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Food and feeding of *Portunus (Portunus) sanguinolentus* (Herbst) and *Portunus (Portunus) pelagicus* (Linnaeus) (Brachyura: Portunidae) along Karnataka coast

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The diet of *Portunus (Portunus) sanguinolentus* and *P.(P.) pelagicus* mainly consisted of crustaceans, fishes, molluscs, large quantity of unidentified matter and debris. Quantitative analysis of the gut contents revealed that crustaceans contributed to 47.1 % and 42.6 %, fish remains 29.0 % and 20.4 %, molluscs 5.7% and 20.0 % , detritus 4.9 % and 4.7 % respectively of the gut content by volume in both species respectively. The study indicated that these crabs are primarily predators of sessile and slow moving benthic macro invertebrates. *P.(P.) pelagicus* had a strong preference for bivalves as food. The presence of detritus and unidentified items in the stomachs examined suggested that these crabs are detrivorous consuming fresh and decaying flesh of all kinds. The sexwise, sizewise and seasonal variability of diet in these crabs may be largely due to relative abundance of prey species in the habitat or related to change in cheliped strength and foraging behaviour.

The food habits and feeding ecology of several brachyurans have been investigated[1-12]. Although *Portunus (Portunus) sanguinolentus* and *Portunus (Portunus) pelagicus* enjoy a wide distribution and are commercially harvested in many areas within its geographical ranges, investigations on the feeding biology of these crabs are meagre. Therefore, an attempt has been made to study the diet of these two portunids from the Karnataka coast to enhance the knowledge on feeding biology of these crabs.

For food and feeding studies, samples of *P. (P.) sanguinolentus* and *P. (P.) pelagicus* were collected once a month from the commercial landings by shrimp trawlers at Mangalore and Malpe during 1992-93. All crabs were preserved in 10 % formalin for a week. To facilitate penetration of formalin to preserve the gut regions, the dorsocardiac region was pierced with a sharp needle before preserving in formalin. After recording the carapace width, sex and moulting stage, the body of the crab was cut open from the dorsal side and the foregut was removed carefully. It was cut open and the contents were flushed out into a petri dish with water. The gut contents were identified and separated into different food groups under a binocular microscope.

Altogether 65 no. of *P.(P.) sanguinolentus* (size range 60 -140 mm cw) and 92 no. of *P.(P.) pelagicus* (size range 60 -160 mm cw) were examined for food studies. The fullness of stomach was visually examined at 0, 25, 50, 75, 100 %.

Eventhough crabs feed on macroscopic benthic invertebrates, most of the food found in the foregut were already broken down into small fragments. Hence the gut contents were broadly classified into the following five categories: 1) crustacean remains containing penaeid prawn body parts, appendages, telson, eggs, crabs and stomatopods, 2) fish remains containing fins, scales, bones and vertebrae, 3) molluscan remains (both gastropods and bivalves), 4) miscellaneous items containing algal filaments, nematodes, polychaetes, ophiuroides and unidentified items and 5) debris (sand and mud).

The percentage of the total volume of the stomach contributed by each food group was determined visually. Importance of food groups was evaluated by ranking them by percentage frequency of occurrence and percentage points. Percentage frequency of occurrence was estimated as:

$$\frac{\text{No. of stomachs with particular food group}}{\text{No. of stomachs with food}} \times 100$$

To estimate the volume of the food group, points were assigned to each food group as suggested by Stehlik[1] . As an example, a food group that was 40 % of the volume of the stomach which was 50 % full was assigned 20 points (40 points x 0.50).

Percentage points were estimated as:

$$\frac{\text{Point of the particular food group}}{\text{Total points of all food groups}} \times 100$$

The diet of *P. (P.) sanguinolentus* and *P.(P) pelagicus* mainly consisted of crustaceans, fishes, molluscs, large quantity of unidentifiable matter and debris. Out of the 157 stomachs examined 70.8 % of *P. (P.) sanguinolentus* and 63.0 % of *P.(P) pelagicus* only contained food.

The study has indicated that the crustaceans are the most favoured food group (Fig. 1) which occurred in 80.4 % and 74.1 % of the stomachs that contained food in *P. (P.) sanguinolentus* and *P. (P.) pelagicus* respectively and consisted primarily of decapods along with macroscopic cumaceans, amphipods, isopods and stomatopods. This contributed to 47.1 % in the former and 42.6 % in the latter species of the gut content by volume. In different size groups (Fig. 2), the crustacean remains varied between 34.1 % (crabs of 60-80 mm cw) and 53.2 % (crabs of 100-120 mm cw) in *P. (P.) sanguinolentus*, and between 35.9 % (crabs of 100-120 mm cw) and 63.6 % (crabs of 140-160 mm cw) in *P. (P.) pelagicus*.

Fish remains formed the second important item of food. Although it was not possible to identify the fish, they might have been benthic species like soles and gobies which are known to coexist and are caught frequently together in trawls. Fish remains (Fig. 1) were present in 67.4 % and 41.4 % of the stomachs that contained food in *P. (P.) sanguinolentus* and *P.(P.) pelagicus* respectively. This food group formed 29 % by volume of the gut content in the former and 20.4 % in the latter. The occurrence of fish remains varied between 0 (in crabs between 60 - 80 mm cw) and 45.8 % (in crabs of 120 - 140 mm cw) in *P. (P.) sanguinolentus* and 0 (in crabs ranging between 60 - 80 mm cw) and 39.4 % (in crabs ranging between 120-140 mm cw) in *P. (P.) pelagicus* in different size groups (Fig. 2).

The third predominent category of food was molluscs mainly consisted of bivalves and gastropods (*Meretrix casta*, *Paphia* sp., *Crassostrea* sp., and *Telescopium* sp.). The mollusc remains ranged between 3.2 % (in crabs of 120-140 mm cw) and 16.9 % (in crabs of 80-100 mm cw) in *P. (P.) sanguinolentus* and between 2.8 % (in crabs of 140-160 mm cw) and 38.8 % (in crabs of 60-80 mm cw) in *P. (P.) pelagicus* among different size groups (Fig.2).

The miscellaneous dietary group mainly comprised of polychaetes of *Neries* sp. and *Glycera* sp. and other materials. This group contributed to 13.3 % in *P. (P.) sanguinolentus* and 12.3 % in *P. (P.) pelagicus* by volume of gut content. This group occurred practically in all stomachs that contained food (100 % in the former and 94.8 % in the latter species). In different size groups, miscellaneous items varied between 12.4 % (in crabs of 100-120 mm cw) and 37.9 % (in crabs of 60-80 mm cw), and between 8.6 % (in crabs of 140-160 mm cw) and 13.5 % (in crabs of 80-100 mm cw) in *P. (P.) sanguinolentus* and *P. (P.) pelagicus* respectively (Fig. 2).

The debris formed 4.9 % and 4.7 % of the gut content of *P. (P.) sanguinolentus* and *P. (P.) pelagicus* respectively. It was available in 63.0 % and 58.6 % of the stomachs containing food in these two portunids. The occurrence of debris varied between 2.9 % (in crabs of 120-140 mm cw) and 18.2 % (in crabs of 60-80 mm cw) in *P. (P.) sanguinolentus* and between 1.2 % (in crabs of 60-80 mm cw) and 6.5 % (in crabs of 80-100 mm cw) in *P. (P.) pelagicus* in different size groups.

With reference to diet difference in different size groups (Fig.2), it is seen that juveniles of *P. (P.)*

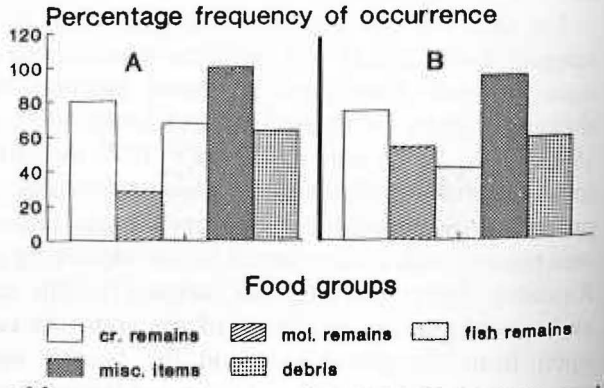

Fig.1—Percentage frequency of occurrence of major food groups for *Portunus (P.) sanguinolentus* (A) and *P. (P.) pelagicus* (B). (Cr.=crustacean, Mol.=molluscan ; Misc. = miscellaneous).

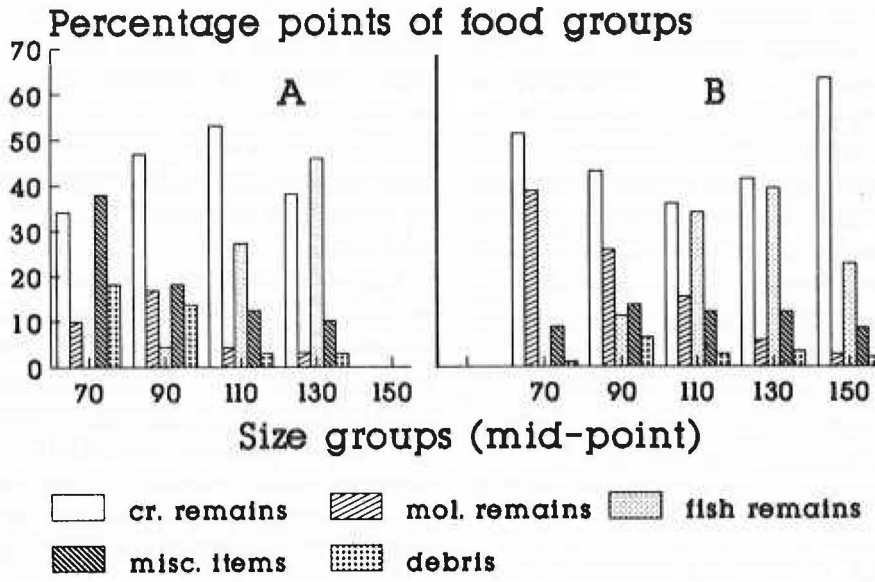

Fig.2—Percentage points of major food groups at various size groups for *Portunus (P.) sanguinolentus* (A) and *P. (P.) pelagicus* (B). (Cr.=crustacean; Mol.=molluscan ; Misc.=miscellaneous).

sanguinolentus (< 80 mm cw) preferred miscellaneous items (37.9 %) followed by crustaceans (34.1 %) as diet, whereas, juveniles of *P. (P.) pelagicus* (< 80 mm cw) had a strong preference for crustacean diet (51.3 %) followed by molluscs (38.8 %). In the subadults (80-100 mm cw), crustaceans and miscellaneous groups (46.9 % and 18.1 % respectively) were the dominant items in *P. (P.) sanguinolentus*, while in *P. (P.) pelagicus*, it was crustaceans and molluscs (43 % and 25.8 % respectively). In adults (>100 mm cw), crustaceans were the principal food category closely followed by fishes in both species of crabs. It was found that adult crabs showed a strong preference for fishes instead of molluscs. Difference in diet composition in different size groups could be related to the change in cheliped strength and foraging behaviour.

Williams[2] found that the diet did not vary seasonally for juveniles of *P.(P.) pelagicus* in intertidal areas in the Moreton Bay, Queensland. The seasonal variation in the animal diet of *Liocarpus holsatus* and *L. puber* are presumably due to changes in availability of prey organisms (Elner[3]). The variation in diet of *P. (P.) sanguinolentus* and *P. (P.) pelagicus* during different months as evident from Fig. 3 may be due to change in availability of prey organisms.

Williams[2] reported that male and female of *P. (P.) pelagicus* ate similar quantities of food and food was of a similar type in the Moreton Bay. Luaghlin[4] in *Callinectes sapidus* and Stevens *et al*[5] in *C.*

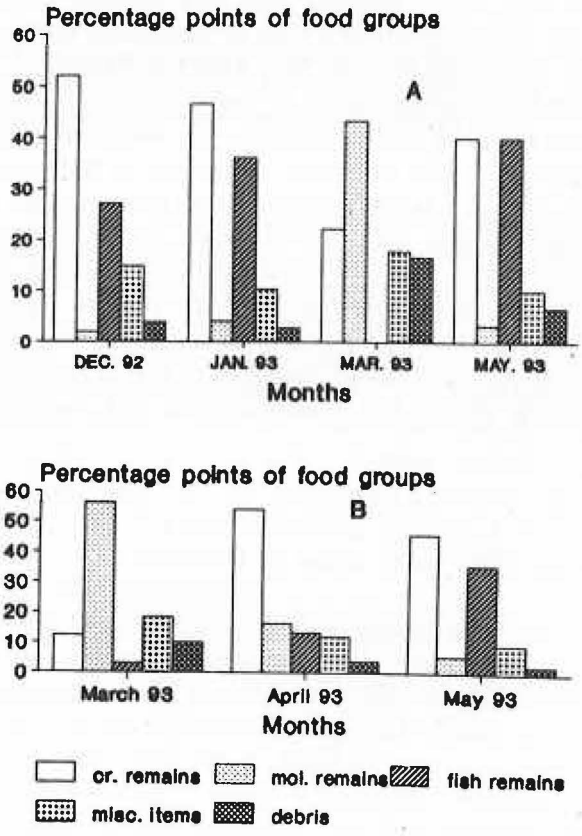

Fig.3—Percentage points of major food groups during different months for *Portunus (P.) sanguinolentus* (A) and *P. (P.) pelagicus* (B). (Cr.=crustacean; Mol.=molluscan; Misc.=miscellaneous).

margin found lack of variation in diet with sex of crabs. However, sexwise difference in dietary composition in crabs have been demonstrated in some portunid crabs (Elner[3]). Choy[6] showed that for male *Liocarcinus puber* molluscs formed a greater portion of the diet than in female crabs and concluded that these differences reflected cheliped strength, with male crab possessing larger and, stronger chela than females. In the present study also, certain amount of variation in the food has been observed between the sexes. *Portunus (P.) pelagicus* males showed strong preference for crustaceans and molluscs, whereas, females preferred fishes in addition to crustaceans. In *P.(P.) sanguinolentus* females, fishes were the second important food item.

Prasad & Tampi[7] referred to *P.(P.) pelagicus* as "scavengers and cannibals" but they also noted that these crabs fed readily on clam meat, prawns and small fish in the laboratory. Guinot[8] referred to *P. (P.) pelagicus* as a carnivore but gave no evidence for this. Eales[9] reported that lamellibranch shells were the most common type of recognised food of this crab in the Moreton Bay, Australia. Patel *et al.*[10] found that small pieces of crabs, gastropods and bivalve shells and sometimes, fish were the main types for *P. (P.) pelagicus*. According to Williams[2] this crab is a bottom feeding carnivore eating on a wide variety of sessile and slow moving invertebrates and the food mainly consisted of bivalves and ophiuroides. The present study indicated that *P.(P.) sanguinolentus* and *P. (P.) pelagicus* are primarily predators of sessile and slow moving benthic macro invertebrates. It is also seen that *P. (P.) pelagicus* had a strong preference for bivalves as food, as evident from the occurrence of large number of bivalve shells in the gut contributing up to 90 % of the gut content by volume. The presence of detritus and unidentified items in the stomach also suggest that these crabs are detrivorous consuming fresh and decaying flesh of all kinds.

Although fish remains are abundant in the foreguts of these crabs, it is doubtful that these crabs can prey on active and healthy fish. Paul[11], and Wassenberg & Hill[12] reported that much of the fish eaten by the crabs is through scavenging dead fish and waste products abundantly discarded by fishermen during shrimp fishing season in areas near the fishing villages. This may be true of *P. (P.) sanguinolentus* and *P.(P.) pelagicus* also.

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