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Research Article

An Investigation about the Natural Precursors of Disasters

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A B S T R A C T

Natural disasters were a matter of things which were happening on the other side of the globe or planet especially for the people in Kerala. But disasters starting from 2004 Tsunami, 2017 Ockhi and 2018 floods exposed our vulnerabilities. Just before these disasters there were certain indications by the nature called as natural precursors. But the coastal community was not at all aware of such things and it contributed to the intensity of casualty. This paper is an attempt to identify and showcase those natural precursors during the event of above mentioned natural disasters which happened in Kerala and Tamilnadu. The investigation highlights the need for creating awareness about these kind of precursors especially among the coastal community. This investigation mentions several different, occurred precursors and briefly mentions about the science behind these precursors and urges the need for an in-depth scientific analysis incorporating large samples of heterogeneous nature, physical modelling and numerical modelling for unraveling the causative factors behind this. In-depth understanding about these kinds of precursors should be carried out and it should be backed with scientific evidence. The investigation recommends effective use of both official warnings and natural precursors for accelerating the mitigation activities prior to a disaster.

Keywords: Precursor, IWO, Waste Reversal, Sensory Perceptions

Introduction

Before 2004, the term disaster was a matter of strange science fiction book, Bollywood/ Hollywood movies and the things which were happening on the other side of the globe or planet. The coastal inhabitants of Indian peninsula deeply and firmly believed that, they were not vulnerable to coastal disasters like the Tsunami. But the 2004 Sumatra tsunami was an eye-opener, which exposed the vulnerability.[4,5] It also established the urgent need for establishing a tsunami warning system in India, which was executed subsequently by Government of India in 2007 through Indian National Centre for Ocean Information Services (INCOIS), Hyderabad under Ministry of Earth Sciences, Government of India. From then onwards this warning center has been successful in predicting several low-profile tsunamis and various other coastal disasters. But beyond scientific warning and templates, the nature itself will be providing some sort of warnings through certain pertinent precursors. Usually these precursors go unnoticed without proper understanding. Investigations in the aftermath of 2004 Sumatra tsunami revealed the significant presence of several precursors along the coasts of Kerala and Tamilnadu.

Besides tsunami, there were cyclones, mild earthquakes, floods and various others disasters which too had certain precursors.

This investigation is about identifying such natural precursors. Though the title deals with coastal disasters this study primarily focuses on the harbingers associated with Tsunami, floods and cyclone which were the most disastrous once concerned with Kerala and Tamilnadu coasts.

Study Area and Criteria Adopted for this Investigation

The worst affected parts of Kerala coast and Tamilnadu coasts (Western and Eastern coastal Sides of Indian Peninsula) were chosen for this investigation as the precursors were visible here during the above mentioned havocs. This investigation was done in three stages viz. 1) 2005-2008, 2) 2009-2012 and 3) 2015-2017. Special perusal was also carried during the 2017 Ockhi Cyclone, 2018 Floods and 2019 Floods along Kerala for detailed investigation.

More than 200 local residents of coastal community pertaining to different age groups and societal statures were interviewed primarily for primary data collection. The validation of the same was done in the second stage in which cross examinations about recurring and replicated facts were further validated, the third stage included merging and comparing of various information.

Observed Precursors

The observed precursors during the last two decades can be summarized as follows

Muted Sea/ Calm Sea

Just after a tsunami genic earthquake, the tsunami waves starts propagating with reference to the earthquake source parameters. The arrival time of a tsunami varies from 1-72 hours depending on the propagation characteristics, topography, bathymetry and various other fault parameters.

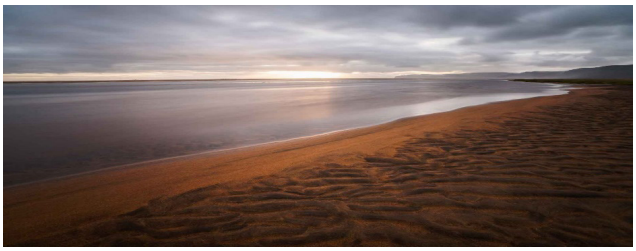

Figure 1.Photo of Calm Sea

For a particular coast the precursors happen mostly in-between 5-1 hours before the arrival of a tsunami. Normally at the coast there will be a huge sound of wave breaking. Investigations unraveled that prior to a tsunami arrival at the coast the sea will be muted or the sound will be of less decibel/ intensity (Figure 1). This can be regarded as a harbinger of an upcoming tsunami wave as evidenced by several coastal inhabitants on the Kerala and Tamilnadu coast.

Unusual Behavior of Terrain Animals

The animals on the land particularly domestic animals will show drastic changes in their behavioral pattern. They make abnormal noises at regular intervals (Figure 2).

Figure 2.Unusual Behavior of Animals in Land

They try to move in a nonlinear pattern especially to move from their positions where they are tied. The animals which are not tied move in a zigzag manner making abnormal noises and behavioral pattern creating havoc to the general public.

Intruding of Sea Creatures in to the Land

The most important and notable natural precursor which was observed during the tsunami of December 26, 2004 was the intrusion of marine creatures into the land (Figure 3 and 4).

Figure 3.Intruding of Variety Sea Creatures into the Land

Figure 4.Photo of Fishes Escaping from Deep Ocean and Taking Refuge in the Coast

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Marine creatures travel non-linearly and will be entering into the land with intense fear, unknowing that they will die after entering in the land. The creatures included fishes, big fishes and other unseen marine creatures. During the 2004 Sumatra tsunami, many fishes accumulated on the coast. As there was no such information about this as a precursor, people from various other coasts also came to the coast for collecting fishes. Minute later tsunami came and carried away many coastal inhabitants. The accumulation of fishes and its subsequent collection increased the intensity of loss at the coast.

Initial Withdrawal of the Ocean (IWO)

Prior to the tsunami of December 26, 2004 many coasts in India witnessed an unusual behavior in the coast.

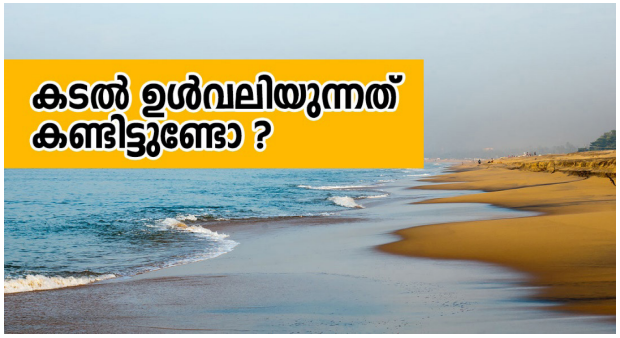

Figure 5.Initial Withdrawal of Ocean prior to a Tsunami

It was the withdrawal of ocean from the coast and extending the width of beach.[3] Some attributed that as lowest low tide or abnormal variations in tidal fluctuations. Some took this opportunity as driving beach for entertainment, fun and for doing sporting events, not knowing about the upcoming tsunami set of waves. A scientific explanation for this IWO was mentioned by Kurian NP et al.[2] IWO can be treated as a harbinger of an upcoming tsunami. But tidal fluctuations and other physical oceanographic processes are often treated as IWO which is a misnomer.

Fragrance at the Coast

The people on the east coast and certain sectors of west coast reported the feel of a good fragrance along the coast particularly just before oceanic disasters, the smell formulation of mixing mud and water. It is to be pertinently noted that a fragrance of this kind was not felt before or after on the coasts during a normal day.

Huge Sound

The precursors started with a muted sea. But maximum 30-45 minutes prior to a tsunami there were reports about huge noises from the deep ocean, as fastly approaching the coast like that of a train or the like the crash landing of a jet plane. This sound comes just prior to a tsunami and it is regarded as the final whistle before the havoc.

Dumping of Wastes

Prior to the arrival of a disaster associated with water, there had been reported incidents of waste reversal. The waste garbage which are dumped into the seas usually come back to the coast, prior to a disaster. It is called waste reversal. Normally it happens on the coast and on the banks of rivers. In Kerala and Tamilnadu there were instances of such cases during the tsunami of 2004, Ockhi cyclone of 2017 and the floods of 2018. In certain coasts and banks it happened during the occurring time of calamity and in several others it happened immediately after the disaster. The waste reversal process can be considered as the harbinger of a coastal disaster. The reason behind this can be mainly attributed towards wave action and wave activity from onshore to offshore and back. Torn fishing nets, discarded clothes, plastic carry bags of various hues and sizes, driftwood, and plastic bottles accounted for the major chunk of trash (Figure 6).

Figure 6.Reverse Dumping of Waste by Ocean

Science Behind These Precursors

The science behind these animal precursors are still ongoing with high voltage debates. Many believe that animals can pick up the “infrasonic” sound pulses created by storms and earthquakes, much in advance and will swiftly move to locations of safety. Besides it is an established fact that animals are having different sensory capabilities than humans as equivalent to that of sixth sense giving them the ability to predict upcoming situation of trouble.

Review of literatures suggest that in the case of the elephants they are capable of picking up infrasound waves created by the tremor which is having a primary frequency of 20 Hz or lower. This frequency range is inaudible to human perceptions, enabling elephants to move to higher terrains.

The generation of infrasonic waves are mainly by volcanic eruptions, avalanches, earthquakes, meteors, iceberg calving, and lightning. Many animals, falling under the group of elephants, hippos, rhinos, felines, whales, many birds, and dogs, rely on infrasonic sounds for navigation and communication. These animals purely sense the sound and cannot classify the kind of upcoming disasters. But studies

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from time immemorial have proved that there exist huge sound variations as evidenced from the sensory perceptions based on the type of disasters. But the animals falling under the above category indulge in lack of sensory perceptions due to inborn physical deficiency and disability.

Studies also underscore that tiny creatures like insects, birds, and animals are particularly receptive to Rayleigh waves. Rayleigh waves are waves of minor vibrations travelling through the crust of earth from its epicenter. These waves have the capability to travel ten times faster than the speed of sound and cannot be detected by human sensory systems, whereas the same can be detected by animals.

Studies about humans have unravelled the presence of mechanoreceptors in our skin surfaces. It is helping human beings to detect changes in pressure and vibrations. But the range in which they can detect vibrations are for frequency of 250Hz. But the main obstacle to this is the frequency of Rayleigh waves which are coming in the range of 20 Hz. Studies suggest that the physical size of the animal is inversely proportional to its detecting capabilities and so ants can very well indicate the presence of an upcoming disaster like earthquake. Ants behave quickly to small sounds and subsequently after the disaster they get back to their normal trajectories.

It has been reported that ants have unique receptors unlike humans and other animals with detecting changes in electromagnetic fields and atmospheric gasses. The relevance of atmospheric gases and electromagnetic fields are important as it is the consequence product of tremors and quakes. Ants are very well experienced to detect changes in rainfall pattern too.

The studies about unravelling the mystery behind natural precursors in still ongoing which cannot be concluded or culminated at a particular point due to the huge variations prevailing in sample size monitoring and analysis.

Besides these animals can also respond to ground tilting, humidity changes, electrical currents and magnetic field variations. These are usually referred as seismic escape behavioural system. The process of humidity reception is animals is attributed as hygroreception.[1] A set of significant precursors primarily associated with earthquakes was reported by Wyss M & Wyss M, Booth DC.[7, 8] Since the replication time period of disasters are beyond the life span of most animals a comprehensive conclusion about precursors cannot be made. The electrical sensitivity of terrestrial animals are rather low compared due to marine animals which is mainly due to the high resistivity of air. Animal precursors should be associated with three different modes of disaster prediction, Long term, Intermediate and Short term prediction. Moreover the different nonlinear behaviour of animals like panic nature, jumping, tumbling, standing up, biting wires, flying up is still unexplained and it needs more research and investigation.

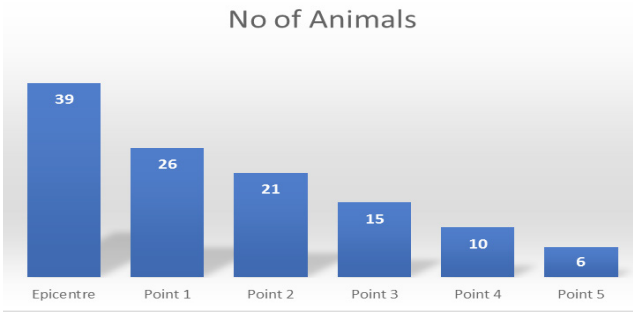

Figure 7.Results Obtained from Physical Modelling (Swimming Pool Test)

Swimming Pool Test (Physical Model)

Under this investigation, a modelling study was also carried out for understanding the sensory perceptions of animals. The layout of this physical model consisted of a medium sized swimming pool, medium sized fishes and a sound generating source. Medium sized fishes were selected and were deposited in a swimming pool equally bifurcating the regions of swimming pool based on distances. Medium sized fishes were selected as an ideal modelling condition as there are sensory variations in sound reception for small sized and large sized fishes. Swimming pool was horizontally divided into two boundaries A and B, in which different distance based segments falling inside. The swimming pool was horizontally divided into two so as to ensure the source and destination. The distance between source and destination is the mobility which is taken by the fishes upon the action of sound. Around 39 fishes were deposited in the initial point taken as epicenter. With the use of a transducer, sounds in the range of 5-25 Hz were generated. The sound was generated with consistent intensity for 15 minutes. From the epicenter, soon after the generation of sound, fishes started to move swiftly overcoming the hindrances created between segments (Point 1 to Point 4). The movement from point 1 to point 4 was gradual and subsequent in a decrement mode. It should be pertinently noted that amidst this huge sound, few fishes remained in that epicenter and can be attributed towards the lack of sensory perceptions or disability of fishes. The same patterns prevailed in each segment and so resulted in the less number of fish populations from point 1 to point 4, before reaching the farthest segment point 5. From the total of 39 fishes 26 moved to the segment 1 soon, and 21 out of 26 moved to segment 2 from segment 1. Five fishes remained in point 1 itself. Since this modelling test was only for a limited period, there is a possibility that almost all the other fishes would have travelled to safer destinations from the epicenter thereby increasing the tally of different point segments. So it can be concluded that tiny animals like fish

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also respond to sound, particularly high intensity sound due to their hyper sensory perceptions. This particular phenomenon can be correlated with the Doppler Effect in physics in which sound intensity will be varying with distance and observer. Larger the distance from the source, less will be the intensity. Nearer the epicenter, sensory organs will be having a high trauma and they will escape to distances where they get lesser trauma and noise of sound.

Conclusion

At times when the issuing of warning or prediction fails, the nature itself will be indicating the coastal community through several harbingers or precursors. A proper understanding of the above-mentioned precursors with proper scientific backing will be helpful for the coastal community to get prepared themselves prior to a disaster, thereby facilitating rescue and mitigation activities. The State/ district disaster management centers should carefully circulate these messages to the coastal population excluding misnomers, as a precursor to disasters. Besides these precursors can be effectively used in tune with warnings for better understanding and strategy planning. More importantly the ongoing investigations regarding the unraveling of science behind precursors should be effectively carried out including wide variety sampling, different boundary conditions and different forms of modelling. Each marine and terrain animals should be classified and investigations should be carried out extensively.

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