EPA

Fellowship

Dr. Andréa Geneviève Grottoli,
Professor, School of Earth Sciences,
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Award Year: 1996

Success Stories

STAR Fellow Pursues a Passion for Researching, Protecting Threatened Coral Reefs

Coral reefs play a vital role in the economic survival of coastal human populations and provide critical habitat for thousands of marine species, but they are declining globally as a result of rising carbon dioxide (CO_2) emissions, says Ohio State University School of Earth Sciences Professor Andréa Geneviève Grottoli. "The loss of reefs will have a dramatic ripple effect throughout human society and marine ecosystems," but that danger is not well understood by the public.

Andréa's passion for her field of reef research arose from her lifelong love of water environments, starting with the lakes and rivers of Northern Ontario, where she grew up and worked at a Great Lakes summer camp. As an undergraduate student at McGill University, Canada, where she received a B.S. in Biology (1992), Andréa studied zooplankton in the St. Lawrence and Ottawa rivers for two summers and did a senior thesis in aquatic ecology. Her original plan for graduate school was to obtain a Master's with a marine focus and then to work for EPA doing environmental remediation.

While at the University of Houston, Texas, Andréa gravitated toward the school's Coral Ecology Laboratory where after her first year she conducted graduate research in Hawaii. Finding the research deeply satisfying, she shifted to the Ph.D. program and committed to an academic career studying corals. "I was very motivated by the fact that coral reefs are these 'canary in the coal mine' ecosystems" whose condition is directly connected to the stewardship—or lack of it—by humans, and by the idea of meaningful work that could make a difference. After receiving her Ph.D. in Marine Biology in 1998, Andréa pursued postdoctoral studies at the University of California, Irvine (1999–2000).

Receiving a STAR Fellowship from 1996 to 1998 "was amazing," Andréa says, explaining that it enabled her to focus fully on her research. Because she was not constrained by a teaching schedule, she had more flexibility in pursuing field work. She also pursued research independent of her advisor at the Rosenstiel School of Marine and Atmospheric Science in Miami, forging a strong relationship with Dr. Peter Schwarz that she still maintains. As a result of her focused research, by the time she graduated, Andréa had published a peer reviewed paper and had a second in press as well as two more near completion. The STAR Fellowship also was a "resume booster" in her job search.

Today, besides her primary role as a professor, Dr. Grottoli is the head of the Water, Climate and the Environment Division and of the Stable Isotope Biogeochemistry Laboratory at her university. She also is an Affiliated Professor in the Department of Ecology, Evolution and Organismal Biology and is a Fellow on the university's Committee on Institutional Cooperation, Academic Leadership Program, which helps prepare faculty members for administrative roles. She also serves as a council member for the International Society for Reef Studies.

A scarcity of federal funding is the biggest challenge facing Dr. Grottoli's field. There is no shortage of important questions to be addressed or good, highly qualified researchers to do the work, but the funding rate is so low that progress is very limited, even though "coral reefs are a bit of a ticking time bomb" assailed by climate change, ocean acidification and other stresses that are occurring "faster than we can study them. "The National Science Foundation, the main research funder, has been affected dramatically by budget cuts made over many years, and the cost of research is rising.

Dr. Grottoli describes two significant conceptual breakthroughs in her field, both related to CO_2. First, scientists learned that elevated temperatures cause coral bleaching. Corals are symbiotic; they are an animal that hosts algae in their tissue, which enables them to obtain some food by photosynthesis, and they eat zooplankton and particulate organic matter. Elevated temperatures cause the corals to lose algae that live within their cells and normally give corals their color. The bleaching is extremely stressful and can cause mortality. Globally, massive coral mortality has occurred as a result of increasingly frequent and intense bleaching events. However, some corals recover from bleaching and survive. At today's warming rate, by 2040 beaching could occur annually, and coral might not recover fast enough to survive. Scientists predict a 60 percent loss of corals globally by the end of the 21st century or sooner.

Second, scientists have learned about the adverse effects of ocean acidification from CO_2. Approximately one-third of excess CO_2 is absorbed into the ocean, interfering with calcification in corals and other ocean animals. If corals, which are the building blocks of reefs, cannot calcify, reef growth cannot take place.

In her research, Dr. Grotolli has shown that corals with a greater capacity for eating plankton, or with higher fat content, can possess higher resilience in response to CO_2 stresses. In addition, certain algae living in coral cells tolerate elevated temperatures better, and some corals can shift the algae around in their systems. Corals with such traits are likely to persist longer amid CO_2-induced stresses. Currently, Dr. Grotolli is researching multiples stresses that are affecting corals, including not just temperature and acidification but also high nutrient levels and changes in light levels along populated coasts that might provide corals some protection from bleaching. Dr. Grotolli states that without drastic reductions in CO_2 emissions, reefs as we know them today will disappear. Reefs will continue to exist, but they will not look or function like the reefs now under assault.

Outside of her various academic and other professional roles, Dr. Grotolli and her husband like to spend time with their 5-year-old daughter. She also practices Vinyasa yoga and enjoys cooking.