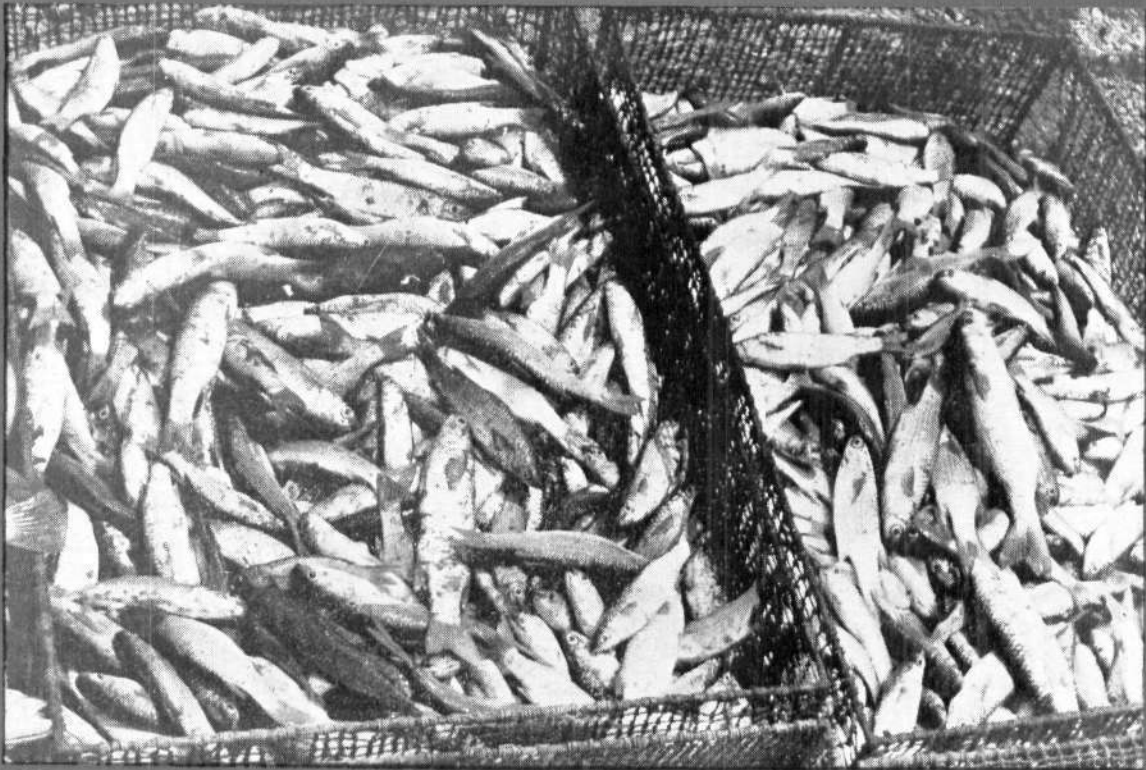




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## AN INSTANCE OF MASS FISH MORTALITY AT MANDAPAM, SOUTH EAST COAST OF INDIA

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### Location of mortality

A large number of dead and dying fishes and shellfishes was found washed ashore along the beaches of Mandapam on the Palk Bay side in the early hours of 13th May, 1987. This mortality of fishes was restricted to the inshore sea of Palk Bay from Mandapam fish landing centre to about 6 km stretch of the coast towards west and between the seashore and the coral reef on the seaward side (Fig. 1). The open sea beyond the coral reef and the coastal waters east of Mandapam fish landing centre and west of the eastern border of Pillaimadam lagoon were not affected by this phenomenon. However, the dead fishes washed ashore and

other organisms were found as far as about 12 km stretch of the coast from the Mandapam fish landing centre towards west upto Theedai fishing village (Fig. 1).

### The species involved and the impact of mortality

Although an accurate estimate of the quantity of dead fishes and shellfishes was not available due to the removal of dying or dead fishes by the local people immediately after the occurrence of the incidence, it was estimated that about 2-3 tonnes of fishes might have been killed by the phenomenon. About 20 species of important fishes (Figs. 2 & 3) including some of the commercial species, two species of crabs, molluscs such as *Sepia* spp., *Loligo* spp., *Aplysia* spp. and *Donax* sp., and alpheid shrimps were found affected (Table 1). Among the dead fishes, *Epinephelus* spp., *Lethrinus* spp., *Siganus* spp., *Platycephalus* spp., *Psammoperca waigensis*, *Therapon* sp., *Apogon* sp., *Plotosus* sp., *Muraena* spp. and *Gobius* spp. were abundant and among crustaceans the blue swimming crab *Portunus pelagicus* was the principal species. Besides these fishes and shellfishes, an appreciable number of juveniles of *Siganus* spp., *Gerres* spp. and *Epinephelus* spp. was also found washed

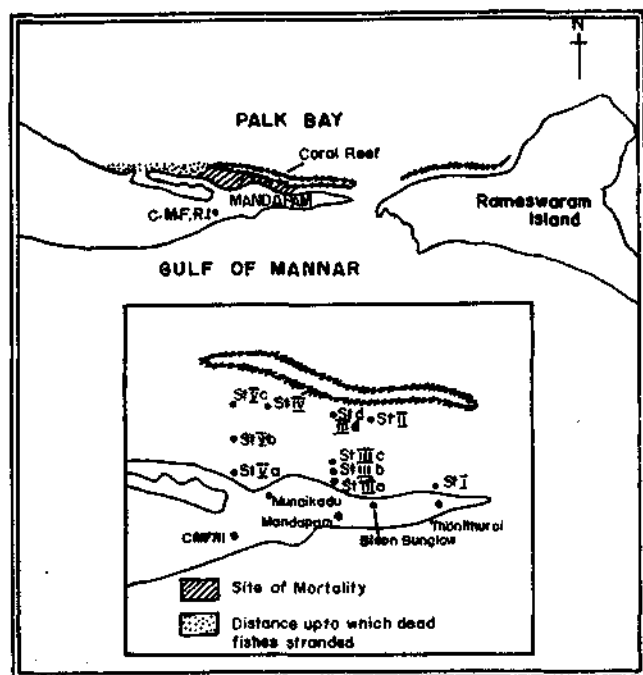


Fig. 1. Map showing the site of fish mortality and the stations from where data on hydrological parameters were collected.



Fig. 2. A view of the dead fishes washed ashore at Mandapam on 13-5-1987.

\*CMFRI, Cochin.

ashore. The size range of the different species is given in Table 1.

**Table 1.** List of dead fishes and shellfishes collected from the area of fish mortality at Mandapam during 13-15 May, 1987

Species	Size range (mm)
<b>FISHES</b>	
* 1. <i>Epinephelus</i> spp.	80-520
* 2. <i>Psammoderus waigensis</i>	200-270
* 3. <i>Platycephalus indicus</i>	300-400
* 4. <i>Lethrinus</i> spp.	210-300
* 5. <i>Hilsa kelee</i>	160-200
6. <i>Holocentrus</i> spp.	120-160
7. <i>Chaetodon</i> spp.	75-150
* 8. <i>Plotosus</i> spp.	65-175
* 9. <i>Siganus</i> spp. (adult)	200-300
10. <i>Siganus</i> spp. (juveniles)	30- 45
11. <i>Tetrodon</i> spp.	150-350
12. <i>Muraena</i> spp.	600-700
13. <i>Gobius</i> spp.	70-135
14. <i>Sparus</i> spp.	20- 35
15. <i>Apogon</i> spp.	45- 80
16. <i>Diodon</i> spp.	300-350
17. <i>Abudefduf</i> spp.	110-115
18. <i>Chromis</i> spp.	90- 95
*19. <i>Liza waigensis</i>	300- 350
20. <i>Pseudopristipoma niger</i>	100-150
*21. <i>Arius dussumieri</i>	400-600
*22. <i>Amphotistus kuhlii</i>	200-350
<b>CRUSTACEANS</b>	
*23. <i>Portunus pelagicus</i> (Measurement across carapace)	40-140
*24. <i>Scylla serrata</i>	41-160
25. <i>Alpheus</i> spp.	80- 90
**26. <i>Penaeus</i> spp.	—
<b>MOLLUSCS</b>	
*27. <i>Sepia</i> spp.	60-80
*28. <i>Loligo</i> spp.	—
29. <i>Aplysia</i> spp.	—
30. <i>Donax</i> spp.	—

\* Commercially important forms

\*\* Very rare

The species composition of the dead fishes indicated that most of the species affected by the phenomenon were those inhabiting near the bottom or the reef-dwelling fishes. It was noteworthy that neither prawns nor the pelagic fishes were found among the affected population. Some of the fishes such as juveniles of *Epinephelus* and gobids and crabs were seen congregating near the shore in a semi-conscious state gasping for air, even after two days of the incidence. An examination of the gills of these fishes revealed that they were either light red or reddish. The gills of the dead fishes were covered with sand. No abnormal conditions such as excessive slimy



Fig. 3. Some of the principal species of fishes and shellfishes affected by the mortality reported on 13-5-'87 at Mandapam.

nature or blackish discoloration or parasitic infestation were observed. The stomach content analysis of the dead fishes such as *Epinephelus* sp., *Siganus* sp., *Lethrinus* sp., *Platycephalus* sp., *Holocentrus* sp. and *Chaetodon* sp. showed that the gut was devoid of any food in all the cases except in one specimen of *Epinephelus* sp, which contained an undigested *Therapon* sp.

#### The environmental features of the affected area

The inshore sea of Mandapam during the reported period of mortality was calm. There was also no strong wind normally prevalent in the area but the water in the affected area appeared turbid and murky. The bottom soil at patches was found to be black.

Data on hydrographic features such as temperature, pH, salinity, dissolved oxygen, phosphate, silicate, nitrite and nitrate collected from different regions of the affected and the adjacent unaffected areas during 13-22 May, 1987 are given in Table 2. The surface water temperature during 13-15 May following the incidence, varied between 31.5 and 31.8°C while the pH showed a range of 8.0 to 8.2. The salinity of the surface water

**Table 2.** Ecological features of the inshore area of Mandapam on the Palk Bay side during 13–22 May, 1987 immediately after report of mass mortality of fish

Date	Station	Distance from the shore (km) and depth of the station (m)	Surface temp. (°C)	Salinity (‰)	Dissolved oxygen (ml/l)	pH	Phosphate ( $\mu\text{g-at/l}$ )	Silicate ( $\mu\text{g-at/l}$ )	Nitrate ( $\mu\text{g-at/l}$ )	Nitrite ( $\mu\text{g-at/l}$ )
13-5-'87	I	Intertidal	—	S 33.79	5.82	8.2	0.05	18.0	1.75	0.74
	III a	0.03	31.8	S 33.28	0.94	8.0	0.05	21.0	1.0	0.84
	V a	Intertidal	—	S 34.81	3.58	8.0	0.05	18.0	1.0	0.84
14-5-'87	II	1/4	31.5	S 33.29	2.28	8.0	0.05	21.0	0.25	3.15
				B 32.51	1.50	8.0	0.13	22.0	7.75	6.30
	III d	1/4	31.8	S 32.02	1.09	8.0	0.18	24.0	6.50	1.05
				B 33.79	0.78	8.0	—	—	—	—
	IV	1/4	31.5	S 33.79	1.71	8.0	0.05	30.0	0.25	1.89
				B 32.76	1.91	8.0	0.05	25.0	0.50	0.21
15-5-'87	V c	1/4	—	S 33.54	2.34	8.0	0.07	21.0	0.25	0.21
	III b	0.2/1	31.5	S 31.70– 32.00	0.21– 0.26	8.0	0.75– 1.50	14.0 17.0	4.25– 9.78	5.88– 12.18
	V b	0.5/3	—	S 34.87	2.60	8.0	0.70	18.0	9.25	12.39
				B 2.08	—	—	—	—	—	—
20-5-'87	III a	0.5	—	S 32.00	0.94– 1.18	7.79– 8.00	0.40– 0.45	9.0– 16.0	0.25– 1.00	0.84– 1.68
	b	1.0	—	S 31.5– 32.00	1.23– 1.30	7.76	0.40– 0.48	21.0	0.25– 0.37	0.63– 1.89
	c	2.0	—	S 31.5– 32.0	1.43– 1.58	7.63– 7.79	0.35– 0.43	14.0– 24.0	0.25– 1.00	0.42– 0.63
	III a	0.5	—	S 31.5– 32.0	1.79– 3.32	8.0	0.40	4.0– 6.0	0.25– 0.37	0.21– 0.32
	b	1.0	—	S 31.5– 32.0	3.06– 3.37	8.0	0.40	5.0– 5.5	0.25	0.21
22-5-'87	c	2.0	—	S 32.0	3.12– 3.17	8.0	0.40– 0.45	4.0	0.25	0.21

Station I: off Thonithurai; II: off Bison Bungalow; III: off Mandapam fish landing centre – Marakayar Boat Yard; IV: off Munaikadu; V: off Fish Farm of RC of CMFRI.

at different stations ranged between 31.7 and 34.8‰. The dissolved oxygen values of the surface water in the affected area were found between 0.21 and 3.58 ml/l, while near the bottom, it varied from nil to 2.08 ml/l. In the open sea (about 1 km from the shore) and also in the unaffected area (Station I), however, the dissolved oxygen was at 4.37 ml/l (off Dhargavalasai) and 5.82 ml/l respectively.

While there was not much variation in the temperature and salinity values during 13–15th May and the

following days, the dissolved oxygen values of the seawater in the affected area showed gradual improvement and reached normal conditions by about 22-5-'87, i.e. after a week of the report of mass mortality of fishes.

The data on phosphate, silicate, nitrite and nitrate concentration of the seawater during the affected days (13–15 May) showed variation between 0.05 and 1.50; 14.00 and 30.00; 0.25 and 9.78 and 0.21 and 12.39  $\mu\text{g at/l}$  respectively (Table 2). Relatively higher values of these nutrients were observed immediately after the incidence.

The above ecological features indicated that while the temperature, pH and salinity of the waters in the affected area were within the normal range reported earlier, the dissolved oxygen was found highly depleted registering nil values, particularly in the inshore region between the coral reef and the shore. Similarly, although higher values of nutrients were recorded in the water samples collected on 14th and 15th May, the data were found comparable with those recorded in the corresponding period of the previous year and those of the previous month from the adjacent region.

The phytoplankton samples collected on 13-5-'87 from the affected and the adjacent unaffected areas showed the common diatoms such as *Nitzschia* sp., *Pleurosigma* sp. and a few filaments of *Oscillatoria salinarum*. Toxic forms were not present. The sample collected on 14-5-'87 showed the dominance of diatoms represented by the species of *Coscinodiscus*, *Chaetoceros*, *Rhizosolenia*, *Nitzschia*, *Asterionella*, *Pleurosigma* and *Synedra*. A few forms of dinoflagellates such as *Ceratium* spp., *Peridinium* spp., *Dipllopsalis* spp. and *Prorocentrum* spp. were also present. *Trichodesmium thiebautii* formed the exclusive species of the phytoplankton collected on 15-5-'87. Similarly, the pennate diatom *Nitzschia sigma* var. *indica*, constituted the principal species of the phytoplankton of 19-5-'87. These observations indicated that although no actual phytoplankton bloom was observed on 13th May when the incidence was first reported, blooming of *T. thiebautii* and *Nitzschia sigma* var. *indica* respectively were seen on 15th and 19th May in the affected area. Further, isolated observations on phytoplankton blooms near Mandapam on the Gulf of Mannar side in the last week of April showed blooms of *Trichodesmium* sp. on 6-5-'87 in the inshore waters off Keelakarai and discolouration of seawater from the normal from off Mandapam and Devipattinam on 9th and 10th May. However, there was no record of any fish mortality on these days. Zooplankton biomass was generally poor. It was composed of copepods, *Evadne* sp., fish larvae and a few fish eggs.

#### **The possible causes of the fish mortality**

Although no large scale industrial or domestic effluents polluting the sea were observed in this region, the disposal of unsold and rejected fishes and washings from the fish curing tanks into the sea at the Mandapam fish landing centre on the Palk Bay side where over 250 mechanised vessels are based and land their catches, were found to affect the water quality of the sea at this centre. During the period of the incidence, the inshore sea at this centre was found murky, emanating constant

bad smell of hydrogen sulphide. The bottom soil was also found to be black. This polluted water was found to get mixed up with the adjoining open sea water. Besides, it was reported that small quantities of untreated effluent were also occasionally discharged into the sea by the Pamban road bridge construction authorities.

On the basis of the above information and the data, it appears that the cause of fish mortality observed between 13th and 15th May, 1987 at the Palk Bay side of Mandapam was mainly due to the natural phenomenon resulted by the ecological changes restricted to an area of about 3-4 km<sup>2</sup> between the shore and the coral reef. It was possible that the phytoplankton blooms reported just before the phenomenon and its isolated occurrence immediately after the incidence, and the associated changes in the water quality, the mixing up of the polluted water drained from the Mandapam fish landing centre and its subsequent spread within the reef area due to the prevailing water current would have triggered off an anoxic condition in the water column causing stress in the environment and consequent mortality of the fishes. Such occasional mortality of fishes and ecological disturbances have been reported from this region earlier by Chacko (1942), Chidambaram and Unni (1944), Chidambaram and Kurien (1952), Prasad (1953), Chacko and Mahadevan (1956), James (1972) and Nammalwar and Narayanan (1979). The facts that only the reef dwelling and bottom living fishes were affected by the phenomenon and that there was no mortality of either the pelagic fishes or the fishes living outside the reef indicated that the impact of the incidence was confined within the reef and the shore. The same reason rules out the possibility of mortality caused by the incursion of oxygen depleted waters into the area. Further, the absence of any physical and biological symptoms as revealed by the examination of the dead fishes, their gills and the gut contents, and the absence of any report of untoward incidents on the consumption of the dead fishes excluded the possibility of the cause of the reported mortality due to poisoning, pollution or the use of explosives.

#### **Remarks**

There was an initial hesitation among the local people to collect the gasping fishes near the shore and those washed ashore for consumption/marketing due to the suspected cause of the mortality by poisoning. Subsequent to the allay of this fear, however, both fishermen and local people gathered these fishes, sun dried or used for fish meal. As there was little

demand locally, an appreciable quantity was transported for marketing elsewhere in places such as Madurai, Trichi and Kerala.

It is interesting to note that the recovery of the affected area to the normal condition took nearly a week. This might be due to the reef-protected nature of the area, weak water movement within the reef and absence of strong wind during the period.

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