THE "RED TIDE" AND THE FLORIDA FISHERIES

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Mass mortalities of marine animals have occurred on the west Florida coast ever since 1844, so far as the historical record shows, coming about once every 10 years, but at irregular intervals. The similar characteristics of these outbreaks lead to the conclusion that they all probably had the same causes. The 1916 occurrence was described by Harden F. Taylor (1). It was the last one before the 1946-47 outbreak. He apparently arrived on the scene too late to determine the cause.

The next outbreak of the red tide began in November, 1946 off Naples, Florida. It progressed to the north as far as Boca Grande Pass and died out the early part of January, 1947. Later it sprang up in Florida Bay and apparently covered most of the area. It died out there very quickly but in the summer of 1947 resumed again around Ft. Myers and Captiva Island, and spread northward as far as Sarasota dying out in the late summer. Untold millions of fish and marine animals were killed, but fish were the most conspicious because large numbers of them floated. The vastness of the mortality was amazing and is hard to describe in words. Probably the fishes killed numbered between a half billion and a billion. As Dr. Walton Smith said to me, "Probably no one realized that as many fishes lived on the West Florida coast as we saw dead."

This phenomenon was worked upon from the beginning by the staff of the Marine Laboratory of the University of Miami. (2,3) They discovered that the cause of the death was a microscopic phytoplanktonic organism, a dinoflagellate, which bloomed or increased enormously in numbers. It was a new species and it was described and names Gymnodinium brevis by Dr. C. C. Davis. (4) In places where it was most abundant it turned the water an orange yellow or reddish brown color and was so thick that it changed the viscosity of sea water to a consistency similar to a thin oil or syrup. It apparently was present all over the whole area in greater or lesser numbers but in its greatest abundance grew in patches of from a few yards to a few hundred yards in extent. Dr. Davis estimated that it attained a concentration up to sixty million to a liter. Fishes entering these patches began to show signs of distress very quickly and acted as if they were being asphyxiated or poisoned. We showed in the laboratory that water containing small amounts of Gymnodinium brevis killed fishes. This water was strongly aerated. Apparently Gymnodinium in some manner gives off a poison. The agent or mechanism is unknown.

Aside from the type of this poison, which is a pharmacological question, two other interesting questions are paramount when we consider the red tide as a whole. One is how the organism came to grow in such great abundance and the other is the effect upon the fishes of the west coast of Florida.

Although Gymnodinium is a protozoan, it ingests no food, has chloroplasts and lives essentially as a green plant. We know that the phytoplankton in the sea, according to Liebig's law of the minimum, is usually limited in its growth by the nutrient salts, nitrates, nitrites and phosphates, just as green plants on land are limited in growth by the same materials in the soil. That an abnormal abundance of nutrient salts played a great part in the vast and damaging bloom of Gymnodinium, is indicated by the observation of Ketchum of the Woods Hole Oceanographic Institution that in patches of the yellow water the total phosphate content was 8 to 20 times greater than in normal sea water. It has been

suggested that the nutrient salts might have been stacked up somewhere in their cycle in a temporarily non-utilizable state, until a much greater than normal abundance was attained. It has also been suggested that nutrient salts came into the area from the vast reservior for these elements, the deeper waters of the Gulf below the euphotic zone. Possibly a combination of both processes took place.

Since we do not know how many fishes were on the west Florida coast, what percentage of them were killed, how fast they grow in that area and how fast they would feed in from other areas, we cannot talk in definite terms about the damage done by the red tide. We do know that, when the red tide reappeared a few months later in the area where it had occurred previously, not nearly so many fishes were killed the second time. We also know that the catch of mullet and sports fishes has seriously declined on the west Florida Coast. We know from other catastrophic mass mortalities of fishes, caused by cold waves and over-salinity in Florida and other parts of the Gulf coast, that visible general effects are noticeable in the fish catch for about 3 years. This leads to the tentative conclusion that barring the occurrence of future catastrophe, the amount of fish live on the west Florida coast will return to normal about 1950.

Another interesting point concerning the red tide is the fact that these catastrophes and others caused by cold waves and over-salinity on the Gulf coast are probably more conducive to fossilization than normal periods when the few dead fishes are quickly consumed by scavengers.

The red tide and its effects are matters of great importance to all the people of Florida, and the phenomenon is certainly one of the most interesting ones taking place in the oceans. Although the immediate cause or organism has been determined, it is obvious that the chain of events leading up to it are unknown. A great deal of further research is needed and doubtless it will be as fruitful in discovery and increased understanding as any that are carried on in the field of oceanography.

References

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