NOAA'S ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABORATORY

Hurricane, Climate, Coastal, and Ocean Research

Harmful Algal blooms affect many coastal communities across the US. AOML conducts a variety of research to investigate harmful algal blooms and their impacts. For example, AOML has increased their investment in red tide research in Florida in response to the 2016-2018 red tide bloom. In South Florida, blooms occur almost annually along the west coast. Toxins produced by *by* the dinoflagellate *Karenia brevis* cause widespread mortality of marine animals and respiratory irritation in humans. AOML is focusing on determining the duration, spatial extent, movement, compounding factors, ecosystem consequences, and the impacts of red tide on coastal communities.

Photo Credit: NOAA-AOML

Tourism & Economic Impacts

Red tides cause significant economic losses to coastal communities in Florida, not only through declines in fisheries landings, but also through negative impacts on tourism. These are two of the biggest industries in the state, and their losses propagate from locally-impacted communities. *The Fort Myers Florida Weekly* surveyed 156 businesses in Fort Myers Beach. These businesses reported $48.8 million in lost revenue during the 13-week period from July 27, 2018 through October 26, 2018. AOML is currently funding research to quantify the social and economic impacts of the 2017-2019 red tide on fishing communities on the southwest Florida coast. This project will:

Photo Credit: NOAA-AOML

- Identify the people, assets, and economic activities at risk in the fishing community of the Charlotte Harbor region.

- Produce accurate estimates of direct and indirect economic losses associated with changes in commercial fishing revenues and recreational fishing effort resulting from the 2017-2019 red tide event.

- Integrate oral histories, vulnerability indices, and economic impact assessments to assess fishing community vulnerability as a result of red tide events.

Commercial Fisheries & The Blue Economy

AOML works closely with the commercial fishing industry to determine the impacts of red tide. Fishing vessels collect and transmit data to AOML, and in turn, we conduct and schedule surveys that help them fish more effectively. For instance, AOML is conducting a cruise at the end of July 2019 to look for indicators that another dead zone might be forming. This information is shared with commercial fishermen so they can efficiently allocate resources in preparing and deploying fishing gear.

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Photo credit: NOAA-AOML

Fishermen as Citizen Scientists

AOML has formed a partnership with the Florida Commercial Watermen's Conservation group to systematically monitor red tide and oceanographic conditions offshore of Charlotte Harbor, one of the fishing areas hardest hit by the 2016-2018 red tide. Red tides negatively impact fishery populations via their toxins, the low-oxygen bottom environment they may create, and through changes in the food web. The negative impacts on fishery populations result in decreases in fishery landings. AOML provides instrumentation expertise, training, quality assurance, and quality control for monitoring data collected by the fishermen. AOML also collects and analyzes the resulting data. Using this citizen science approach, we can fill the gaps in offshore systematic monitoring, collaborate with a donation-based non-profit to diversify the funding and sustainability of monitoring efforts, as well as transition these data to operations via the Gulf of Mexico Coastal Ocean Observing System.

Photo credit: NOAA-AOML

Research Partnerships

Red tide in 2018 caused a significant mortality event for dolphins (149 deaths reported), as well as for Florida's manatees and turtles. Negative impacts on protected species underscore the importance of determining the causes and further assessing ecological impacts related to severe blooms. AOML has made understanding these blooms a priority by modifying existing research cruises and enhancing our collaborations. AOML is working with partners across Florida and the US, including NOAA's Southeast Fisheries Science Center, the State of Florida, Florida Gulf Coast University, NOAA's Gulf of Mexico Integrated Ecosystem Assessment Program, Mote Marine Labs, Texas A&M University at Corpus Christi, University of Miami, University of Florida, University of South Florida, the National Ocean Service, the Florida Keys National Marine Sanctuary, and several non-profits. This multi-disciplinary effort will provide a diverse set of solutions and tools to mitigate red tide impacts.

Photo credit: NOAA-AOML

The Next Generation of Red Tide Monitoring

AOML is taking an Earth systems approach to understand everything from how physical and chemical oceanography provides the conditions that lead to massive red tides and dead zones, to how these red tides impact the marine environment which includes both commercial and protected species. This approach incorporates both human and societal elements to determine how these ecosystem changes and the accompanying red tide publicity impact coastal communities and their economies.

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