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Mud Banks are areas of the sea adjoining the coast with calm water during the roughest monsoon conditions of the sea. They provide a rich catch of fishery too.

Coastline view of Mud Bank region, Alappuzha, Kerala



Mud Banks of Kerala:

Mystery Yet To Be Unveiled!

HAILED as the 'most anxiously awaited weather feature', the onset of monsoon over Kerala heralds the rainy season in the Indian subcontinent. Prior and subsequent to the monsoon, coasts witness the fury of the turbulent and raging seas.

Strong monsoon winds associated with high waves make it impossible for fishermen to go out into the sea. Small canoes and catamarans are kept far ashore. Fishing in the artisanal sector comes to a standstill. The entire length of coast bears a deserted appearance. All along the shore, the coastal communities eagerly look towards the sea and pray for the 'bounty of the mother'.

However, this period of acute peril and poverty does not last long at some stretches of the coast. These are the Mud

Banks! Mud banks bring joyous waves to the shore and also fill the heart of fishermen with joy. The news spreads like a forest fire.

Mud banks (Chaakara) are the seasonal windfall for artisanal fishermen, which are demarcated as calm zones just adjoining the coast, during the roughest south west monsoon conditions where squally conditions prevail in the adjoining coasts.

Thousands of fishermen from the surrounding villages rush to the fishing village where mud banks surface. During the short-lived mud bank season the shore is lined with fishing canoes and country boats and fishermen landing, sorting and selling a wide variety of fishes. The entire region transforms into a festive mood.

In the safe and hospitable environment they harvest shoals of fish from their traditional fishing canoes. A single throw of nets enables them to bring home a miraculous bumper harvest of fishes such as mackerel, prawns, sardines, anchovies and others. Seafood processors and exporters buy up the bumper crop and cash in on the abundance.

The formation and behaviour of Mud Banks is a phenomenon unique to the southwest coast of India. They are peculiar in their formation as well as functions. Mud Banks are defined as areas of the sea adjoining the coast that have the special property of dampening the waves and creating clearly demarcated areas of calm water during the roughest monsoon conditions of the sea.

The mud bank formation occurs within a week or so after the onset of the southwest monsoon. The occurrence is sporadic. This varies from year to year, in extent and duration. In some years they are not formed at all. They are also mobile, moving from place to place for long distances along the coast. A suitable combination of several factors such as rainfall intensity/duration, temperature, salinity and some other unknown factors lead to its formation, its extent and duration of continuance.

Despite its importance, it is not clear why the mud bank regime is so seasonally persistent. Just how and exactly where a mud bank occurs is little understood. The phenomenon still remains a mystery!



Huge fishery catch

History of Mud Banks

The earliest known record of the existence of mud banks dates back as far as 1678 in Pinkerton's *Collections of Voyages and Travels*, given in the *Travancore Administration Report* of 1860. In 1881, King has given an account of the formation and migration of mud banks, while Capt. Cope called the mud bank as a zone with no parallel in the entire globe!

Anchorage or mud banks have been known to mariners from time immemorial. They were also aware of the peculiar characteristics of the sea in these regions. There are indeed, strong reasons to suppose that in the early years of the Christian era the Arabian Sea was gracefully calm along the Kerala coast. The sea in these regions is perfectly quite and smooth during the southwest monsoon contrary to the tumbling sea outside. The fact that the ships of Vasco da Gama were anchored in the open sea off Kozhikode (Calicut) from 20th May to 26th August during the southwest monsoon of 1498 is a historic proof.

The mud-deposits in the sea floor which suppress the waves are the unique feature of the Malabar Coast. It may be due to the mud bank where there were no waves making the sea calm. The floor of the Arabian Sea along the coast was covered with mud-deposits, with the result that no waves were formed along

the coastal sea. The sail-ships of those days could therefore anchor right in the sea, and remain as safely as in a pond. Devoid of waves, the ships were free from the thrust and pull normally experienced in the open sea. Consequently the big vessels remained in the sea and the cargo used to be carried to and from the ships in the canoes and small boats even during monsoon season.

The remarkable characteristic of mud banks is that they did not lead to any silting of the coast on which ships could have run aground. They protect both the incoming and outgoing ships during the heavy downpours and stormy winds of

the southwest monsoon. When active, they are noted for their wave damping effects – a 1.8 m high wave outside the mud bank is reduced to 0.5 m in the mud bank, within a distance of 1.1 km. This reduction can be 100% in a fully developed mud bank. The quiescence offered is on account of the increase in viscosity of the sea water due to the mud being in a colloidal suspension over a very loose and non-rigid clay bottom. The mud bank also provides protection to the coastal zone, by way of allowing accretion, apart from being beneficial for fishing.

The first scientific study on mud



Arrival of Vasco da Gama in 1498
(Artist's view)



Mud banks have high socio-economic relevance as they support livelihoods of subsistence fishermen besides protecting the beaches from erosion.

banks was carried out by Sir Robert Bristow (the creator of Cochin port). In 1938 he published two volumes titled *History of Mud Banks* which detail the first exhaustive description on the origin, formation and movement of Kerala mud banks. Since then, numerous studies have been carried out.

There were several locations (~20 nos.) along the southwest coast of India, where mud banks have appeared some time or the other in the past. Recently, these have dwindled to appear only at a few locations with deviant changes in characteristics. Though a large number of studies were undertaken for unravelling the processes that initiate and sustain the mud banks, a large knowledge gaps still exists.

Hypotheses of Formation

The most remarkable feature of the mud banks is the damping effect of the mud suspension on the incident waves. The line of breakers on the seaward edge of the mud banks makes it distinct from the rough seas all around and can be clearly seen. Under the influence of changing coastal circulation, they tend to migrate slowly during its evolution laterally along the coast.

It is interesting to note that the effect of the mud banks is felt within a fortnight after the beginning of the monsoon showers. Huge discharges reach into the sea through the numerous perennial and seasonal outlets and by seepage through barrier beaches. The violent winds and strong ocean currents created by the monsoon winds stir the bottom of the sea, and fine mud particles are churned up into a thick suspension.

The southerly currents that run parallel to the coast at maximum speed drive the entire floating mud slowly towards the shore. A semicircular boundary develops around the suspended mud, which consistently absorbs the

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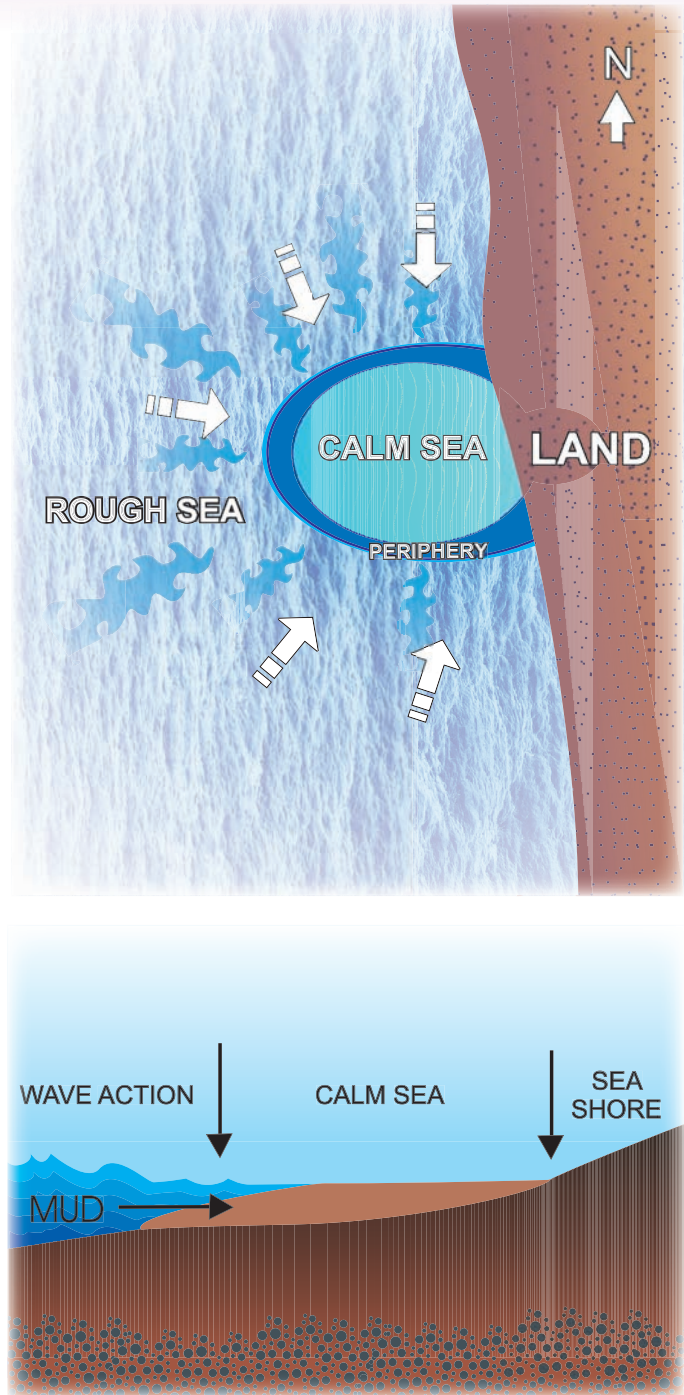
wave energy and substantially reduces turbulence.

Muddy water attracts a wide variety of fish, shrimp and prawns in abundance, and they surge to the surface from the bottom of the sea where they normally live. The tranquil waters inside the mud bank turn into a bustling fishing harbour.

Further, the sea bed is agitated by the action of the waves and the material is thrown in suspension. The monsoon swells provide a continuous source

of energy to maintain the colloidal suspension which alternately dampens the waves progressively and finally the sea becomes completely calm within the area. The most striking character of the mud bank is its extreme calmness when all other places are highly wave-beaten. Though it is known that the calmness is caused by the mud in suspension, how the monsoon waves can bring the mud into suspension too is not satisfactorily explained.

A. Diagrammatic depiction of a typical mud bank. Periphery indicates seaward breaker zone enclosing the mud bank. B. Cross section of a mud bank (Adapted and modified: Jacob and Qasim, 1974)





The bounty of Mud Banks
(Alappuzha, 2014)

The entire length of coast bears a deserted appearance. All along the shore, the coastal communities eagerly look towards the sea and pray for the 'bounty of the mother'.

Kerala has brought about significant modifications in land utilization during the last three decades. As a result land utilization has dramatically changed the fertility, soil erosion, ground water resources and surface water flow severely.

According to the findings, deforestation, migration to those areas and leveling of agricultural land for dwelling have adversely affected our environment. So far no constructive studies have been carried out to determine the impact of such land utilization.

The decrease in watersheds and increased human invasion has accelerated the disintegration of mangroves. On account of port development, Wellington Island and its surrounding lands have been encroached at the expense of urbanization. Similarly, Kuttanad a sub-sea level area that once flourished with mangrove population has become a no-mangrove land now.

Mud banks have high socio-economic relevance as they support livelihoods of subsistence fishermen besides protecting the beaches from erosion. There is an urgent need to find definite answers for the origin and source of the mud of the mud banks; their active life and longevity; shifting habits; subsequent dissipation and prevalence of pre- and post-mud bank conditions, besides the all-important societal concerns.

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Mud Banks and Fisheries

Huge abundance of fishery in the mud bank zones makes the Kerala mud banks unique. It is believed that the mud banks and fishery are interdependent and if the former occurs the latter should follow. To many, a good mud bank means good fishery. Since calmness of water and the mud accumulation are not significant, all mud banks need not be productive. Therefore, the success or failure of a mud bank is judged from the quantity of fish caught during the season.

Studies have shown that the mud banks sustain a high fishery potential (Raghunathan et al., 1984). The pelagic fishes and prawns move from deeper waters closer to the shore during the southwest monsoon following upwelling (Banse 1959). The general tendency of fish being to swim against the prevailing current (which is southerly), it is possible that they move in shoals northward and a portion, on passing through the mud bank area, are easily caught by the numerous canoes operating in and outside the mud banks.

If so, it is also possible that a shoal of a particular composition, after its passing, is followed by another of entirely different composition, which might account for the abrupt changes in the composition

of fish landed. It is, therefore, likely that the monsoon catches landed at the mud bank area are from the moving shoals as they are caught from this region because fishing is possible only in this region (Raghunathan et al., 1984).

Another argument is that the process of upwelling causes development of hypoxia over the shelf, which creates stress on the fishes and prawns, as they move either shoreward or to deeper waters (Rao et al., 1980). Such a condition occurs throughout the coast where upwelling is intense. During this migration, these shoals may also cross the mud bank zones. Most of the fish landings during monsoon take place at the site of the mud bank due to the calmness of the sea in the region.

Unveiling the Mystery

Mud Banks of Kerala coast differ from mud banks reported from other muddy coasts of the world as they do not form a regular relief-forming feature. Mud banks have high socio-economic relevance as they support the livelihoods of subsistence fishermen of Kerala during the southwest monsoon, when fishing is suspended all along the coast. A decline in occurrence is clearly visible with noticeable characteristic changes.