Role of *Laternula truncata* (Lamarck, 1818) in maintaining of biological integrity of West Bengal coastal region

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ABSTRACT

Laternula truncata, a truncate lantern calm has been recognized as a benthic species in a mudflat of degrated mangrove oriented coastal region of West Bengal with Bay of Bengal. By virtue of their bioturbatory activities like nest building, burrow formation, reconstruction and rebuilding of their own habitat they help juveniles of *Lingula anatina, Glauconome sculpta, Macoma birmanica*, *Uca* sp., *Parachondylactis* sp., *Virgularia* sp., *Glycera* sp. etc for settlement and recolonization. Their burrow strongly form a microhabitat with different complex food chains and food webs starting from phytoplankton to higher vertebrates made this ecosystem more dynamic. Water and oxygen influx within the burrow constructed by them enrich soil texture with nutrients made possible for successful succession of new mangrove vegetations in this habitat. The present work aims to highlight on the biological and ecological activities of studied species for maintenance of biological integrity of mangrove estuarine ecosystem of West Bengal coastal region with Bay of Bengal.

Introduction

The mangals of West Bengal coastal region near Subarnarekha estuary have undergone significant human induced ecological changes. With ongoing threats to this ecosystem it remains imperative that there be a continued and expanded research effort to understand this versatile ecosystem and their associated biota. Mangrove habitats of East Midnapore coastal region, West Bengal although offer a rich biota and an important fishing habitat, yet remain biologically poorly known with little information available about even some of the more common taxa. One such group includes laternulid bivalves. Field studies of laternulids from Asia as well as from india are uncommon. Although some studies on eco- biology of some selected bivalves has been conducted throughout last few years from west Bengal coastal region and associated mangrove

ecosystems, no studies on *Laternula truncata* have been done so far from this region . The present paper emphasizes on the Role of *Laternula truncata* in maintaining of biological integrity of West Bengal coastal region

Material and methods:

Physiography of the study site.

The ecologically significant mudflats of a mangrove ecosystem near Subarnarekha estuary (Longitude 87°52 E, Latitude 20°302 N and Longitude 87°452 E, Latitude 21°472 N)) has been selected for the present study during July, 2018 to June, 2019.

Procedure for biological samplings.

Random samplings of *Laternula truncata*, were made from the study site through twelve months and three seasons in a year during low tide level. For quantitative estimation, five quadrates having an area of 1 m^2 were placed randomly and bottom dwelling faunal components especially the laternulids were unearthed, counted and expressed as No/m^2. Specimens were grouped into different size classes (0-2 cm, 2- 4 cm, and 4- 6 cm) and their mean size classes (lengths) were recorded with the help of slide calipers and with a plastic scale.

Identification of collected specimen.

L. *truncata* after collection from study site was identified following standard literature of Prezant et al., 2008.

Burrowing behavior :

Burrowing behaviour was examined in the laboratory using recently collected specimens of *Laternula truncata* during study period. Larger sized specimens of L. *truncata* were placed in a small aquarium that held 10 cm of field-collected sediment covered with 5 cm of field-collected water to monitor burrowing behaviour and/or differences in rate of burial between size classes. Specific behavioural landmarks were monitored by first foot probe of sediment, movement of valves and fully burrowed with only siphons exposed.

Results:

The present study site is an extensive shallow mudflat with soft muddy to sandy sediments dotted with degraded mangrove vegetations. The flats are heavily fished by hand by local residents for edible bivalves, crabs, and mudskippers. The majority of plants are species of Acanthus, Avicennia, Salicornia, Ipomea etc. The mudflats are well drained, oxygenated, and the salinity can be brackish.

The animal is particularly prevalent in estuarine tidal mudflats of studied area and is most commonly found within burrow as a macrobenthic animal. They are lying vertically in their habitat with the siphon pointing upwards.

All living *Laternula truncata* (Figure- 1 and Figure- 2) collected during study period showed gradations of sizes from very small specimen (1.6 cm length) to the largest (7.6 cm length). There was some indication of an

age-related die-off in the largest size range because the number of clams decreased rapidly. Prominent low and tightly positioned rings were present on the shells of L. *truncata*. These regular concentric rings were interspersed with concentric, irregularly placed but more prominent growth stoppage rings. All such rings seamlessly traversed across the umbonal slit typical of the valves.

Specimens of *Laternula truncata* were often found buried 6–14 cm deep in highly compacted sand layers beneath clay canopy. The open sand sites between these mangrove islands held few specimens.

Sediments in study site along my transect was dominated by fine sand following silt and clay . Sand, silt and clay content of the habitat recorded during present study was 61.73 ± 0.81%, 28.81 ± 0.29% and 8.49 ± 0.61% respectively. Organic carbon content of Soula mudflat sediments along the transect was relatively low, averaging 1.14 ± 0.08% as found during present study. The average value of salinity of interstitial water as recorded during present study was 21.72 ± 1.62 ppm (Figure- 3).

The highest concentrations of *Laternula truncata* along the transect were found within quadrats during post monsoon period and average value of population density of studied species was 17.16 ± 4.49. Average shell length, width and height of the studied species as found during present study was 5.6 ± 4.91 cm, 2.3 ± 0.62 cm and 1.6 ± 0.71 cm respectively (Table-1).

Quite straight forward burrowing behavior of *Laternula truncata* has been observed during present research work. Smaller specimens of *studied species* probed more readily in the sediment with their foot. Among all studied specimen it was observed that some reburrowed fully and majority reburrowed partially when removed from sediment. After lying on one valve, the foot emerges and immediately probes the sediment for an extended period of time and similar observation has been documented by Prezant et al., 2008 also. On the average, larger clams burrowed slowly than smaller calms and depth of burial was usually related to siphonal length of the studied species.

Discussion

Marine- coastal- estuarine- mangrove ecosystem represents the most productive and dynamic ecosystem of the world. It supports innumerable number of fora and fauna in its diversified habitats and ecological niches (Chakraborty, 2017). Midnapore (East) coastal belt in West Bengal, India, just on the southern part of Sundarban Mangrove Estuary, encompasses a diversified habitats and niches which accommodate a good number of faunal components in the form of pelagic and benthic form (Samanta et al., 2015). Among these,

truncated bivalvia- *Laternula truncata* has been reported from an mudfl at Saula estuary with the Bay of Bengal, West Bengal coastal belt, India.

Among various mangrove- estuarine bivalves *Laternula* is currently the sole accepted genus within the family Laternulidae (Prezant et al., 2008). Although Morton (1976) noted eight species within the family, there is no clear delineation as to the total number of species (Prezant & Smith, 1998). In 1980, Piyakarnchana, in an overview of mangals of the Thiland noted only *Laternula truncata* among laternulids. Although two species under the genus Laternula have been reported by Tudu et al. from Odisha, India coastal zone in the year 2018 no such report on biology and ecology of *Laternula truncata* has been published from West Bengal Coastal zone, India.

The intertidal belts along with mangroves-estuarine system function like a sponge with complex network of biogenic structures which foster to and fro movement of interstitial water, nutrients and gases both vertically and laterally coupled with tidal advection and drainage.(Chatterjee et al, 2008). In estuarine environment, macrobenthic communities generally are characterized by low diversity with high abundance (Attrill et al., 1996). But low population density of studied species as recorded during present investigation clearly indicating that their existence in this area is in danger or threatened condition. Human induced activities like fishing, mangrove destruction for collection of fuel materials, oil leaching from fishing boat made this highly productive ecosystem into a stressed ecosystem which in turn threatened the existance of macrobenthic fauna in this habitat. Changes in the population density of studied truncate bivalve could be due to changes in the sediment structure and composition.

From an ecological perspective, bioturbation is coupled to physical processes and associated chemical changes related to movement of particles or water. The important biological and biogeochemical consequences of bioturbation must be considered in a larger context, such as within the framework of ecosystem engineering as pointed out by (Meysman et al., 2006).Vertical tube formation in the sediment through bioturbatory activities by bivalves such as *Laternula truncata* made the environment more comfortable for juvenile settlement of various faunal component of this area. their burrowing activities can directly break and transport sediments, decrease the hardness of the soil (Botto et al., 2005) burrowing also affects soil chemistry and associated microbial processes, increases soil oxygenation, and alters pore water salinity (Fanjul et al., 2007). Burrowing activities by laternulids significantly affect belowground processes that

can impact marsh plants which have been noticed by Smith et al. 2009 in fiddler crabs. Burrowing by them increases the passage of liquid and gas between the soil and environment , increasing soil oxidation (Weissberger et al., 2009) and the decomposition rate of organic debris (Fanjul et al., 2007). Burrows of studied species can selectively trap sediments that have high organic matter concentrations, finer grain size and low density through the interactions of the burrow openings with tidal water, which facilitate organic matter decomposition, which in turn increase nutrient availability and thus, promote their growth (Botto et al., 2005). Excavation by L. *truncata* transport soils and nutrients from deep layers to the marsh surface which might accelerate the turnover of soils and nutrients. It seems that above mentioned different unique structures of different species have diverse functional roles, but more intensive study is required to understand their functional as well as ecological significance.

The relatively aerobic sediment, lower organics, and ability to the fine sand substratum, could be a requisite sedimentary habitat for *L. truncata*. Periodic deposition of silt/clay into the upper substratum, on the other hand, could inhibit initial larval settlement. The abundances of *Laternula truncata* are partially related to predation, which in turn are related to prey accessibility. How accessible an infaunal bivalve is to a surface or near-surface dwelling predator is related to depth of burial, rate of burial, and/or the mechanical ability of a predator to "reach" the prey (Prezant et al., 2008).

The author hypothesizes that the burrowing cycle of studied species can be divided into four phases: (i) foot extension (ii) penetration of foot into the sediment, (iii) anchorage by foot tip dilation, and (iv) insertion of shell into the sediment by contraction of pedal retractors. Zamorano et al. (1986) also reported unusual siphonal activity associated with locomotion and burial. This process consisted of levering the tips of the siphons against the substratum to lift the shell and then "looping" the siphons in a process that allows shell rotation while forcing water from the exhalent siphon to create jetting. Zamorano et al. (1986) suggested that this method was used by *L. elliptica* to move the bivalve to another favorable position for reburying.

Burroing activities performed by the studied species makes top soil of the habitat more smooth and comfortable for larval deposition and settlement of Lingula sp. and Glauconome sp.It is hypothesized that for this reason high population density of these two associated faunal component have been observed during field work.

Laternulid bivalve- *Laternula truncata* is an important part of the biota in the mangals of

the Soula, Midnapore (East), West Bengal, India seaboards and little is known about this organism in the studied threatened mangrove forest. Hence in future more extensive studies on *Laternula truncata* should be organized by the researchers.

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Figure- 1: Freshly collected specimens of *Laternula truncata.*

Figure- 2: *Laternula truncata* after opening of shell by dissection.

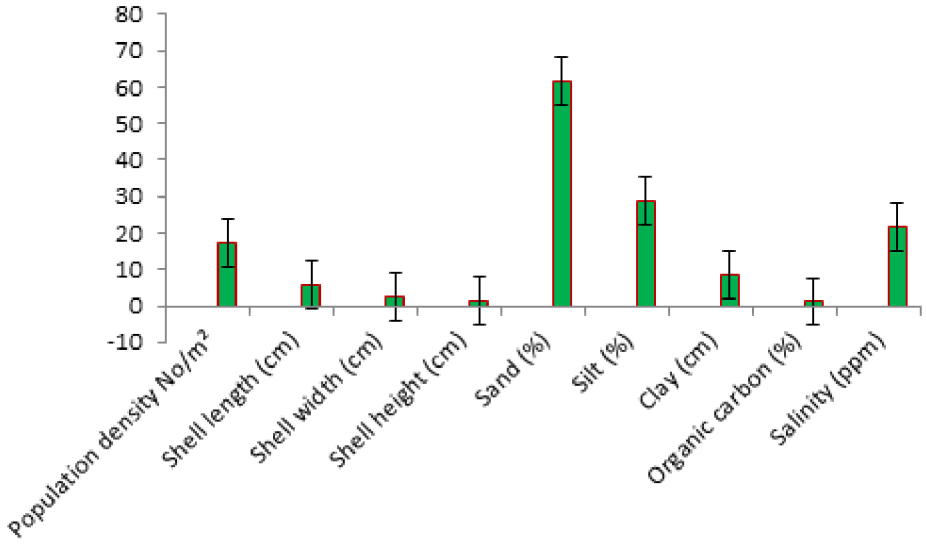

Table-1: Graphical representation of different biological and hydroedaphic parameters.