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17–19 March 2021

THE U.S. NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION'S EFFORTS TO ADDRESS OCEAN ACIDIFICATION IN THE CARIBBEAN

For reasons of public health and safety associated with COVD-19, this meeting is being convened virtually. Delegates are kindly requested to access all meeting documents electronically for download as necessary.

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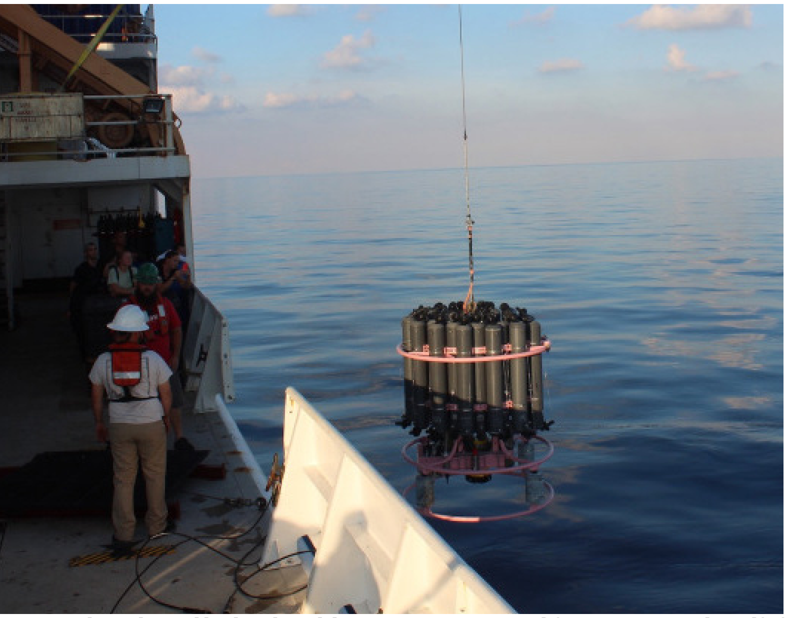
The U.S. National Oceanic and Atmospheric Administration's Efforts to Address Ocean Acidification in the Caribbean

Oceanic and Atmospheric Research
National Oceanic and Atmospheric Adminstration (NOAA)

What is Ocean Acidification (OA)?

Since the industrial revolution, the atmospheric concentration of carbon dioxide has increased from 280 to over 400 parts per million due to the burning of fossil fuels such as coal, gas, and oil, along with land use change. The global oceans are the largest natural reservoir for this excess CO2, absorbing approximately one-third of that attributed to anthropogenic activities each year. While the ocean's uptake of CO2 has alleviated some of the atmospheric burden, the increase of CO2 in the oceans can have major impacts on the marine ecosystems and the communities dependent upon them. When CO2 reacts with seawater, a series of equilibrium reactions occur including the production of carbonic acid, causing a reduction in seawater pH. The anthropogenic reduction in seawater pH is termed Ocean Acidification (OA). Though seawater naturally "buffers" against such changes, it does so at the expense of carbonate ions, which play an important role in the creation of calcium carbonate shells and skeletons produced by a large number of marine organisms (e.g., corals, marine plankton, coralline algae, and shellfish).



A CTD being hoisted back on board during a NOAA Ocean Acidification Cruise in the Gulf of Mexico. Credit: NOAA

Ocean Acidification in the Caribbean

The wider Caribbean region contains extensive coral reef ecosystems that are at the heart of economically important fisheries, active tourism industries, and coastal protection. These reefs are important to the United States and many Caribbean nations, as they had an estimated annual net economic value between US$3.1–4.6 billion in 2000 (World Resources Institute). Unfortunately, at least 2/3 of Caribbean reefs are threatened by a host of threats, including human population growth, overfishing, coastal development, sediments, land-based pollution, nutrient runoff, boat damage, and coral disease. Climatic threats of rising ocean temperatures and ocean acidification further threaten the diverse taxa that occupy and form these important Caribbean reefs. Coral reefs' heightened sensitivity to stress and their close relationship with carbonate chemistry underscore their vulnerability to OA in the region.

NOAA's OA Work in the Region

Over the last decade, the U.S. National Oceanic and Atmospheric Administration (NOAA) has contributed to OA research that has supported the creation of a monitoring program to characterize carbonate chemistry across space and time. The program is also tracking the effects of certain biological processes, such as calcification and bioerosion, on coral reefs. This has been done through close collaboration with existing monitoring programs, chief among them the U.S. National Coral Reef Monitoring Program (NCRMP, coris.noaa.gov/monitoring). NOAA's NCRMP was established to collect biological, physical, and socioeconomic information needed to gauge changing conditions of U.S. coral reef ecosystems.

To further expand surface observations in the wider Caribbean region, NOAA has collected extensive underway and ship-of-opportunity data for more than a decade with support from partnering programs. Since 2007, two quadrennial OA surveys in the region have conducted repeated transects, collecting climate-quality full-water column measurements of OA parameters and affiliated biogeochemical samples. A third cruise to perform these measurements is planned for 2021. NOAA also expands surface ocean observations by conducting monthly Caribbean-wide estimates of carbonate mineral saturation state, derived from satellite measurements and models, which are available from the Ocean Acidification Product Suite (OAPS, https://www.coral.noaa.gov/accrete/oaps.html).

NOAA's OA Work in the Region cont.

NOAA has also supported experiments to explore the sensitivity of key coral taxa to OA, including those that support local fisheries. NOAA continues to conduct sustained, long-term measurements of the chemical progression of OA and associated biological and ecological impacts in and around coral reefs. OA monitoring on reefs throughout the Caribbean has been a highly collaborative activity with numerous academic, government, and . Despite these efforts, significant gaps remain that are crucial to the conservation and management of economically important marine resources within the region.

The (E/V) Nautilus at see in the Gulf of Mexcio (Credit: Nautilus)

Local scientists in Panama collect water samples for testing during a recent ocean acidification training. (Credit: The Ocean Foundation)

Capacity Building Efforts

NOAA continues to support the monitoring and capacity building efforts of the Global Ocean Acidification Observing Network (GOA-ON) in the wider Caribbean region, particularly through the Latin America and Carribean OA regional hub (LAOCA). Through GOA-ON, organizations and scientists have established observation standards, enhanced data sharing, and quantified global and regional ocean acidification trends to identify areas of heightened vulnerability or resilience. The current GOA-ON observing network is comprised of over 800 members from 105 countries, and provides access to an inventory of OA monitoring assets around the world through a data portal (http://portal.goa-on.org/). With support from NOAA, the Intergovernmental Oceanographic Commission (IOC), the Ocean Acidification International Coordination Centre (OA-ICC) of the International Atomic Energy Agency, and other national contributions and private foundations, GOA-ON has organized capacity building workshops, mentorship programs, technology trouble-shooting, and data sharing resources, all of which support UN Sustainable Development Goal 14.3.

GOA-ON also works to address gaps in the current understanding of ocean chemistry through global monitoring capacity-building efforts, such as the distribution of "GOA-ON in a Box" kits and providing training on quality data collection and management. The GOA-ON in a Box kit is a low-cost kit that contains all of the lab equipment, chemicals, and sensors needed for collecting ocean acidification measurements of sufficient quality for use in models. GOA-ON in a Box kits have been distributed to scientists in Ecuador, Mexico, Argentina, Colombia, Panama, and Jamaica.

GOA-ON, in partnership with The Ocean Foundation and NOAA, has hosted numerous training workshops to educate scientists on proper ocean acidification monitoring methods, data sharing, and communication to policymakers. In 2019, GOA-ON, TOF, and NOAA hosted a workshop in Colombia, which brought together more than 80 participants from 15 countries. Scientists, policy-makers, and industry professionals from around the region learned and collaborated on strategies for enhancing ecosystem resilience to ocean acidification.These efforts have been critical to the development of ocean acidification monitoring programs in many countries and are currently being expanded to cover additional regions through the continued support of GOA-ON, NOAA, and other partners.