Conducting Valuable Research in the Gulf of Mexico
NOAA's Atlantic Oceanographic and Meteorological Laboratory

Research for the Most Productive Blue Economy in the United States

The Gulf of Mexico is the most productive component of America's blue economy. Its coastal and marine ecosystems account for the largest contribution—36.7% or an estimated $104 billion dollars—of the total US ocean gross domestic product. The Gulf ecosystem supports 598,000 workers who ensure the region's productivity, including over 90% of oil and gas production for the US, a multi-billion-dollar marine construction and shipping industry, and a $20 billion dollar recreational and commercial fishing industry[1].

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1   National Oceanic and Atmospheric Administration (NOAA), Office for Coastal Management. 2020. *NOAA Report on the U.S. Marine Economy: Regional and State Profiles.* Charleston, SC: Office for Coastal Management.
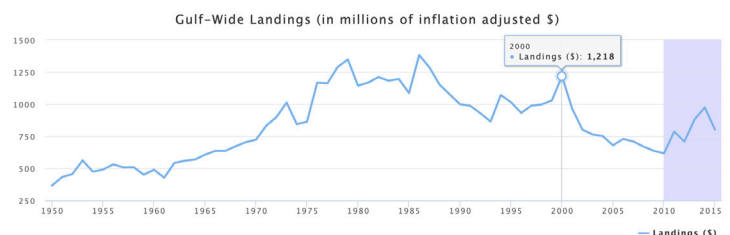Available at *coast.noaa.gov/digitalcoast/training/econreport.html*.

The Gulf of Mexico borders five states and is the ninth largest body of water in the world. It experiences some of the nation's most extreme weather and ecological phenomena and is home to an abundance of valuable resources. Estuarine ecosystems, shallow and deep-water reefs, and highly diverse marine life support productive food, fishing, and tourism industries. The region provides a unique opportunity for NOAA to conduct partnered research. This research serves the nation by advising stakeholders of changing environmental conditions, improving extreme weather forecasts, and ensuring resource and emergency managers have the tools they need to protect their people, natural resources, and coastal economies.

Ecosystem Based Management For Stakeholders in the Gulf of Mexico

AOML co-leads the Gulf of Mexico Integrated Ecosystem Assessment with NOAA's Southeast Fisheries Science Center. The Integrated Ecosystem Assessment process is applied in close collaboration with partners and stakeholders to provide products that are useful to them. This includes decision-support products for ecosystem-based management, an integrated approach to managing marine resources.

Observations, empirical analyses, and ecosystem modeling are used to better understand complex coastal ecosystems including services provided to human society by the ecosystem and the natural and human pressures placed upon the ecosystem. This understanding allows us to predict and evaluate how potential management actions and changing environmental conditions might affect our ecosystems, natural resources, economy, and

ultimately, human well-being. Upon the launch of the Florida Keys Integrated Ecosystem Assessment Report website, Andy Bruckner, research coordinator for the Florida Keys National Marine Sanctuary, said that "one of the most valuable aspects of this site are the visualization tools that allow the user to see the changes in resource condition over time." Because of the Gulf of Mexico's highly productive and diverse industries, a major focus area of these assessments is to investigate the tradeoffs between services and sustainability using cross-sectoral analyses.

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Understanding and Predicting Red Tide Impacts

Red tides negatively impact marine populations by creating a low-oxygen bottom environment that directly affects benthic animals and their habitats and by producing toxins that cause fish kills. These negative impacts decrease fishery landings for a number of important commercial and recreational species. In addition to fisheries, red tides also negatively affect tourism, a dual impact for Gulf of Mexico coastal communities.

AOML conducts research with partners and stakeholders to improve our understanding of red tide and their economic impact. By providing instrumentation expertise, training, quality assurance, and quality control for monitoring data we are able to leverage citizen science performed by commercial fishermen. This partnership benefits for local fishermen by helping them fish more effectively based on how we analyze the data they provide.

Using this approach, we fill critical gaps in offshore systematic monitoring, collaborate with a donation-based nonprofit to diversify the funding and sustainability of monitoring efforts, and transition these data to operations via the Gulf of Mexico Coastal Ocean Observing System.

AOML has made understanding these blooms a priority by modifying existing research cruises and enhancing our collaborations with the State of Florida, academic partners, non-profits, and local industries.
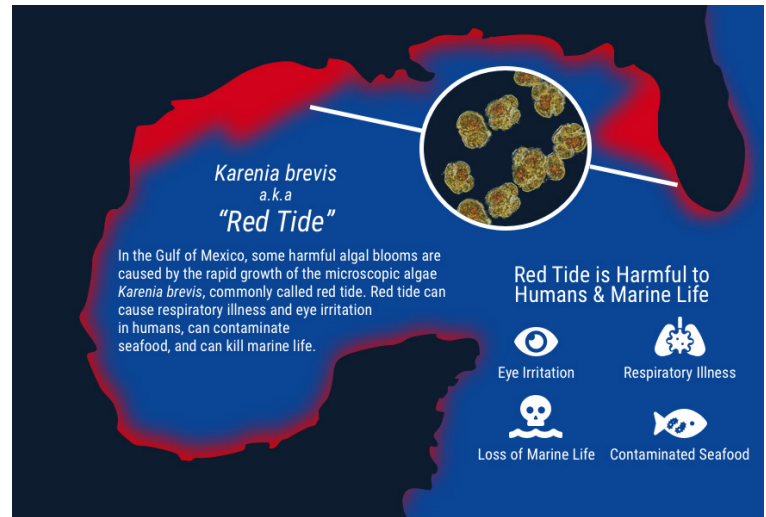
Infographic showing how Harmful Algal Blooms such as red tides can damage human and ecosystem health. Scientists at AOML are actively working to understand and predict these blooms. Image Credit: NOAA AOML.

Ocean Acidification Research to Prepare Our Country for a Changing Climate

Excess carbon dioxide is increasing the acidity of the oceans and impacting marine organisms from plankton to economically important fish species. Scientists at AOML track ocean conditions around the southeast US and Gulf of Mexico by gathering a robust array of data during research cruises. AOML also monitors the impacts of ocean acidification at its sentinel sites in the region, including the Flower Garden Banks National Marine Sanctuary in the northern Gulf of Mexico and the Florida Keys National Marine Sanctuary in the southern Gulf of Mexico. Information collected during research cruises and from in situ sampling enables AOML to provide tools such as ecoforecasts for monitoring and management purposes. The information also provides a context for measuring local changes and analyzing trends over time to predict future ocean conditions and potential ecological impacts.

Scientists at AOML are working to improve a research quality hurricane model know as Basin-Scale HWRF. Photo Credit: NOAA AOML.

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