

# My Journey into Underwater Acoustics

*Gail Scowcroft*



As I look toward retirement and reflect on the winding road of my career, I feel much gratitude for the underwater acoustics community, in which I have been engaged for the second half of my career. This has bought me many satisfying opportunities to contribute to the field. In addition, the friendships I've made with several of my ocean acoustic colleagues have been a highlight of my career. As the principal investigator for the Discovery of Sound in the Sea (DOSITS; see [dosits.org](https://dosits.org)) project for over 22 years, I have led a team of scientists and education professionals in making significant contributions to the nonexperts' understanding of ocean acoustics and the multiple subdisciplines under its umbrella. We have held the highest bar possible, peer-reviewed research, in developing content on these topics, always striving to make complex acoustics concepts and research results understandable for a variety of audiences.

My career did not start out in ocean acoustics. When I decided to become a scientist almost 50 years ago, ocean acoustics, or acoustics in general, was not a consideration for my studies. As a geology major at the University of Rhode Island (URI), Kingston, I fell in love with the history of the Earth and its systems. I was fortunate to be able to take two graduate level micropaleontology courses with Eugene Tynan and was bit by the micropaleo "bugs" (in this case, Silicoflagellates and Archaeomonadaceae). In 1975, a new team conducting paleoceanography research at the URI Graduate School of Oceanography (GSO; see [web.uri.edu/gso](https://web.uri.edu/gso)) was seeking staff and students. With my micropaleo experience, I was a good fit. At the GSO, my ocean science education provided me with a wealth of opportunities to do independent research and work with a world class team of oceanographers. I became one of 119 researchers, who

were contributing their data to the Climate Long Range Investigation, Mapping, and Prediction (CLIMAP) project, which focused on describing the global climate at 18,000 years ago. This research informed the development of the first major global climate model (GCM) (CLIMAP Project Members, 1984). My first large scientific meeting was a CLIMAP synthesis meeting held at Columbia University's Lamont-Doherty Earth Observatory, Palisades, New York, in 1978. There, Syukuro Manabe of Princeton University, Princeton, New Jersey, gave a presentation based on CLIMAP data in which he predicted that increased levels of carbon dioxide in the atmosphere would lead to an increase in Earth's global average surface temperature of as much as one degree by 2100. He was the first scientist to issue such a prediction. The CLIMAP reconstructions would describe boundary conditions for atmospheric GCM's for years to come. Manabe went on to win the Nobel Prize for the physical modeling of the Earth's climate in 2021.

Following the CLIMAP Project, I participated in the Cenozoic Paleoceanography Project (CENOP), another large, multiinstitutional project that reconstructed ocean conditions during the Miocene. Paleogeography, stratigraphy, water mass circulation and distributions, temperature, biogeography, and many other parameters were identified by CENOP's participating scientists. Working with large teams across disciplines and institutions at a relatively young age was great preparation for my future endeavors. As CENOP ended, I left the GSO and went to work for Woods Hole Oceanographic Institution (WHOI), Woods Hole, Massachusetts.

Frustrated by the lack of the public's understanding of climate change and the growing misinformation about it in

the mid-1990s popular media, I decided to begin taking classes in science education pedagogy and psychology to learn about how people acquire knowledge and what makes it stick. I eventually had enough credits to be qualified to teach high-school science and took a five-month leave of absence from WHOI to teach ninth-grade Earth Science. I learned more about education in those five months than in all of my combined previous education.

Returning to the GSO after my classroom stint, I began collaborating on proposals to conduct climate change education programs. Within a year, I had received grants from the Environmental Protection Agency, the National Aeronautics and Space Administration, and the Department of Agriculture for a suite of climate change education initiatives. I began teaching two graduate courses for educators in climate change and oceanography at the GSO. With my grant-funded projects, I was able to teach all middle-school science teachers in the 36 Rhode Island school districts and assist them in incorporating climate and ocean science into their districts' curriculum. Another of my projects, funded by the Department of Education, created a marine science magnet school in the city of Providence. Every teacher, even the art and physical education teachers, in this inner-city elementary school with a population of over 80% minority students received training in ocean and climate science.

The 2000s were busy and productive, including my entry into the ocean acoustics community. In 2001, I was approached by Kathleen Vigness-Raposa of Marine Acoustics Inc. (now at Inspire Environmental, Newport, Rhode Island; see [bit.ly/47xEYjj](https://bit.ly/47xEYjj)) to see if I wanted to collaborate on a proposal to the Office of Naval Research (ONR) to develop educational materials for nonexperts related to underwater acoustics. Kathy had been working with Peter Worcester (see [bit.ly/3OFVZiu](https://bit.ly/3OFVZiu)) at the Scripps Institution of Oceanography, La Jolla, California, on the Acoustic Thermometry of Ocean Climate (ATOC) project off Hawai'i. There was significant public opposition to this research because people believed that the underwater ATOC sound source would harm humpback whales in the vicinity, even though research had shown that this was unlikely. Kathy approached me because of my experience in translating science and conducting programs for nonexperts. Although I knew very little about the science of underwater acoustics, the partnership of

educational outreach with acoustic technical knowledge proved incredibly fruitful for Kathy and me as well as for the underwater acoustics community.

Our proposal for the DOSITS project to the ONR was funded in 2001, and I have been fortunate to serve as the principal investigator and work with Kathy for the last 22 years on this very rewarding project. I have been able to leverage several other projects that I have had funded over the years to introduce ocean acoustics to a variety of audiences. From 2003 to 2012, I received National Science Foundation (NSF) funding to direct a large, national program for educators, the Teacher Research and Mentoring ARMADA Project, which placed educators in ocean- and climate-related research experiences from pole to pole, many of which involved time at sea. We involved over 120 US educators, who all were introduced to DOSITS resources and underwater acoustics during their training.

Overlapping with DOSITS and the ARMADA Project, I became the executive director of NSF's Centers for Ocean Sciences Education Excellence (COSEE) program (2008-2015). Charged with building a national network of ocean science research and education institutions, I was able to draw on my early experience of being involved in large networks of researchers and institutions. With over 300 institutional members, COSEE provided training for two-thirds of the ocean science workforce and engaged over 10,000 formal and informal education professionals. We were able to promote DOSITS resources and content throughout the COSEE network. As an outcome of COSEE, I cofounded and have been coleading the Global Ocean Science Education (GOSE) Workshops since 2015. The 2023 workshop (see [bit.ly/47x7yRU](https://bit.ly/47x7yRU)) was focused on ocean acoustics and brought together 71 ocean scientists, policy makers, business leaders, and education professionals.

In 2013, the organizers of the third meeting on the Effects of Noise on Aquatic Life (see [an2022.org](https://an2022.org)) in Budapest, Hungary, invited me to moderate a workshop for the international regulatory community. Bringing ocean acoustics experts and policymakers together highlighted the need for educating the people who are making decisions about how people can use sound underwater. The DOSITS project began developing resources for this community and in 2015 began offering an annual webinar series (see [bit.ly/47CRVbu](https://bit.ly/47CRVbu)) on a variety of topics

related to ocean acoustics. Since then, we have conducted several needs assessments of the international regulatory community and, working with the ocean acoustics community, do our best to provide content that is in high demand ([bit.ly/3OY0qXg](https://bit.ly/3OY0qXg)).

We have recently received ONR funding for the next three years (2023–2026). During this time, we will be expanding our activities to develop a new professional development program in ocean acoustics for educators of students aged 13 through undergraduate level. We will continue to conduct our annual webinar series and regularly synthesize new research as it is published. During this funding cycle, I am planning to retire from the URI. However, I hope I can stay involved in DOSITS on a volunteer basis. It feels a bit like having your child graduate from college and go off into the world without you.

It was a winding road toward ocean acoustics, and once I arrived, I was met by a kind and gracious community of scientists. I remain ever grateful for the opportunities that my career has brought and, most of all, for the wonderful people with whom I have had the pleasure of working with for the last 22 years.

#### Suggested Reading

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#### Contact Information

**Gail Scowcroft** [gailscow@uri.edu](mailto:gailscow@uri.edu)

Graduate School of Oceanography  
University of Rhode Island  
Narragansett, Rhode Island 02882, USA



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