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AN INCIDENCE OF FISH MORTALITY IN ATHANKARAI ESTUARY NEAR MANDAPAM*

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Introduction

Mass mortality of marine animals is occasionally reported from several parts of the world. Various causes have been attributed to mass mortality in the sea. Of these, the main causes are the sudden changes in the temperature and salinity, noxiousness of water bloom and the lack of oxygen and release of poisonous gases. Brongersma-Sanders (1957), in a comprehensive treatment of the subject, has dealt with different causes for the mass mortality of animals in the sea.

In India, such mortalities have been reported on Kathiawar, Canara, Malabar and Madras coasts and these have been attributed to the swarming of *Noctiluca*, *Trichodesmium* or the flagellate, *Hornellia marina* (Hornell, 1917 ; Aiyar, 1936 ; Bhimachar and George, 1950 ; Subrahmanyan, 1954).

Observations and Remarks

Occurrence of fish mortality in Athankarai estuary (Fig. 1) near Mandapam was reported on 20th July, 1963. On visiting the place, widespread mortality of mullet fingerlings, *Tilapia*, the clam *Meretrix casta*, and prawns was observed (Pl. I, Figs. 1-4). Fishes and prawns were washed ashore on either bank while clams were observed in gaped condition on the bottom. The mullet fingerlings were found strewn mainly on the northern bank for a distance of 1 km. from Vaigai Causeway (shown as bridge in Fig. 1) to Perungulam bus-stop (Fig. 1, station 2). *Tilapia* were observed dead in small shoals more towards the latter. Clams which occur only from station 2 to a little beyond Athankarai ferry, were found dead near the former place only. No live fish or clam was observed anywhere in the region from the Vaigai Causeway (station 1) to station 2. Beyond the latter, both fishes and clams were found alive. The density of the dead mullet fingerlings was about 50 per meter in the densest regions while it was only about 7 per meter in the sparse region. In the case of *Tilapia*, the number of dead fish in each shoal averaged about 80. Enquiries with the local people revealed that this mortality occurred about 2-3 days before.

Athankarai estuary is formed by the river Vaigai which takes its origin in the Western Ghats and meets the Palk Bay near the village Athankarai (Fig. 1) about 15 km. west of Mandapam. The river is not perennial due to the diversion of its water for irrigation purposes and thus, during summer, the river flow more or less ceases even much upstream of Vaigai Causeway. At this place the width of the river is about 180 m. and remains more or less the same for a distance of 2 km. downstream, after which this width lessens a little.

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However, near the sea the estuary widens again. At the mouth, the estuary bed is elevated and hence very shallow. The mouth is about 60 ft. in width, but widens during high tides. There is no sand bar formation at the mouth and the

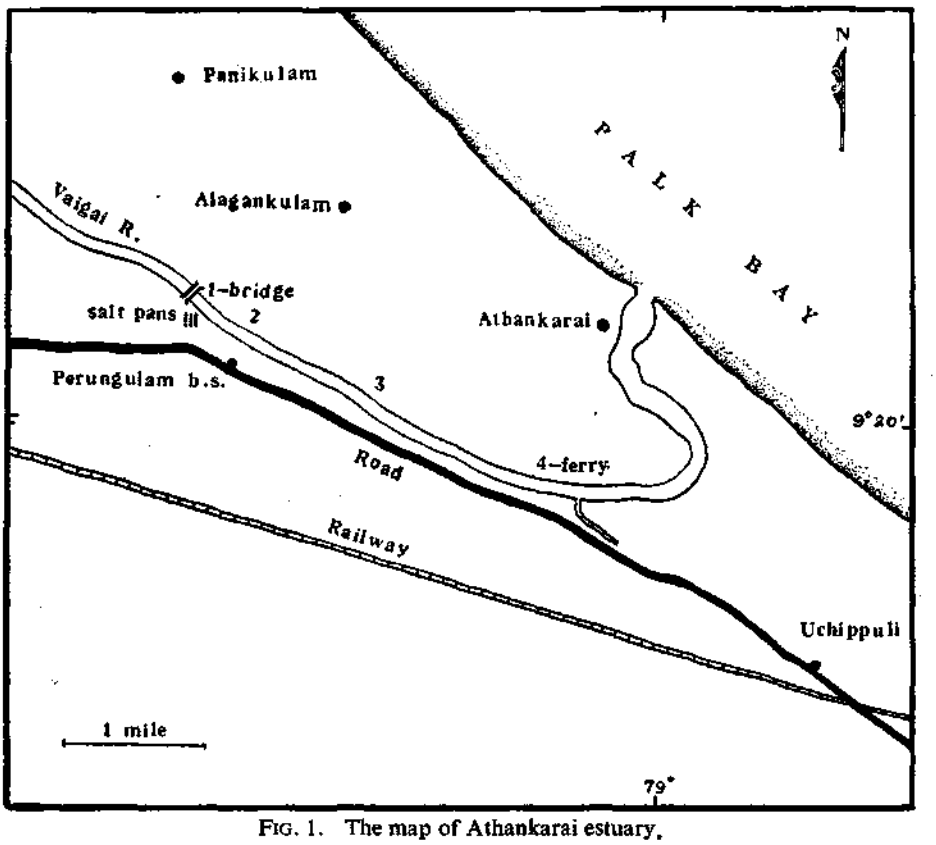

FIG. 1. The map of Athankarai estuary.

sea is always in communication with the estuary. The tidal amplitude in the Palk Bay is very low. The highest tides in the year range from 0.5 to 0.8 m.

At the Causeway the tidal effect is not appreciable except during high water springs. The tidal effect is more pronounced during North East winds. The soil in this region is very clayey and there are salt pans on the southern side of the estuary. The sub-soil water which is highly saline (sal. 106.48‰) is used for the manufacture of salt in these pans. The water is very easily procured by sinking shallow wells on the pan site itself. This indicates that the sub-soil water has a very high water table.

Samples of plankton, water and mud were collected from stations 1 to 4 (Fig. 1). Plankton samples from these stations did not show the occurrence of any obnoxious plankter like *Noctiluca*. Flagellates, however, could not be observed. The plankters were conspicuously absent at station 1. At station 2 the plankton consisted of a few *Coscinodiscus*, copepods and copepodites while at stations 3 and 4 there was no phytoplankton and the zooplankton consisted predominantly of copepods and medusoids along with other organisms like nauplii, decapod larvae and *Oikopleura*.

Water was analysed for its temperature, pH, salinity and oxygen while in the case of mud, pH alone was determined. The results are tabulated below :

Station	Temp. °C	pH	Salinity °/oo	Oxygen ppm	pH(mud)
1	30.7	8.6	105.39	2.19	8.3
2	31.2	8.4	96.97	2.36	8.2
3	30.4	8.2	43.51	3.23	8.2
4	30.3	8.1	38.14	3.45	8.2

The temperature, pH and oxygen values at all stations were found to be normal. However, the salinity at station 1 was found to be excessively high. It was slightly low at station 2 and more or less normal at stations 3 and 4. This suggests that the rise in salinity to lethal limit might have been the cause of this heavy mortality of fishes and other fauna. Though the precise reason for this excessive rise in the salt content of the water is difficult to attribute, the following explanation could be given.

There was no freshwater flow in the estuary from the river during the period when the present mortality was reported, and there had not been any such flow at least for a few days before. The water near the Causeway was, therefore, the tidal water from the sea. The depth near the Causeway was about $\frac{1}{2}$ m. while at station 2 it was barely 10 to 12 cm. The latter depth might have been further reduced during the period of mortality.

Owing to the aforesaid site conditions and the probable absence of the tidal flow, the water in the area between stations 1 and 2 may present itself as a partially stagnant water mass. From 5th July to 12th July, the period of spring tides (highest tide 0.7 m.), the tidal water would have reached the Causeway. During this period, because of the higher gradient of water above than in the soil, the sea water percolated in the clayey soil of the banks and got itself concentrated in percentage of salt. The clayey soil retained the water for a long time. During the following neap tides, due to the reverse gradient now created, the water slowly flowed back from the clayey banks. The water from the bottom also permeated by capillary action. These two agencies might have been sufficient to bring the sub-soil very salty water having a high water table, as stated earlier, to the surface. This salty water got mixed up with the existing more or less stagnant water mass above, thereby raising its salinity. Evaporation of the water further enhanced the process which ultimately resulted in the salinity attaining a very high level. The next spring tides began on 19th July. It is felt that the time lag of seven days is enough to increase the salinity to the observed value of 105.39 °/oo, especially in view of the fact that there was no freshwater flow in the estuary and no high tides to dilute the increasingly saline water. Some such phenomenon might have been responsible for the increase in salinity and the consequent heavy mortality of fishes, clams and prawns in Athankarai estuary.

Enquiries with the villagers revealed that this is an annually recurring phenomenon and such mortalities have been noticed in summer, when the freshwater inflow from the river is stopped.

Observations were continued for another week, by which time, the salinity

dropped to the level of 24.07‰ especially due to the heavy rain, and fishes were seen swimming in the region where mortality had occurred before.

During the last week of September, a similar mortality of fish, but to a very small extent, was observed in the same locality. Observations made during this period confirmed our findings regarding the cause of mortality and the reasons for the excessive rise in salinity.

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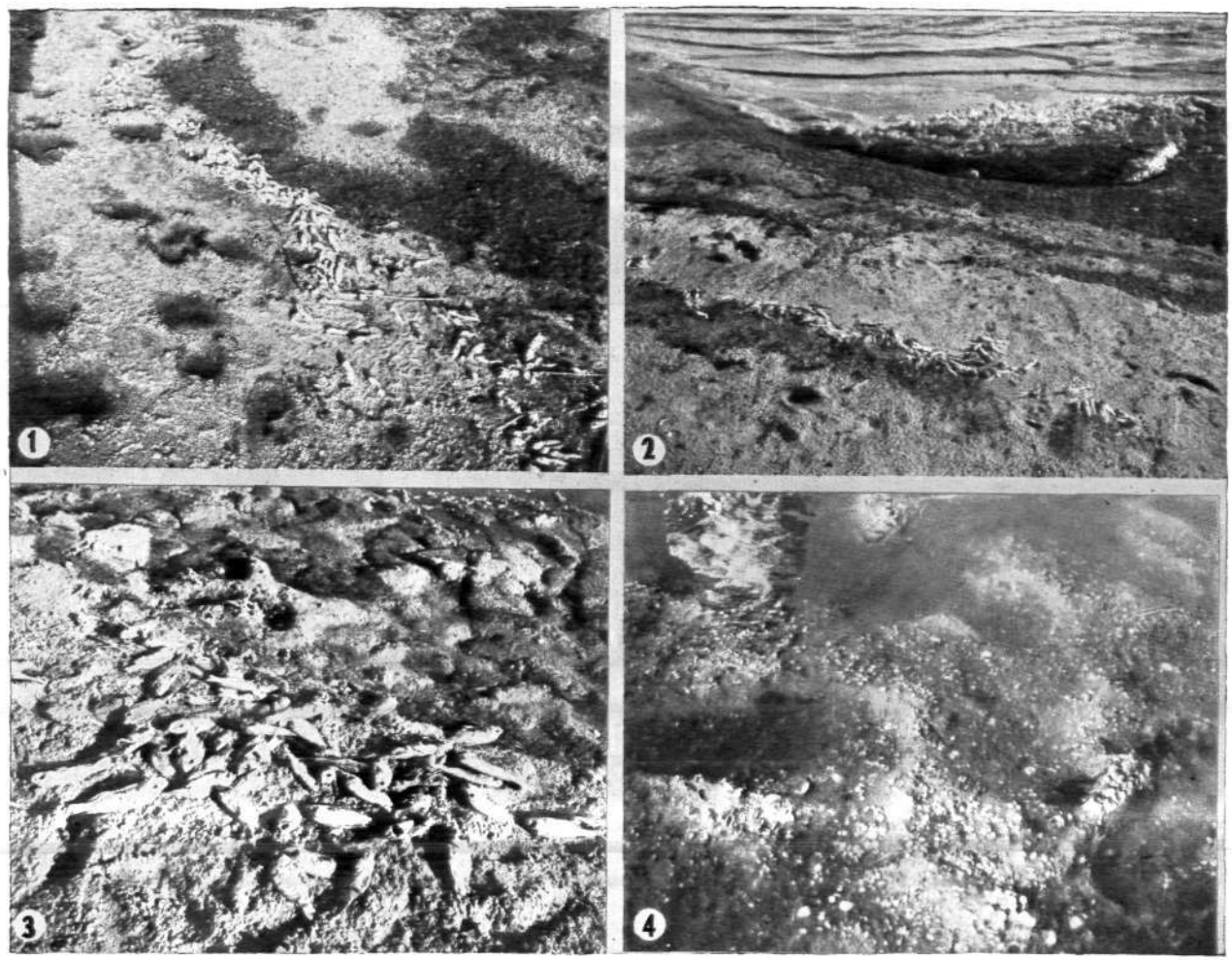

PLATE I. FIGS. 1 and 2. Dead mullet fingerlings seen lying along the water edge.
FIG. 3. A shoal of dead *Tilapia* washed ashore. FIG. 4. Dead clams seen in gaped condition under the shallow water.