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MUD BANK BIOLOGY

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Introduction

Mud banks are unique, clearly demarked naturally occurring calm areas which occur mainly in the inshore waters along the Kerala coast during the southwest monsoon period. Formation of mud banks can be either just before the onset of SW monsoon or during the monsoon. Mud banks are popularly known as "*Chakara*" or "*Shanthakara* " (meaning calm area) and fishermen consider mud banks as 'gift of God' since these are safe fishing areas for launching and berthing the fishing crafts when the rest of coastal belt is surf ridden, with high swells and unsuitable for small scale fishing operations.

Though mud banks are known to occur in the region between Kannur and Kollam, the most popular is the Alappuzha mud bank which occurs every year. However, considerable annual variations have been observed on the location of mud banks even along the Alappuzha coast and the extent (area) of mud bank which can range from 10 to 50 sq km. Apart from this, the duration for which one area remains clam as a mud bank has also shown wide variation and this can vary from few days to months.

The cause for formation and dissipation formation of mud banks still remains an unsolved mystery, though several theories have been put forth by researchers including factors like absorption of wave energy near the bottom by thixotrophic drag and subterranean flow from adjoining backwaters or Vembanad Lake. The observations on the ecology of mud banks have shown presence of upwelled water with low levels of dissolved oxygen and low temperatures. The turbidity has been found to be very high and during July August, unique 'mud cones' are formed very close to the shore.

Mud bank Fishery

The productivity has been found to be high with good plankton biomass. Mud banks are considered as good fishing areas. Every year during mud bank season several small scale fishers from neighbouring districts move to Alappuzha district where mud banks are known to form.

During SW monsoon, fishing by mechanized sector comes to standstill primarily due to the ban on trawling implemented by the Government of Kerala for a period of 47 days from June 15th to July 31st every year. Rough weather also hinders fishing to a large extent. However, in the mud bank area seines, gill nets and cast nets are operated. Among these,

mini ring seines with 10 to 15m OAL fitted with outboard engine of 25 to 50 hp operate gears which are popularly known as *chooda /disco vala* which are small meshed (8-10mm). Large crafts of 20 to 24m OAL with inboard engines also operate ring seines with 20mm mesh size. Each craft is manned by several fishers, ranging from 12 to 15 in ring seines with out board engine while almost double (30 to 35) the number in inboards ring seine operations.

Gill netters in 7 to 9m OAL with out board engine use slightly larger mesh net (28 to 32mm *chala vala*) and in a single craft 5 to 6 fishers will be involved in fishing. In addition to this, small (2-3m OAL) thermocol non mechanized gill netter (28-32mm *chala vala*) commonly known as *Ponthu vallam* operate in the mud bank area . These operate in very shallow areas within 2 to 20m depth. Fishing in the shallower areas is mainly by the thermocol crafts which are manned by one or two fishers.

Fishery Resources

The Indian oil sardine, *Sardinella longiceps, Stolephorus* spp and shrimps mainly *Fenneropenaeus indicus and Metapenaeus dobsoni,* form the main fishery resources of the mud bank area. Shoals of sardine and anchovies are sighted very near to the coast and these two resources together contribute more than 50 to 60% of the catch. *Penaeus monodon, Metapenaeus affinis, Parapenaeopsis stylifera. Rastrelliger kanagurta, Secutor insidiator, Thryssa mystax, Esculosa thoracata, Otolithes ruber,* A*nodontostoma chacunda, Dussumieria acuta. Opisthopterus tardoore, Leiognathus* spp, *Pellona* sp and *Johniops* spp are other main resources which occur in the fishery during the mud bank season. The catch of these resources range from few kilograms to about 50 tonnes per season. Apart from these, about 50 other resources occur in negligible quantities in the fishery. Mud bank fishery is also observed in Ernakulam, Thrissur and Malappuram districts of Kerala and the same resources are seen in these mud banks also. However, formation of mud banks is not common in these districts.

Mud banks are not major feeding or breeding grounds of the finfish and shellfish resources. Wide fluctuations have been observed in the mud bank fishery. The dominant fishery resource on each day of the mud bank has shown wide variation in the past and the same trend continues now also. If sardine shoals are observed one day, the following day it may be anchovy shoal or there may not be any shoal at all. Very high variability has been observed indicating that these are shoals are moving and they accidently reach the mud bank area. Shoals of sardine and anchovies are sighted in the non mud bank areas also and most often the non mud bank areas are more productive with higher catch rates than mud bank areas.

During a targeted study on mud banks conducted by CMFRI during 1966 to 1975, it was observed that the catch from the mud bank area of Alappuzha was higher than the non mud bank area from 1966 to 1970 and was considerably lower than the non mud bank area

during 1971-72 and 1974-75 (CMFRI Bulletin 31, 1984). The average catch during the monsoon season (June-August) during the period 1966 to 75 was estimated at 2868 tonnes. In 2012, the catch for same season was estimated at 5240 tonnes from Alappuzha district (MFIS, 217; 2013). The increase in landing can be attributed to the increased effort and gear efficiency.

The landing centres adjacent to mud banks are the main markets during monsoon. These landing centres are used by merchants to auction and market the catch fished from the mud bank and non mud bank areas also, hence it is difficult to estimate catch from mud bank areas separately. Experimental fishing by CMFRI in mud bank (MB) and non mud areas (NMB) in 2014 have shown that mud banks are not special fishing areas. Usually more fishes are in the adjacent non mud bank areas.

In recent years, fishermen communicate to the merchants through mobile phones as soon as the catch is hauled and the catches are landed in mud bank areas where berthing the fishing craft is easy. Several fishery related ancillary small trade units like the ice plants in the village and other temporary units including tea stalls are set up in beaches where mud banks usually form and the coastal villages of Alappuzha become festive during mud bank. More than 8000 fishermen are actively involved in fishing in mud bank area. Mud banks play a significant role in improving coastal village economy and many villagers clear off their debts during this period. The Government of Kerala has protected the country crafts and provided permission to fish during the monsoon.

Targeted study on the trophic links in the mud bank area

Experimental trawling mud bank (6m depth) and non mud bank area (6m and 12 m depth)-RV Silver Pompano was conducted during 2014 from April to October. The catch obtained were analysed and species wise contribution of fish, shellfish and other invertebrates in each haul were studied. The feeding and reproductive biology of these resources were investigated and the trophic levels identified. Apart from this the occurrence of sea birds and their links with the major fishery resources identified. Biological details of the major resources landed during 2013 and 2014 were also analysed.

Primary and secondary productivities

Analysis of phytoplankton of the 3 sites mud bank and non mud bank indicated very high densities of diatoms like *Fragilaria, Skeletonem, Melosira, Biddulphia. Chaetoceros* and other groups. In one sampling, even shrimp guts were found to have *Fragilaria* spp. which was in full bloom. Zooplankton biomass was also high with dominance by copepods, Lucifer, bivalve larvae, *etc*. The benthic community was dominated by bivalves in the beginning.

Twelve trophic groups were identified based on diet, size and habitat preference (Fig 1). Among these the community was dominated by small pelagic omnivores (eg. anchovies, mackerel), small benthic omnivore (eg. shrimps, crabs etc) and small pelagic herbivore (oil sardine)(Fig 2).

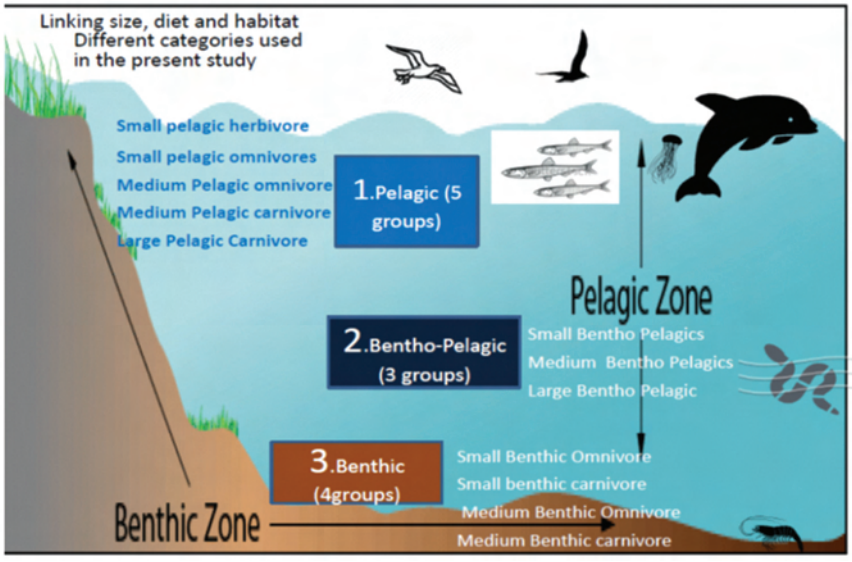

Fig. 1. Schematic diagram of the trophic structure of mud bank of Alapuzha

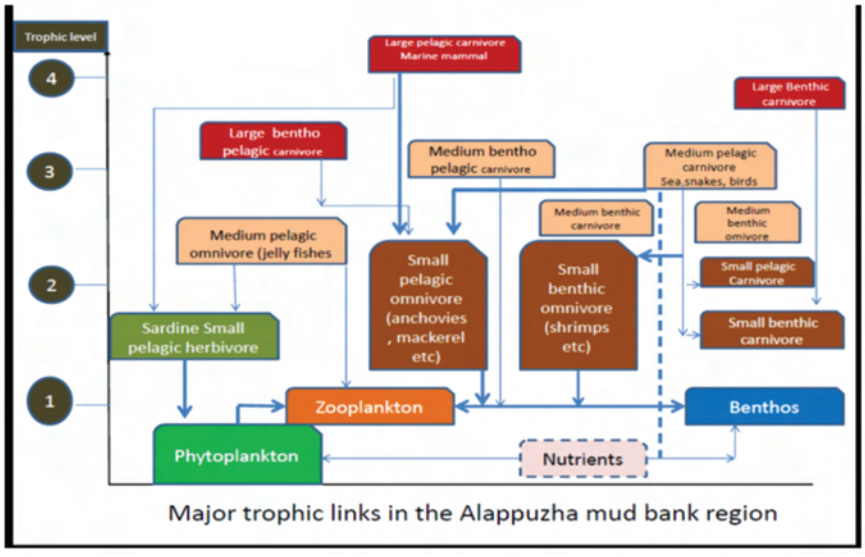

Fig. 2. Major trophic links in the mud bank of Alapuzha.
The size of the box indicates relative abundance

Anchovies, mackerel and sardines were found to be in actively feeding state, indicating the rich plankton in the MB and NMB area which supports the high biomass of these resources. Very strong similarity between gut contents and plankton & benthos. Other trophic groups found to feed on these resources (eg Ribbon fishes, Indo-Pacific humpback dolphin *etc*).

The large biomass of **shrimps i**n the upper column water masses indicates disturbance in the bottom, mainly due to cold and low oxygen upwelled water. Their half filled stomach indicated active feeding. The shoals of all the three groups were found beyond the calm area. **Beaked sea snake** *Enhydrina schistosa* (Daudin, 1803) was caught in the experimental hauls. It was observed that in the snakes caught at 6 m depth the main food item was cat fishes while the stomach of snakes caught at 12 m depth had more puffer fishes.

The teleost ***Trypauchan vagina*** was present just before the formation of mud bank and was present throughout the mud bank period. This species lives in a self made burrow and when the bottom is disturbed, it comes up and gets caught in the fishing gears. Not only mud bank, any region which is disturbed either by low oxygen, churning , low temperature or any other abiotic or biotic stress would make it rise to the column waters. Presence of *Trypauchan vagina* which is called chakara mani just before the onset of mud bank and all through the mud bank period indicates disturbance in the bottom. This species can be considered as an indicator of upwelling /mud bank.

Flocking of sea birds (migratory) especially terns and gulls for foraging on anchovies, sardines and shrimps was observed all along Ernakulam-Alappuzha area and their role in nutrient enrichment was also observed.

Conclusion

The targeted study on mud banks of Kerala indicated that though mud banks are physically different from the adjoining areas by their calmness, biologically they are comparable. The resources found within the mud bank and outside were similar and the main reason for the high catch of shrimps was the disturbance due to low oxygen condition at the bottom. Active feeding by small pelagic and bentho-pelagic fishes indicated that the rich plankton and benthos support these groups. Their presence in the inshore waters supports good fishery.