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THE MYSTERY OF CHAKARA

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Introduction

Each year, in the month of May or June, the Southwest Monsoon winds begin to blow across the Arabian Sea on to the Kerala Coast. These strong winds raise powerful waves that make the sea rough, very rough indeed, and then viciously lash the coast, right through the season, for nearly four months. These winds also bring the much needed rains to the parched lands. The surging sea with its relentless waves makes the coastal areas practically unliveable. The coastal residents, the poor fisher folk, drag their tiny canoes inshore to save them from being carried away to sea by the surging waters. They even have to relocate their bamboo huts to higher grounds to escape being swamped. So, there is none left on the coast to witness the furious grandeur being played by the Southwest Monsoon winds. Even the hardiest fishermen choose to stay ashore to mend their canoes and nets. Every one then awaits 'Chakara'.

Chakara literally means 'dead sea'. As the sea is raging on, driven by the relentless monsoon winds, some sections of the Kerala Coast, suddenly turns calm; waves cease their furious onslaught. The sea literally dies. That's Chakara. And that's

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not all; the calm waters along the Chakara coast simply abound in fish. The news of Chakara spreads fast. Fisher folk—men and women, and even children rush in with their nets and 'kottas'(woven bamboo baskets) to harvest the bountiful gift from Kadalamma, their Sea Goddess. Chakara won't last long—seldom more than a few days at any place. They had better hurry. The sea would soon revert to its violent fury. Yet the catch can be quite abundant. In the good old days, the legends tell, the fish was simply gathered in the kottas, without having even to cast a net! Imagine walking into sea and returning with basket full of fish, alive and shimmering. That's the magic of Chakara.

Chakara is unique to the Kerala Coast. It occurs only during the thick of the Southwest Monsoon, but not everywhere, only along the coastal stretches of Alappuzha, Kochi, Thrissur and Kozhikode. The most famous is along the Alappuzha coast. There's a reason for that.

As such, Chakara has attained a mythical status. The local fisher folk believe that it is a divine benevolence conferred on the fisher folk by 'Kadalamma', more so when the going gets tough as the raging seas prevent them from venturing to sea. Chakara is thus the central theme of many a coastal folklore. It has inspired poets, writers, and even moviemakers.

But in the recent times, Chakara has started to wane. Even when it does show up, the effect is indeed brief, vanishing even before the fisher folk can get their acts together. They wonder if Kadalamma is upset. Has it to do with over fishing with large mechanised trawlers... or global warming? 'Poojas' and sacrifices seem to no avail. Will Chakara ever return to its old glory, heralding good times to the beleaguered fisher folk, just as the ancient legends extol?

Mudbanks—the Secret behind Chakara

Huge sums have been spent on numerous research programmes to unravel the mystery of Chakara. Many theories have been proposed, some esoteric, others quite farfetched. It has however been established that Chakara occurs when mudbanks form up along the coast, not far from the shoreline. And when these mudbanks do form up offshore, rather suddenly, the intervening sea right up to the shoreline becomes calm, while the rest of the Arabian Sea continues to rage on. But how do the mudbanks form so suddenly offshore? The scientists are still grappling with the question, let alone explain why Chakara has become elusive. There is however a serious difficulty in the research effort—the rough seas, which preclude any serious on site investigations as the mudbanks form offshore. That has led to some speculation, often based on inferences made on mudbank

studies elsewhere. Although many theories have been making rounds for a while, the following appear to be more widely subscribed to, having been proposed by some great names and institutions, and also having featured in many scientific papers in prestigious journals, in earth science symposia, and even in doctoral dissertations.

Theory 1: *The increased flow into the backwaters during the monsoons discharges substantially more mud into the sea. Due to the increased density of seawater, the mud bubbles form on the surface and take a lot longer to settle down, which then forms up as mudbanks.*

Theory 2: *The turbulent seas which batter the coast during the monsoons result in mud up-swellings from the seabed, leading to formation of mudbanks or mud in suspension in the seawater.*

Theory 3: *The Southwest monsoon winds create a current, which runs parallel to the coast. This current flows perpendicular to the tidal flow and wave lashing the coast and forces the subsurface water to come up, churning up the mud particles in the process, which in turn results in the formation of mudbanks.*

Theory 4: *The mud that forms mud-banks originates in the Lakshadweep Sea, from as far as the Lakshadweep Islands, and is brought close to the coast to form mudbanks by action of rough monsoon waves.*

Mudbanks Originate on Land

At the outset, these theories, in spite of their wide spread acceptance, are not based on any fieldwork, at least, along the Kerala Coast where the Chakara occurs, simply because of practical difficulties. More over all these theories go against some very significant laws of nature, including that of gravity. Nevertheless, the simple truth is—mud can only originate on land, and not at sea. When rocks erode due to heat, flowing water, chemical action, or even wind, the eroded material are eventually transported to sea through a system of drainage. The finest of these eroded materials, finer than silt, becomes clay or mud. Such fine particles tend to stick to each other, forming a sticky clayey substance. The mud samples collected from the mudbanks reveal large presence of biomass, which again has its origin on land. Obviously, the muds that form the mudbanks must originate on land. But then, how do they get there where they form up so suddenly?

Chakara actually happens quite suddenly; therefore the formation of mudbanks also should be just as quick. That wouldn't be possible if any of the above

theories hold, because wave or current induced sedimentary processes are indeed very slow. Obviously, mud must arrive at the site and form into mudbanks very rapidly. That's possible only if mud erupts from the seabed like a 'mud volcano'. If this 'mud volcano' is due to any seismic causes the matter would have been common knowledge, because there would be other easily observable side-effects accompanying such causes, perhaps even mild tremors, and the net effect would be anything but making the sea calm. Moreover, such seismic causes cannot be confined to monsoon season alone, nor occur with such regularity. Therefore, the mud gushing out of seabed simply cannot be due to any seismic causes.

What then could provide the motive power to make mud gush from the seabed, so suddenly? The only other option is to see the mud discharging from seabed as if an underwater drain has been suddenly opened up from storage tank of fluid mud, which in turn results in mud gushing out. So then, where is this storage tank of fluid mud, from where the mud originates?

The Kayals—the Mud 'Bank'

Let us take a closer look at the morphology of the areas where the Chakara usually occurs. Other than the coastline and sea, the one thing common to all these areas is the presence of large water bodies—Kayals or backwaters, just landward of the coastline. A narrow strip of sandy stretch separates the Kayal and the sea. Several perennial rivers and monsoon streams discharge into these Kayals. These rivers and streams scour the lands and bring in huge quantities of eroded sediments—sand, silt and mud into the Kayals. Moreover the waters flowing into the Kayals also carry along huge amounts of biomass, fallen leaves and dead plants from the dense vegetation on the rain fed slopes of Sahyadiri Ranges. So that's how mud and biomass gets into the Kayals—the storage tank of fluid mud.

Each Kayal has a long narrow channel that runs along the coast before opening out to sea. Normally, the waters from the Kayal flow out to sea through the 'visible' surface channel. Also, the seawater flows into the Kayal this channel during the flooding tide, which makes the waters in Kayal quite brackish.

For example, the adjoining Alappuzha Coast is Vembanad Kayal—the largest, hence the biggest source of fluid mud. A narrow strip of land separates Vembanad and sea. Twelve major rivers and numerous other streams flow into Vembanad. But the only 'visible' discharge out of Vembanad is a channel passing through the Port of Kochi in the north. During dry season, this 'visible' surface channel is adequate to discharge the inflow into Vembanad. But with the onset of monsoon

rains the inflow into Vembanad increases dramatically. Even with a marked increase in outflow through the Kochi Channel, the entire inflow into the Vembanad cannot be drained, and so the level of Vembanad begins to rise.

With increase in water level, the hydrostatic pressure along the Kayal's bed increases. And when the hydrostatic pressure on the Kayal's bed crosses a critical figure, the subterranean channels below the narrow strip of land separating the Kayal and sea open up. Through these subterranean channels fluid mud is forced out to sea, under pressure. The mud then erupts some distance away from the shoreline like a mud volcano. These mud volcanoes form into the mudbanks. The subterranean channels are about the same as the ground water channels elsewhere on land, but remain normally clogged shut with mud keeping the seawater from entering into the Kayals or freshwater being drained to sea.

Mudbanks—an Offshore Seawall

The mudbanks though made up of soft mud are quite densely packed because of the pressure of release, and stand several metres proud of the seabed, almost like an offshore 'seawall'. This mudbank 'seawall' stops the waves from reaching the shore. The waves begin to break away from the coast at these mudbanks. The intervening 'dead' sea is the Chakara. Beyond the mudbanks, to west, to north and to south, the sea continues to be rough.

Chakara—Short Lived

The mudbanks formation takes place only as long as there is the mud supply from the Kayal. But as the discharge fluid mud takes place, the hydrostatic pressure at the Kayal's bed drops, and soon the subterranean channels gets clogged shut with mud. Then for a while the mudbanks hold out against the waves making things calm landward. But as the relentless waves lash on them, they disintegrate and the mud gets spread on the seabed. With the mudbanks disintegrated, the waves once again resume their onslaught on the shore. The sea there once again becomes 'alive'—the end of Chakara.

Fish in Abundance

The mud ejected from the Kayals through the subterranean channels is rich in biomass. This 'nutritious' mud appears to be an excellent source of food for the fish, hence attracts schools to the Chakara. As this phenomenon has been going on for several millennia, the fish in the region perhaps know quite instinctively

about the impending formation of mudbanks and the abundance of food therein. In addition, the soft nutritious mud that eventually spreads on the seabed after the mudbanks disintegrate serves as a spawning ground. Incidentally, it is also the spawning season for many endemic species of the region. This may yet be a more plausible reason for the abundance of fish at Chakara site.

Chakara—erratic—elusive

Hydrostatic pressure build up on the Kayal's bed is vital for providing the necessary motive power to eject fluid mud to sea through the subterranean channels. Such a pressure build can take place only if there is adequate inflow into the Kayal, and that too, faster than the surface channel can drain out. Such a rapid and copious inflow into the Kayals can happen only during the monsoon rains, and that too, only when the runoff through rivers and streams and even overland is allowed into the Kayal unimpeded by dams or irrigation networks. If the inflow into the Kayal is reduced, or even happens at a slower rate, the waters will drain to sea through visible surface channel, then Kayal's level wouldn't rise, and so the required hydrostatic pressure build up on its bed won't take place.

In the recent times, while there has been no marked reduction in rainfall, the inflow into the Kayals has reduced considerably. Most rivers and streams have been either been dammed or their waters have been diverted through a network of irrigation canals for agriculture. The inflow into the Kayal has thus become erratic depending on the storage in numerous dams and barrages, unlike the earlier times when there was a surge of runoff during the Southwest Monsoons. Thus the build up of hydrostatic pressure beyond the critical level necessary to eject the fluid mud to sea has become just as erratic, and even elusive.

Coupled with the reduction of flow in the rivers and streams, there is yet another menace that has contributed to the worsening of the situation—unbridled sand mining? Sand mining has led to literal 'ponding' of many rivers feeding into the Kayals, even within the Kayals. The net gradient flow into the Kayal from such rivers and streams has almost ceased. The problems still don't seem to end there for Chakara. Of late, there has been large scale reclamation of Kayals for both agriculture and even housing. With the reduction in the water-spread of the Kayal, the visible surface channel is quite adequate to discharge the already reduced inflow. No more will the required hydrostatic pressure build up take place, sufficient to eject the mud to sea through the subterranean channels. The end of Chakara isn't too far!

Ecological Impact of Chakara's End

With increase in anthropogenic demand for water from the rivers and streams, the nature itself may be deprived of adequate water to sustain certain ongoing natural processes. It may not be long before it is curtains down for this magnificent phenomenon of Chakara. Chakara is not only important to the fisher folk, but for the entire ecology of the region. Without adequate discharge mud out to sea, the Kayals will get silted and get shallower. The siltation of the Kayals will no doubt affect the livelihood of many who live off the Kayals. Siltation of the Kayals will result in many endemic species in the region facing the threat of extinction due to loss of habitats. In addition, during heavy rainfall the silted up Kayals will lead to flash floods in the adjoining areas due to poor storage within the Kayals.

The end of Chakara will also have impact out at sea, with the loss of the natural source of food for the fish and eventual destruction of natural spawning grounds. It is then not difficult to predict a loss of fish yield all along the Kerala Coast, or perhaps even the entire Indian West Coast. Loss of mudbanks at sea may in addition contribute to an increase in the erosion proneness of the already eroding coasts.

Conclusion

Chakara is nature's way of maintaining equilibrium of levels, both water and the bed below, within the Kayals. The problems start when humans interfere with such delicate processes of nature. Then the natural processes are either hastened or even reversed, often with devastating consequences. If we must ensure Chakara's continuance, then we must take immediate measures to restore requisite inflow into the Kayals during the monsoons. This is possible, only if, we first carefully study and regularly monitor the environmental processes and the changes that are taking place therein. That does call for extensive research into such processes, and also into developing necessary instrumentation for the much needed field observations. We simply cannot afford to let such a unique natural phenomenon of nature become extinct for want of timely and decisive action. This may perhaps be our last chance to sustain/rejuvenate such an ecologically significant phenomenon, and of course, for protecting the fragile ecosystem that makes all that possible.