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Short Communication

Population eruption of sunset shell *Siliqua radiata* (Linnaeus, 1758) along Versova beach in Mumbai

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Abstract

Sudden population eruption of *Siliqua radiata* during monsoon months (June-August 2008) was observed along Versova beach in Mumbai. Relationship between shell length (SL) and total weight (TW) was $TW = 0.0001137 * SL^{2.67922}$, shell length (SL) and meat weight (MW) was $MW = 0.0000237 * SL^{2.91756}$. *S. radiata* had isometric growth. The average density was estimated as 14 per square meter and the biomass was 153 $g.m^{-2}$. The proportion of meat was 60%. Analysis of meat showed high amount of heavy metals namely copper, cadmium and arsenic.

Keywords: Sunset shell, *Siliqua radiata*, heavy metal, Mumbai

Introduction

Siliqua radiata (Linnaeus, 1758) (Class: Bivalvia, Order: Veneroida, Family: Tellinidae) is commonly called as sunset shell. They inhabit sandy bottom of beaches in small burrows. A sudden population eruption of this species was observed in the intertidal zone of sandy beach at Versova, Mumbai during the monsoon months of June-August 2008.

Apte (1988) has recorded the occurrence of *S. radiata* from Konkan region of Maharashtra, and Jaiswar and Kulkarni (2005) reported the occurrence from Mahim Bay in Mumbai. This is for the first time that the species has been observed in large numbers along the sandy beaches of Versova, Mumbai. The clam beds were in shallow waters from high watermark to a short distance beyond the low watermark. The entire area is submerged at high tides, but a greater portion is exposed at the receding tides.

An attempt was made to study some aspects of biology of this species including population density and the tissue was subjected to heavy metal analysis.

Material and Methods

Fortnightly samples of *Siliqua radiata* were collected from the beach during the low tide of monsoon months (June-August 2008). Shell length (SL) was measured using a digital caliper and total weight (TW) (± 0.01 g) was determined using an electronic balance after the specimens were dried on blotting paper. The measurements were taken as suggested by CMFRI (1995). The meat was removed by opening the shell and before weighing the meat weight (MW), the moisture was removed with tissue paper.

To determine the length-weight relationship, 156 specimens ranging from 60 mm to 78 mm in shell length and total weight ranging from 5.984 g to 15.887 g were considered. The length-weight relationship was obtained by the method of 'least squares' based on individual measurements. The relationship of length and weight was 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' and 'b' are constants representing the intercept and slope of the regression line, respectively.

The population density was estimated by counting the number of animals in quadrants of 25 cm^2 each. Four stations on Versova beach were fixed for this purpose and collections were made

fortnightly, during low tide. Two quadrants from each station were selected during every field trip and the animals were dug out of their burrows by means of a knife. The numbers of clams collected from each quadrant were averaged to estimate the animal density.

The tissue from twelve animals was removed carefully without contact with metallic objects and cleaned with sterile distilled water. The tissues were digested following modified wet digestion technique (ASTM, 1998). Five ml of HNO_3 and 1 ml of HCL were added to 0.5 g of tissue and digestion was carried out in a closed system. Heavy metals, namely arsenic (As), copper (Cu) and cadmium (Cd) were analysed using an atomic absorption spectrometer with an air-acetylene flame under recommended operating conditions (Anon, 1968).

Results and Discussion

Relationship between shell length (SL) and total weight (TW), and shell length (SL) and meat weight (MW) showed exponential relationship. Therefore the values of length and weight were transformed into log to linearise the equation. The relationships are expressed as

$$TW = 0.0001137 * SL^{2.67922} \quad (r^2 = 0.78471)$$
$$MW = 0.0000237 * SL^{2.91756} \quad (r^2 = 0.68947)$$

The density of animals ranged from 9 to 21 per square meter and the average density was calculated as 14 per square meter and the biomass was estimated at 153 $g.m^{-2}$.

These clams showed isometric growth. A curvilinear relationship was obtained when the total weight of the specimens was plotted against the total length of the shell. This indicates that like other animals, in these molluscs too, the rate of growth by weight is faster than their length (Le Cren, 1951).

According to Apte (1998) the maximum length of the species is 50 mm but in the present study specimens as large as 78 mm were recorded. The bivalves were exploited maximum during full moon and new moon days when the tide was extremely low and a large intertidal area was exposed. The animals came to the surface during the monsoon months probably because of heavy rains leading to reduction in salinity. Apte (1988) and Jaiswar and Kulkarni (2005) have mentioned the occurrence of *S. radiata* as not so common from Maharashtra and particularly from Mumbai there seems to be no reports. This species was never observed in such large numbers along the coast of Mumbai for the last 15 years (personal observation). Hence the abundance of these animals may be due to sudden favorable conditions, which could have lead to their population eruption (as much as 21 per square meter). After monsoon the number of shells on the beach reduced drastically, showing a short term phenomenon of population abundance.

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). The heavy metal values per g of meat weight for arsenic ranged from 0.570 to 0.884 ppm (mean: 0.728 ± 0.11 ppm), copper from 35.900 to 47.740 ppm (mean: 41.809 ± 3.90 ppm) and cadmium from 4.676 to 6.068 ppm (mean: 5.310 ± 0.42 ppm). The arsenic levels in the tissue of *S. radiata* were below WHO permissible limit level of 4 ppm while copper was above permissible limit of 30 ppm (Fig. 1). Cadmium concentrations were much higher than the permissible limit of 2 ppm. The higher levels may be attributed to the sewage sludge outfall from the area. Since large quantity of *S. radiata* was easily available from the sandy beach, some fishers sold them in local markets, as the bivalve has high proportion of meat (60%), unlike clams and mussels. There was very good demand for these bivalves initially and fetched good

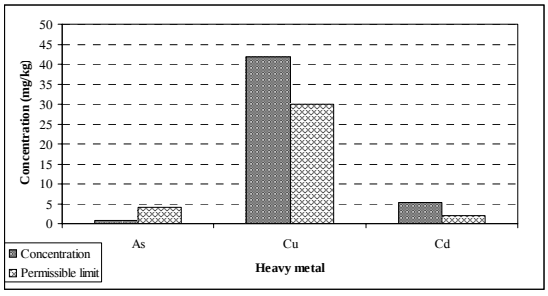

Fig. 1. Heavy metal concentration in the tissue of *Siliqua radiata* in comparison with WHO suggested maximum limits

price, but the consumers later realised that the meat was tainted with metallic taste and oil smell. Based on these observations, it may be inferred that due to high metal concentration in the tissue, they are harmful for human consumption.

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