) pelagicus*, the spawning activity was pronounced during January-February and in September even though mature, spent or berried females were available practically in all months from August to May (Table 2) suggesting prolonged breeding in this species. Maximum values of GSI in September and January-February indicating peak

gonad activity during these months was in conformity with the results obtained by the observation of gonadal stages/ovigerous females in this species. The recruitment of juveniles *P.(P.) pelagicus* (50-80 mm cw) from November to April with maximum intensity during December-January suggests that the breeding activity is extended over several months in this species as in *P.(P.) sanguinolentus*.

Menon (1952) while studying on the biology of *P.(P.) sanguinolentus* observed that the species is breeding during February-April along the Malabar coast. George and Nayak (1961) reported year-round spawning with peak activity during March-April along the Mangalore coast, while Chhapgar (1956) noticed that the crab is breeding throughout the year in the Bombay area. Sukumaran *et al.*, (1986) mentioned that this crab is breeding all through the season with maximum intensity in February and April-May along the South Kanara coast. Ryan (1967) indicated that the Hawaiian population of this species spawn year-round with a peak season from October to February. Pillay and Nair (1970, 1976) found that breeding is almost continuous throughout the year except July with peak activity in February along the southwest coast of India. They (Pillay and Nair, 1976) observed high incidence of ovigerous females in the population with peak in February. According to Campbell and Fielder (1986), *P. sanguinolentus* displayed a single spawning period extending from October to February in the Australian waters.

While studying on the breeding biology of *P.(P.) pelagicus*, Prasad and Tampi (1953) found that the species breeds throughout the year with maximum intensity during September-March in the Mandapam area on the southeast coast

Table 1: Monthwise percentage distribution of various maturity stages of *P.(P.) sanguinolentus* females in the trawler catches in Karnataka

Month	Sample size	Stage I (IV)	Stage II (R)	Stage III (EM)	Stage IV (LM)	Stage V (M)	Stage VI (SP)	Berried	GSI
Oct. 92	2	0	100	0	0	0	0	-	-
Nov.	104	33.6	37.5	26.8	0	0	2.1	-	0.65
Dec	427	7	17.1	33.4	18.3	6.3	17.9	16.6	2.38
Jan. 93	350	0	20.8	29.2	13.1	6.6	30.3	24.2	5.99
Feb.	265	14.9	33.1	26.2	12.9	6.6	6.3	18.2	5.52
Mar.	225	32.3	38.8	16.5	6.7	0.6	5.1	4.1	2.36
Apr.	218	18	38	19.2	16.5	4.1	4.2	14.5	3.11
May	124	17.6	42.6	11.9	17.7	5.7	4.5	17.8	2.53
Sep.	10	0	90	0	0	10	0	10	0
Oct.	3	33.4	33.3	33.3	0	0	0	0	0
Nov.	54	1.9	35.2	33.3	16.7	5.5	7.4	0	1.57
Dec.	221	23.2	40.9	12.3	14	4	5.6	14.7	3.24
Jan. 94	244	16.4	42.6	11.4	12.6	8.6	8.4	21.2	6.08
Feb.	106	7.2	42	11.4	21	18.4	0	18.3	5.32
Mar.	83	26.5	35.5	14.9	5.4	8	9.7	30	3.61
Apr.	114	35	29.5	11.5	8.8	11.4	3.8	8.6	3.96
May	89	40.4	26.2	3.4	13.7	13.7	2.6	3.4	3.84
Total	2639	17.3	33.4	20.5	12.6	5.8	10.4		

Size range - 80 - 170 mm cw

IV = immature virgins; IR - immature resting; Em = early maturing; LM = late maturing; M = mature ; SP = spent; berried and gonadosomatic index (GSI) also indicated.

Table 2: Monthwise percentage distribution of various maturity stages of *P.(P.) pelagicus* females in the trawler catches of Karnataka

Month	Sample size	Stage I (IV)	Stage II (R)	Stage III (EM)	Stage IV (LM)	Stage V (M)	Stage VI (SP)	Berried	GSI
Sep. 92	22	4.6	36.4	22.6	31.8	4.6	0	6	5.19
Oct.	23	0	8.8	56.5	21.7	13	0	4.3	2.61
Nov.	0	0	0	0	0	0	0	0	0
Dec.	27	50	18.8	12.5	8.4	0	10.3	5.5	0
Jan. 93	67	14.1	1.6	51.2	26	2.4	4.7	16.8	1.08
Feb	133	48.3	33.2	5.2	7.3	0	6	19.6	2.68
Mar.	149	45.9	43.6	5.3	1.5	1.5	2.2	8.2	1.07
Apr.	171	60.2	33.2	4.6	0.6	0	1.4	0	1.06
May	327	31.6	63.8	2.1	1.6	0	0.8	0.8	0.68
Aug	31	0	74.2	25.8	0	0	0	2.8	0
Sep.	28	7.1	57.1	35.7	0	0	0	1.2	6.36
Nov.	2	50	0	0	50	0	0	0	0
Dec.	27	31.7	41.7	6.6	16.6	0	3.4	14.5	0
Jan. 94	192	18	41.6	16.9	11.8	2.3	9.4	33.5	5.48
Feb	130	24.2	34.7	8.9	9.6	11	11.6	27.4	5.5
Mar.	167	16.3	42.4	4.4	10.3	19.1	7.5	20.5	3.29
Apr.	210	87.5	10.8	0.9	0	0	0.8	0.25	0.63
May	119	60.3	30.8	5.4	0	0	3.5	0	0
Sep.	57	1.8	24.6	28.1	33.1	8.8	3.5	2.9	0
Total	1818	40.8	34.3	9.8	7.3	3.2	4.6	-	-

Size range 80 - 170 mm cw

IV = immature virgins; IR - immature resting; EM = early maturing; LM = late maturing; M = mature ; SP = spent berried and gonadosomatic index (GSI) also indicated.

of India. Pillay and Nair (1973) observed high gonad index in this species for several months from August to March with definite peaks during December-January along the southwest coast of India suggesting peak breeding during that period. The same authors (Pillay and Nair, 1970, 1976), by following the incidence of ovigerous females observed that the breeding in this species is from August to April with peak in January. Dhawan *et al.*, (1976) mentioned that the breeding in *P. (P.) pelagicus* takes place during February-March in the Zuari estuary in Goa. Two peaks in the incidence of gravid females of *P. pelagicus*, one in September and another in February were reported by Campbell and Fielder (1986) from Australian waters.

#### Spawning frequency

The occurrence of maturing and fully mature ovaries in several ovigerous females during December-February in *P. (P.) sanguinolentus* and in January-March in *P. (P.) pelagicus* tends to suggest that these crabs might produce another batch of eggs shortly after the eggs carried in the pleopods are hatched. Since these crabs are having a prolonged breeding season with one or two peaks, it is reasonable to surmise that an individual female may spawn at least 2-3 times in a spawning season. Ryan s (1967) observation that *P. (P.) sanguinolentus* may spawn at least 3 times in a mature instar is in conformity with the present view.

#### Spawning population

All males above 120 mm cw and 130 mm cw were fully

mature in *P. (P.) sanguinolentus* and *P. (P.) pelagicus* respectively, although mature males were available in all sizes above 80 mm cw. Similarly, eventhough spawning females occurred in all sizes above 80 mm cw, pronounced breeding activity was noticed in size groups between 100 and 130 mm in the former and between 100 and 160 mm in the latter species. This has been corroborated by the results obtained by studying the incidence of ovigerous females in relation to size. Sumpton *et al.*, (1989a) are of the opinion that mature females of *P. (P.) sanguinolentus* move into deeper oceanic waters to spawn. The present data, however, indicate that the spawning ground is within the fishing ground itself during the non-monsoon months, although there are some size and sex related segregated movements. This view is based on the occurrence of large number of mature, spent and berried crabs of *P. (P.) sanguinolentus* and *P. (P.) pelagicus* throughout the peak breeding season in otter trawls operating within 40 m depth. Even the shore seines operating in the Karwar bay and the mini trawl operating in the Mangalore estuary caught crabs in berry of both these species, though in fewer numbers, tends to suggest that these crabs may spawn in the coastal waters itself during the non-monsoon months.

The present data clearly suggest that the peak time of fertilization was during December-February in both these species. This view is based on the occurrence of berried crabs in higher proportions coupled with the sudden rise in the incidence of spent females in these months (Tables 1 and 2). Potter *et al.*, (1983) opined that the peak time of fertilization in

this crab was during January and February in the Australian waters.

#### Hatching

It is seen that the eggs on pleopods in highly advanced stage of development (Stage III) was occurring more during December-February and April in the former species and during January-February in the latter suggesting peak hatching in these months. Females which have been recently hatched its eggs on pleopods were often taken in considerable numbers in otter trawls operating from Mangalore, Malpe and Karwar during December-May in *P. (P.) sanguinolentus* and March-May in *P. (P.) pelagicus*.

The occurrence of juveniles of *P. (P.) sanguinolentus* (20-50 mm cw) in large numbers in trawl and shore seines, operating in the nearshore waters practically in all months with maximum abundance during December-April, indicates that hatching may possibly be taking place in shallow coastal waters itself. Similarly, the occurrence of brachyuran zoea in fairly large numbers during February-April in the coastal waters of Mangalore as reported by George and Nayak (1961) tends to suggest that these crabs are not moving far away from the fishing ground for hatching their eggs. In contrast, the occurrence of juveniles of *P. (P.) pelagicus* (50-80 mm cw) in small numbers and the rarity of younger juveniles (20-50 mm cw) in trawl, mini trawl (estuary) and shore seine catches throughout the year indicate that the berried crabs particularly the larger ones, probably move to more saline deeper waters for hatching. The low incidence of ovigerous crabs in comparison to that of *P. (P.) sanguinolentus* can well be explained by the offshore migratory behaviour of this crab for hatching.

It is seen that the breeding activity in *P. (P.) sanguinolentus* and *P. (P.) pelagicus* is found increasing from December to late February or early March, reduced sharply in April and May and low in the rest of the months except perhaps another peak in September in the latter species. The steady increase in breeding activity during December-March may be attributed to the increase in temperature, salinity and availability of food.

It is possible that the adult population which has moved into deeper waters during monsoon months due to low saline conditions prevailing in the nearshore waters, may be breeding in the deeper waters during monsoon months (August-September), where the hydrological conditions may be more favourable resulting in recruitment of younger juveniles into the fishery in October/November period. The high incidence of ovigerous and mature/spent females of *P. (P.) pelagicus* in the samples obtained in September is also in conformity with this view.

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