Red tides and its impact Florida's marine life

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A red tide is a naturally occurring algal bloom characterized by a reddish tint to the water. Red tides are caused by phytoplankton-led neurotoxic algae (*Karenia brevis*) that is released into ocean water, often at the expense of marine life (Perkins, 2019). Two notable symptoms of this toxic bloom are the deaths of a number of different fish species due to respiratory failure and the tainting of shellfish, rendering them inedible (Bidlack & Jansky, 2014; Perkins, 2019). While the majority of cases involving ingested shellfish are non life threatening, fatalities can still occur (Bidlack & Jansky, 2014).

The unicellular organisms that cause red tides are also known as dinoflagellates. Samples of water taken from the ocean during red tides will reveal their remains, which are shell-like in nature (Bidlack & Jansky, 2014). While red tides are often documented on the coast of the ocean due to the neurotoxins that dinoflagellates will produce (Bidlack & Jansky, 2014), they also occur in freshwater. According to Weisberg et al. (2014), algal blooms on the Gulf Coast have been observed as early as the 1500s, when Native Americans warned Spanish explorers not to eat any fish that were caught in water that was discolored, a key feature of red tides.

The reason that toxic blooms like red tides can have such a negative impact on sea life is because of the large amount of neurotoxins that will accumulate, which then kills a large amount of marine life. What's more, the neurotoxins can accumulate within different types of shellfish like clams, mussels, oysters, and scallops (Bidlack & Jansky, 2014), which will have a bottom-up effect on trophic levels. Consider it from a more basic perspective of the food web. Clams, for example, are eaten by a wide variety of secondary, tertiary, and quaternary consumers, including fish, sea birds, sea mammals, and crustaceans. Whether preyed on by other consumers or merely falling victim to eating the shellfish itself, this harmful algal bloom can severely impact entire communities of aquatic life.

Though red tides have happened in other parts of the globe, the state of Florida has seen the historical brunt of them, especially in recent years. One of the worst red tides took place in 2018, which researchers from the University of South Florida believe was caused primarily by oceanic currents (University of South Florida, 2018). The following describes how this particular oceanic circulation - spatially and temporally - led to one of the worst red tides the Gulf coast of Florida experienced in decades:

> If nutrient levels offshore are high in spring due to the upwelling of deeper ocean waters, then there tends not to be major red tide blooms along the shoreline in fall. Such upwelling did not occur in winter and spring of 2018, allowing a new bloom to form offshore in spring and summer 2018. An upwelling circulation then set in toward the end of July, ensuring that the newly formed bloom would be carried to the coastline along the

> bottom where it reinforced what had already been in place from 2017 (University of South Florida, 2018).

This, according to Weisberg, is the primary reason why the red tide of 2018 occurred on Florida's Gulf Coast, as opposed to another popular theory that anthropogenic fertilizer runoff was to blame (Perkins, 2019). Yet is is likely that human outflow aids in the growth of red tides (Weisberg et al., 2016). It is also likely that climate change has had a direct impact on the increased frequency with which red tides have occurred. Researchers at the Environmental Protection Agency believe that the biosphere will become even more hospitable to algal blooms if air and ocean temperatures continue increasing (Fritz, 2018; Paerl et al., 2016). In Florida, *K. brevis* has been found to thrive in warmer temperatures, and will continue growing faster if aided by an increasing amount of carbon dioxide (Fritz, 2018).

Researchers are considering different methods to mitigate red tide and its devastating impact on marine life. One such method is to somehow trap red tide in a giant holding tank and then kill it with ozone molecules (Perkins, 2019). A second idea is finding natural substances that could kill it, such as natural compounds extracted from seaweed, which might be able to destroy it without causing any collateral damage (Perkins, 2019).

References

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