Muddy shore

Introduction

Muddy shores are formed along the seashores where there is no or little wave action. These intertidal areas are formed by the deposition of silt from the water flowing into the sea. Muddy shores are also of shifting substratum or very loose in nature and there are many intergradations of particle sizes as in sandy shores. No distinct line can be drawn between the animals of the sandy and muddy shores. Muddy shores are quite common along the sheltered beaches, estuaries and mangroves. The mud is also known for its high organic carbon content and hence serves as a very good food source for many of the mud dwelling organisms. These shores are just opposite to the sandy beaches, which is mainly formed along the beaches of moderate or strong wave action and hence this is just opposite to that of sandy shores both in the nature of substratum as well as in the faunal and floral composition.

Wave action

Muddy shores are developed only along the shores of mild wave action and therefore these shores restricted to the intertidal areas of enclosed bays, lagoons and especially estuaries. Mild wave action facilitates the fine grained particles brought in by the freshwaters to settle and form muddy substratum or mud flats. As these areas are with minimal water movements, the slope of the intertidal is much less than that of the sandy beaches and thus these areas are referred as mud flats. Furthermore, these areas are stable than sand substrates and more conductive to the establishment of permanent burrows.

Substratum

As this area is having very fine particles and flat surface, it is known to retain high amount of interstitial water with in the substrate. This retention of water in its interstitial space for long time leads to the poor exchange of water and high load of microbes in it may results in the formation of anoxic condition below the surface of the sediments. Between the upper aerobic layer and the lower anaerobic layer is a transition zone called the redox potential discontinuity (RPD) layer. Below the RPD zone, sediments are anaerobic and decomposition of organic compounds is by anaerobic bacteria. The anoxic RPD layer is characterized by the gray colour of the sediments; the oxidized layer above is usually brown or yellow; and the anoxic layer is black. In the RPD zone, chemoautotrophic bacteria are the common forms present.

Temperature and salinity

Fluctuations in temperature and salinity, though present in the muddy shores, are not very significant. These are effectively buffered by the mud. The slow interchange of interstitial water is mainly responsible for the maintenance of nearly constant salinity in the muddy substratum.

Moreover, the variations at the surface do not significantly affect the organisms, as most of them are burrowers living deep inside the mud.

Organic materials

Muddy shores tend to accumulate organic material. There is an abundant potential food supply for the resident organisms, but the abundant small organic particles “raining” down on the mud flat also have the potential to clog respiratory surfaces.

Oxbow theory

In contrast to sandy beaches, muddy shores often develop a substantial growth of various plants. On the bare mud flats, the most abundant plants are diatoms, which live in the surface layers of mud and often give brownish colour to the surface or low tide. Other plants include large macroalgae, such as species of Gracilaria (red algee), Ulva, and Enteromorpha (green algae). The large algae often undergo seasonal cycles of abundance, becoming common in the warmer months and virtually absent or disappear in cooler months. Other areas, particularly the lowest tidal levels, may be covered with a growth of various sea grasses, such as the genus Zostera. As a result of the occurrence of these primary producers, there is substantial primary productivity in the mud flats.

Mud flats contain large numbers of bacteria, which feed on the abundant organic matter. Bacteria are the only abundant organisms found in the anaerobic layers of the mud shore and constitute a significant biomass. These bacteria are capable of using the potential energy of the various reduced chemical compounds abundant here. These chemolithoautotrophic or sulphur bacteria obtain energy through the oxidation of a number of reduced sulphur compounds, such as various sulphides (e.g. H2S). These organisms are thus primary producers of organic matter analogous to green plants. They produce organic matter using energy obtained from the oxidation of the reduced sulphur compounds, whereas plants produce organic matter using energy obtained from sunlight.

Since these autotrophic bacteria are located in the RPD layer of mud, mud flats are unique among marine environments in that they have two separate layers in which primary productivity occurs: the surface, where diatoms, algae and marine grasses carry on photosynthesis; and a deep layer, where bacteria conduct chemosynthesis.

The dominant macrofaunal groups on muddy shores are the same as those encountered on sand beaches and sand-flats namely, various polychaete worms, bivalve molluscs, and small and large crustaceans, but of different sorts.

Feeding biology of the muddy shore organisms

The greater availability of food materials as organic matter permits more large organisms to live on muddy shores. The dominant feeding types on mud flats are deposit feeders and suspension feeders, which is in contrast to open sand beaches, where the availability of organic matter is sparse. Deposit feeders are generally abundant as this area is abound with organic matter as well as large populations of bacteria in the sediments. Deposit feeding polychaetes include the genera such as Arenicola and Capitella. These polychaetes feed by burrowing through the mud, ingesting it and digesting out the organic matter including bacteria and passing out the undigested material through anus. Arenicola lives in a U-shaped burrow, in which one end of the burrow is permanently open shaft to the surface, called tail shaft and the other end of the burrow is filled with sediment which the worm ingests. The ingested sediment is passed out as faecal mounds in the tail shaft. Capitellids on the other hand, form no permanent tubes but move like earthworms through the surface layers of the sediment and ingesting it. Apart from these deposit feeders, the species of surface feeding terebellid polychaetes and the burrowing hemichordates are also represented here. The deposit feeding bivalves included are the species of Macoma and Scrobicularia. These bivalves are abundant in the temperate shores and they have separated siphons of very long inhalant and exhalent siphons, which extended up to the surface of the sediment. The long inhalant siphon helps the animal to suck the deposited organic matter and bring the same for ingestion.

Suspension feeders include the species such as various species of clams (Mya arenaria, Macoma balthica), some crustaceans and variety of polychaetes. In general deposit feeders are more common in fine grained shores and suspension feeders become more abundant in coarser sediments where there is very little organic matter.

The common carnivorous animal on the muddy shores included are mainly fishes (e.g. Periophthalmus sp.), which feed when the tide is in and the birds, which feed when the tide is out. Indigenous mud flat predators include a few polychaete worms (Glycera sp.), moon snails (Natica, Polinices), nemertean worms and crabs.