

# Red Tide

## Bad for Business?

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*Red Tide is a harmful algal bloom that has been observed off the Gulf Coast of Florida for decades. The damage caused by red tides can be seen from beaches to local businesses to shellfish farmers. Research to learn more about how red tide is formed and how to mitigate the effects is a multi-million-dollar effort connecting scientists from all different parts of the world. While no solution has yet been found for a problem of this magnitude, several methods have been proposed and are undergoing experimentation. Looking at the effects red tide has on the state of Florida may provide a better understanding as to why finding a solution for red tide is a pressing issue.*

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### Discussing Some Effects of Red Tide

Algae blooms are in all oceans across the globe. Most of the algae in the ocean is harmless or beneficial to marine animals and humans, however, *Karenia brevis*, (*K. Brevis*) commonly known as Red Tide, is a harmful algae bloom (HAB) dangerous to fish and humans. What makes red tide dangerous, and is there anything that can be done to prevent this danger? While research across the Gulf Coast of Florida is underway to gain a better understanding of red tide and how to mitigate the negative effects, scientists still have a limited understanding of what red tide is. Red Tide may impact Florida's economy and tourism negatively. Understanding red tide is critical before more damage is done (Threats Facing Florida's Tourism Driven Economy, 2017). Florida may be facing irreplicable damage to the economy and beaches if the red tide blooms continue. Scientists have learned that global warming plays a role in the magnitude of the blooms. Small steps towards slowing climate change may have large impacts for the people and

animals directly affected by red tide. Research is key to finding ways to mitigate red tide.

Red Tide was named after the slightly reddish-brown coloration in water during peak blooms, however, the most notorious element of red tide is the noxious smell. Fish killed by red tide wash up along the shore and give the beach a grim look and rotting smell, which is not good for local coastal communities who rely on tourists to come to their pristine white sandy beaches. For people, swimming in water with high concentrations of HAB is potentially harmful; respiratory issues may also arise after prolonged exposure. The Florida Fish and Wildlife Committee (FWC) releases a weekly report containing the concentrations of *K. Brevis* from beaches across the Gulf Coast of Florida (<https://myfwc.com/research/redtide/statewide/>). People are advised to take these numbers into consideration before heading to the beaches. Visiting tourists coming to Florida for a Spring Break trip or summer family vacation understandably want to be able to safely swim in the water. After seeing dead fish along the shore and smelling algae



My name is Sara McGhee, I am a freshman majoring in marine biology here at the University of Hawai'i. I love learning more about all parts of the ocean and why they are important. As someone who has lived in Florida and has a special interest in marine biology, Red Tide is something I've been interested in and concerned about.

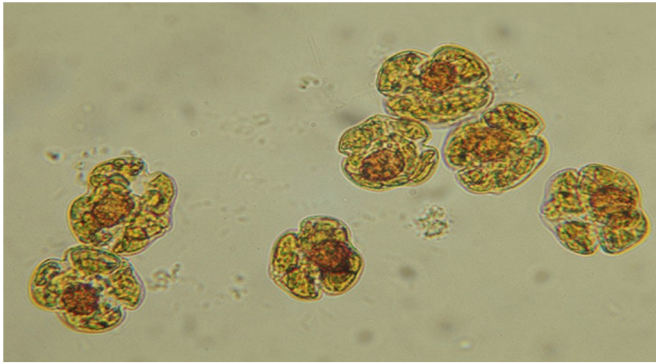


Figure 1

blooms, people may not be willing to return to areas with seasonal red tide. Mote Marine Laboratory and Aquarium, located in Sarasota Florida, is conducting research to mitigate red tide and have a better understanding of what may be causing the blooms. I had the opportunity to tour their research facility and speak with several of their scientists working on projects related to red tide. The consensus however, seemed to be that finding a “cure” for the red tides may be a decades-long process with no foolproof solution.

Simply put, a red tide is an algae bloom and, much like any type of organism, this algae bloom needs nutrients to survive (which can be obtained photosynthetically or by consumption, since it is mixotrophic) and prefers certain conditions to thrive. Typically, warmer waters are favorable to *K. Brevis*, so blooms are more likely to occur during the summer. A red tide has been shown to survive best in water around 86 degrees Fahrenheit and can survive in temperatures of up to 93 degrees (Rutger, 2022). During my visit to the Mote Marine Laboratory, Dr. Cynthia Heil, Director of the Red Tide Institute at Mote shared, “We know *Trichodesmium* (a type of saltwater blue-green algae or cyanobacteria) can fix nitrogen gas from the atmosphere into a nutrient source that *Karenia* can use offshore, where blooms initially begin, typically in low nutrient waters.” The nutrients provided by the cyanobacteria can lengthen the red tide blooms. 13 different nutrient sources have been found to be able to feed *K. brevis*, meaning it has a higher likelihood of survival (Rutger, 2022). It has also been observed that red tide is strengthened after hurricanes or heavy rains, which will become more intense and repetitive as the climate warms. The upwelling of nutrient rich water after storms likely feeds the algae blooms. Dr. Heil also stated that some of the nutrient sources have moved closer to shore, meaning the algae blooms can continue to grow closer to shore as well.

The effects of red tide can be seen in all tiers of coastal food chains. *K. Brevis* produces toxins known as *Brevetoxin*; this is the element that is harmful to fish. After exposure to large amounts, fish die almost immediately as the toxin builds up in their gills and they eventually stop functioning. After exposure, fish may present signs of intoxication, such as abnormal

swimming or even fin paralysis (Florida Fish and Wildlife Conservation Commission, n.d.). The mass die-off of fish can be seen on the beaches where fish carcasses litter beaches after concentrations of red tide. While fish are the most affected by red tide, *brevetoxins* can be found in plankton, crustaceans, seagrass and even sediments (Florida Fish and Wildlife Conservation Commission, n.d.). Coastal birds also experience die off events due to their consumption of the infected fish or crustacea. Infected birds exhibit symptoms such as weakness, the inability to stand or fly, and seizures, and unfortunately, birds with high enough concentrations in their systems also die. Marine mammals such as dolphins and manatees may also be affected, but to less of an extent than fish or birds.

During my visit to the Mote Marine Laboratory, Dr. Nichole Rhody, Assistant Program Manager and Senior Scientist at Mote, explained the work their team is doing observing the effects red tide has on shellfish, specifically clams. High concentrations of the toxins cause neurotoxic shellfish poisoning if consumed. Because of this, a law was passed requiring shellfish farmers to close off their harvest areas if red tide counts reach a certain level, these closures have had catastrophic impacts on shellfish fisheries (Mote Research Park Report, 2022). Just a decade ago, 56 families across Florida were the backbone of the clam industry and supplied clams to the state and country. Today, only four of those families remain, and red tide may be to blame for the collapse. A nearly 93% decrease in an industry like that has detrimental effects on the families and the economy of Florida as a whole.

Shellfish farmers might not be the only people to feel the ripple effect of Red Tide. Other businesses in coastal communities across the sunshine state are negatively impacted by the harmful algal blooms. Locally owned shops and restaurants along Florida’s coasts may feel the effects before anyone else. Janet Long, a chair member of the County Commissioner and chair member of the Tourist development Council said at a 2017 hearing, “When red tide comes along or if toxic algae closes a beach, tourism dollars go elsewhere.” (Threats Facing Florida’s Tourism Driven Economy, 2017). Tourism dollars are the backbone of Florida’s economy. An event, such as a red tide, that is exacerbated by climate change might not have a one-size fits all solution. The best that may be possible is to manage the damage done and learn more about what causes red tide. While red tide seems to be an issue confined to the shores of Florida, climate change is happening everywhere around the globe. With algae growing in all oceans, no one can say for certain that the effects and damages are limited to Florida. Hawai‘i, with an economy also relying on tourism, would be devastated if the effects of a harmful algae bloom reached its beaches.

While red tide is a pressing issue, finding a solution may not be as simple as may have been hoped. Dr. Rich Pierce, Associate Vice President for Research, Program Manager for Ecotoxicology Research Program, and Senior Scientist at Mote explained

some of the potential solutions for red tide that the team at Mote is working on. Some proposals involve injecting chemicals into the water. However, whatever kills *K. Brevis* may also kill the marine organisms in that water. Similarly, promising results have been found when water polluted with red tide is run through an advanced water filtration system. "Water taken from oil spills has been run through this machine and came out potable," Dr. Pierce explained. However, whatever goes into the system that is not water (fish, or other marine organisms) would be killed in the process. Additionally, filtering the water of the Gulf Coast may be too great a task in terms of volume for the current filtration systems available. Mitigation attention has shifted to managing and containing red tide bloom effects. Red tide blooms are linked to climate change, and like climate change, may worsen unless solutions can be found and implemented.

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