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ORIGINAL ARTICLE

The natural diet of the mud crab *Scylla olivacea* (Herbst, 1896) in Pichavaram mangroves, India



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Abstract Food and feeding habits of mud crab *Scylla olivacea* (Herbst, 1896) in Pichavaram mangroves was investigated quantitatively and qualitatively for a period of two years from June 2010 to May 2012. Gut contents from 1737 specimens comprising 843 males and 894 females in the size range between 45 mm and 148 mm were examined. Crustaceans form the predominant food item in a majority of size groups in terms of percentage wet weight and frequency of occurrence, while molluscs showed a preference in few size groups. The other dietary items includes fishes, detritus, mud and sand and miscellaneous. Gut content analysis revealed no significant variation between the quantities of food consumed by both sexes. Feeding intensity was higher in juveniles and sub-adults of both sexes than that of adults, revealing a greater preference to feed on fast moving prey such as crustaceans and fishes. The results of the present study indicate that *S. olivacea* in Pichavaram mangroves exhibited a clear preference for crustaceans.

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1. Introduction

The mud crabs belong to genus *Scylla*, a fast growing species that attains larger size among portunids and is widely distributed throughout the coastal zones of the Indo-Pacific region (MacNae, 1968). They represent a valuable component of traditional, small scale coastal fisheries in several tropical and subtropical Southeast Asian countries which stands as a

significant commodity that fetches a high price in the international seafood market (BOBP, 1992). Mud crabs form the 'candidate species for aquaculture' owing to its winsome qualities such as faster growth, larger size, high reproductive capacity (fecundity), disease resistance, marketability, adaptability to farming systems etc. Over the last three decades, exploitation of mud crab populations has increased tremendously in many countries in South East Asia.

For the last 50 years, confusion prevails over the taxonomic nomenclature of the genus *Scylla*, and in particular regarding the number of species existing within the genus. Revised taxonomy of the genus *Scylla* through biotechnological approach proved the occurrence of four species (*S. serrata*, *S. tranquebarica*, *Scylla olivacea* and *S. paramamosain*) (Keenan et al., 1998). This recent revision with the aid of molecular tools creates ambiguity over previous works done regarding the identification of species of genus *Scylla*. Most of the earlier

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work on mud crabs mention the monospecific term *S. serrata* and as per the revised taxonomy, it unravels the fact that different species of genus *Scylla* might be erroneously treated as *S. serrata*.

The study of food and feeding based upon the analysis of stomach content has become a standard practice (Hyslop, 1980). Stomach content analysis provides important insights into feeding patterns and its quantitative assessment is an important aspect in fisheries management. Natural feeding activities of genus *Scylla* has been well recorded in *S. serrata* (Arriola, 1940; Chacko, 1956; Hill, 1976, 1979; Williams, 1978; Lee, 1992; Joel and Raj, 1986; Prasad and Neelakantan, 1988; Mamun et al., 2008). However, despite the ecological and economical importance of *S. olivacea* little information is available on its food and feeding habits. The present work is the first register on the food and feeding habits of *S. olivacea* from Indian waters, describing its prey and feeding intensity which was carried out separately for males and females of different size groups.

2. Materials and methods

2.1. Sampling and laboratory procedures

Live specimens of *S. olivacea* were collected during the early morning hours from Pichavaram mangrove ecosystem (11° 29'N, 79°46'E) situated between the Vellar and Coleroon estuaries in Tamilnadu, on the south east coast of India, for a period of two years (June 2010–May 2012). The crabs were caught by local fisherman employing gill nets. The species were confirmed as *S. olivacea* from DNA barcoding and morphometric analysis (Viswanathan et al., 2012). The gut content was analyzed for a total of 1737 specimens comprising 843 males (Carapace width (CW) ranging from 45 mm to 148 mm) and 894 females (CW ranges from 45 mm to 140 mm). The collected crabs were recorded for size, sex and weight individually, dissected to weigh the gut contents.

2.2. Data analysis

Based on the gut, seven gut replenishment categories were established using a method modified from Wear and Haddon (1987): empty (when the wall was shrinking; devoid of food particles), trace (gut was filled by trace amount of food components), ¼ full (partially filled), ½ full (half full), ¾ full (when it was partially in distorted condition and the wall being thick), full (when the gut was filled with food normally, its wall being thick and intact) and gorged (gut expanded completely packed with food, with its wall thin and transparent). Analysis of stomach contents was made at room temperature with the aid of a binocular dissecting microscope. According to the rate of fullness, the stomach was allotted points ranging from 0 to 100. For the purpose of comparison, the 'gorged' and 'full' stomach conditions were grouped as 'actively fed'; whereas '¾ full' and '½ full' stomach conditions were grouped as 'moderately fed' and '¼ full' and 'trace' as 'poorly fed'. Based on this, the quantitative scoring method of PP (modified from Williams, 1981) was based on point scores of the relative contribution of each prey category to the total volume of material in each stomach: a prey representing 0–10% of the stomach

contents were awarded 10 points; 10–20% were awarded 20 points; 20–40% were awarded 40 points; 40–60% were awarded 60 points; 60–80% were awarded 80 points and 80–100% was awarded 100 points. These points were multiplied by a value dependent on the degree of foregut stomach (¼ full: ½ full: full: gorged). The various components of food were recognized and categorized into major taxa. Semi-digested leafy and algal matters and debris were categorized as detritus. 'Miscellaneous' includes unidentified items and those appeared in a juice form. Mud and sand were easily identified by appearance.

The differences in the food composition between size and sex of *S. olivacea* were tested using a statistical routine named Similarity of Percentage (SIMPER) in PRIMER (ver. 6.1) package developed by the Plymouth Marine Laboratory, UK (Clark and Warwick, 2001). In SIMPER analysis, for the sake of convenience, all the 13 size ranges were pooled into 3 groups as follows: 45–52 mm to 69–76 mm size groups represented as a group I; 77–84 mm to 101–108 mm size groups framed as group II; 109 mm to 141–148 mm size groups (In the case of females, 109 mm to 133–140 mm size groups formed as group III).

3. Results

3.1. Gut content composition

3.1.1. Sizewise variation

The analysis of diet in the gut of different size groups of males and females was consolidated separately (Tables 1 and 2). In males, the results were pooled up and the average was derived; which proved that crustaceans (37.33%) formed the chief food item followed by molluscs (23.62%), fish (14.22%), detritus (11.76%), mud and sand (7.07%) and miscellaneous items (5.16%); whereas in females, crustaceans (34.74%) figured as the prime food item followed by molluscs (23.96%), fish (15.97%), detritus (12.03%), mud and sand (7.63%) and miscellaneous (5%).

3.1.2. Monthwise variation

In males, the results of the monthwise variation in gut contents showed that *S. olivacea* prefers crustaceans as prime food with 34.03%, followed by molluscs with 24.36%, fish with 15.19%, detritus with 12.9%, mud and sand with 6.96% and miscellaneous with 5.88% (Table 3). In females, the results of monthwise variation in food composition reveal that crustaceans (32.83%) forms the major food item followed by molluscs (24.42%), fish (14.93%), detritus (13.54%), mud and sand (6.68%) and miscellaneous items (7.02%) (Table 4).

3.2. Feeding intensity

3.2.1. Size variation

No significant variation was observed in the feeding intensity between different size groups in males. Among the different size groups, the stomach condition was placed in its order of descent as 'empty', 'trace', '¼ full', '½ full', '¾ full', 'full' and 'gorged' with 23.68%, 5.31%, 6.46%, 12.01%, 14.63%, 20.67% and 16.35% respectively (Fig. 1). In general, among

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