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RESEARCH ARTICLE

Studies on some aspects on the biology of green mussel *Perna viridis* (Linnaeus, 1758) from Versova creek, Mumbai, northwest coast of India

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ABSTRACT

The green mussel, *Perna viridis*, was studied in 2005-2008 in the polluted Versova Creek. Maximum numbers suitable for commercial harvest occur in April-June and November. The length-weight relationship of *P. viridis* from Versova Creek is expressed as $W = 0.00035 * L^{2.67035}$. The condition index indicated two spawning peaks.

Keywords: Green mussel, Length-weight relationship, condition index, creek, Mumbai coast

INTRODUCTION

Among the exploited bivalve resources of India, clams are by far the most widely distributed and abundant. Several species belonging to a number of families constitute the clam resources and they are exploited all along the Indian coast but few studies have been carried out on bivalve resources from Maharashtra state. The initial studies were by Subramanyam *et al.* (1949) from Bombay. Rao *et al.* (1962) studied biology and fisheries while Nagabhushanam and Mane (1975; 1978) and Talikhedkar *et al*. (1976) studied reproduction, growth and breeding of clams from Rantagiri coast and Parulekar (1981) the marine fauna of Malvan. Narasimham (1991) gave an account of the status of the clam fishery of India including Maharashtra. Jaiswar and Kulkarni (2001; 2002; 2005) and Mohite *et al.* (2009) studied bivalve resources from the Mumbai and Ratnagiri coasts respectively.

With increasing urbanization and industrialization, Mumbai has transformed into a mega-metropolis with detrimental changes in the coastal marine environment. Owing to indiscriminate discharge of untreated domestic sewage and industrial effluents, creeks, in particular, have become highly polluted. Despite pollution, quite a few mollusks thrive in the coastal waters, among which green mussel *Perna viridis* is commonly noticed in the rocky sub-tidal regions in Mumbai.

During monsoon months (June-August), fishermen tend to exploit bivalves and mussels such as *Meretrix meritrix, Meretrix casta* and *Gafrarium divaricata* from intertidal areas that are generally along creeks. The entire area of the beds is completely submerged at high tides but a greater portion is exposed at the receding tides. Fishermen from Versova fishing village regularly collect (hand-pick) the green mussel, *P. viridis*, from Versova Creek. According to Apte (1988), *P. viridis* are found in rocky shores near the low tide mark, and are widely distributed commonly along the Konkan coast. Though Versova Creek is one of the most polluted creeks in Mumbai, this species was found in the creek throughout most of the year. The average salinity in the creek varied from 7.9 to 33.34 ppt and the dissolved oxygen values varied from 0.41 to 2.75 mg/l. Nil values of dissolved oxygen were also frequently recorded in Versova creek (Singh *et al.*, 2002), indicating salinity fluctuations and high level of pollution.

Because this species contributes to a subsistence fishery in India, and as there seems to be no information on this species from Maharashtra, studies on some aspects of its biology was carried out throughout the year. Though this species has been well studied in aquaculture farms, there seems to be little information on this species occurring in the wild.

MATERIALS AND METHODS

Monthly *P. viridis* samples were collected from Versova creek during lowest tide days and they were hand-picked from the rock crevices and other microhabitats. The samples were brought to the laboratory for biological analysis. Shell length (L) was measured using a digital caliper and total weight (W) ($\pm$ 0.01 g) was determined using an electronic balance after the specimens were dried on blotting paper. The measurements were taken as described by CMFRI (1995). A total of 675 specimens ranging in length from 14 to 89 mm with the corresponding weight ranging from 0.495 to 37.612 g were analysed over a period of four years from January 2005 to December 2008.

Length and weight are two basic components in the biology of the species at the individual and population levels. The length-weight relationships were obtained with regression analysis by the method of least squares based on individual measurements. The relationship of the length and weight is expressed by Le Cren's (1951) parabolic equation of the form $W = a * L^b$ where, W is the weight in grams, L is the length in millimeters and a, b are the constants representing the intercept and the slope of the regression line respectively. In order to calculate the extent of deviation of the 'b' value from cube, t-test was undertaken. The correlation coefficient (r) was tested for its significance.

Considerable variations from the expected weight for the length were often noticed. This variation is due to biological and physiological factors. The condition factor (Kn) is an indicator of the overall well being of the animals (King, 1995). The condition index was estimated by the equation: (Observed weight/ Calculated weight) x 100. The condition factor of *P. viridis* was calculated on a monthly basis to detect seasonal variations.

RESULTS AND DISCUSSIONS

Length (L) and weight (W) is graphically represented in Fig 1. The length weight relationship of *P. viridis* from Versova creek is expressed as: $W = 0.00035 * L^{2.67035}$ ($r^2 = 0.8836$). The t-test indicated that 'b' at the 5% deviation level significantly departed from the cube at $p = 2.39^{-49}$. The correlation coefficient (r) is not significant (t = 71.47, df = 673).

The percentage condition index of the species varied from 6.4 (August) to 10.6 (June). It increased from March and reached a major peak in June and touched a low in August and after that it gradually increased with minor fluctuations and reached a minor peak in November with a subsequent decline up to March (Fig 2).

In the present study, though specific food items could not be ascertained, mussels were observed to feed mainly on detritus.

The species is exploited mainly during full moon and new moon days when the tide is extremely low and large intertidal areas are exposed. The animals showed isometric growth. A curvilinear relationship was obtained when weights of the specimens were plotted against the total length of the shell. Mohan (1980) also reported isometric growth for *P. viridis*. This indicates that as in other animals, the rate of growth by weight is faster than by their length (Le Cren`s, 1951).

To make a comparative study the results were compared with those for from a non-polluted population to get an insight on to the effect of pollution on the growth etc. Hemachandra and Thippeswamy (2008) have reported the length weight relationship of *P. viridis* as $W = 0.0986 L^{2.9495}$ from St Mary's island off Malpe, near Udipi, Karnataka, which is a comparatively non-polluted site. The low value of 'b' at Versova Creek compared to St. Mary Island indicated the impact of

pollution on the growth of the animals. According to Rajagopal *et al.* (1998) the species reaches an average shell length of 83 mm in one year in Edaiyur backwaters, east coast of India.

According to Hemachandra and Thippeswamy (2008), the maximum condition factor of *P. viridis* was recorded in May and suggested that the ideal period for commercial exploitation of *P. viridis* from the island is from March to August, when the meat yield is highest. From Versova Creek the best period of exploitation seems to be between April–June and in November. Traditionally, fishermen exploit these mussels during this period. According to Rajagopal *et al.* (1998) the species has two spawning periods, which the present study supports. The maximum numbers of small sized mussels were observed between June and November. The condition index in all four years was found to be high during the pre-spawning period before the monsoon.

Generally, algae are the main source of nutrition for bivalve filter feeder, but in coastal habitat, they feed on detritus, phytoplankton, benthic microflora, benthic algae and micro zooplankton (Dame, 1996). In Versova Creek they were observed to be detritus feeders.

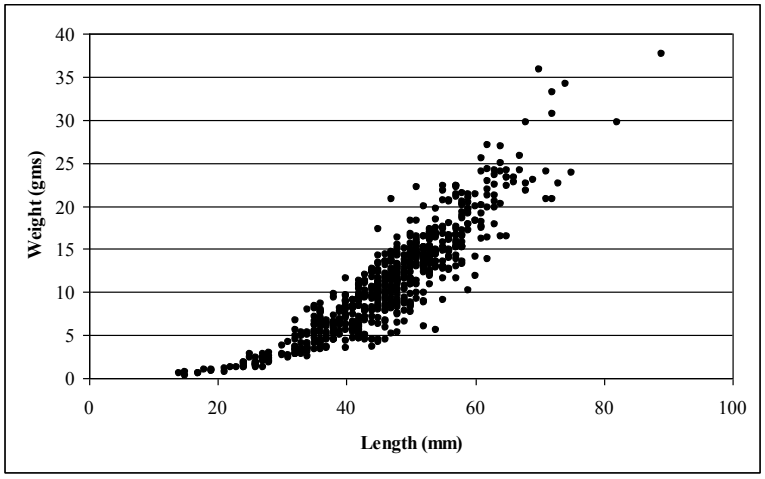

Fig 1. Scatter plot of Length-weight relationship of *Perna viridis* from Versova Creek, Mumbai

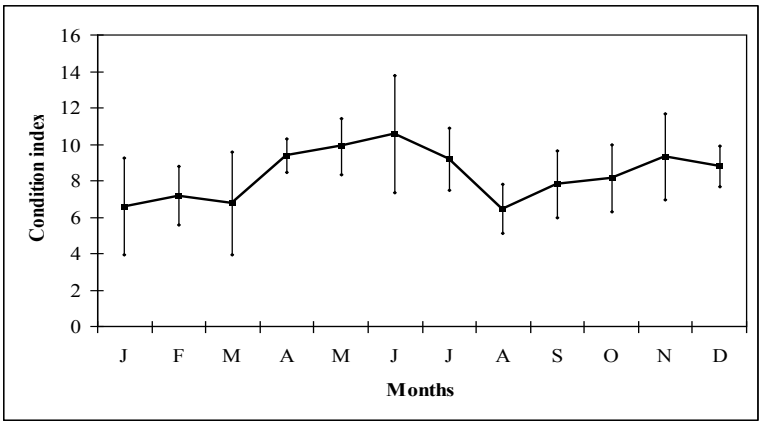

Fig 2. Condition index of *Perna viridis* from Versova Creek, Mumbai.

According to Dame (1996) bivalves are a 'keystone' species. A number of attributes of bivalves have led to their use as 'monitors', 'sentinels' or 'indicators' of environmental stress (Widdows and Donkin, 1992; Smaal and Widdows, 1994). This species from Versova Creek can be used as an indicator organism for pollution assessment and also to assess the stress caused by pollution on the ecosystem of the creek

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