



NURP/MAB

A Project Tomorrow educator provides elementary students with a hands-on lesson, focusing on biology of a sea urchin.

Outreach and Education

Science and technology are the cornerstone of our nation's economic leadership. Maintaining this leadership can only be achieved through a partnership of scientists, students, educators, and the public. The research community must engage in activities that educate future scientists and engineers and inform the public about the results of their efforts to foster a scientifically literate citizenry prepared to make the difficult policy choices called for in balancing economic growth and environmental conservation. While the primary mission of NURP is scientific research, a small portion of the program is aimed at sharing the results of this research through partnerships with education and outreach programs. NURP programs involve hundreds of scientists each year throughout the world studying exciting new frontiers. We are uniquely positioned to meet the challenge of using this excitement to capture public attention and educate our future leaders.

Through the Internet, the scope of potential involvement and access to information is expanded to a global scale. Interactive technologies allow students and teachers to experience and study the oceans without leaving their schools. A Long-term Ecosystem Observatory at a 15 m (50 ft) depth (LEO-15) in the Atlantic Ocean gives hundreds of K-12 teachers and their classrooms access to real-time scientific data from the seafloor observatory. The Jason Project also reaches hundreds of thousands of students around the nation. Students participating in the Jason Project at the *Aquarius* chatted with scientists living in the underwater laboratory, observed how scientists conduct research from a nuclear submarine, and piloted an underwater robot around a coral reef.

This chapter focuses on how NURP enables students and educators to escape the confines of the classroom and textbooks, and sail with scientists on and into the sea.

Hands-on Science

The Aquanaut Program

For almost a decade, the Aquanaut Program (AP) annually has provided an average of 75 high school students and 14 teachers the chance to roll up their sleeves to participate in hands-on experience in marine research. The stimulating nature of advanced technologies used in modern oceanographic research, strong linkages between scientists, teachers, and students contribute to its success. Teachers and students get immersed in the culture of research, allowing them to experience the entire research process. The students learn how to use the technologies to conduct research. The mentor scientist is a positive role model who guides the research project from start to finish: providing background information on the importance of the topic, introducing the research methodologies, explaining the application of advanced technologies, and providing quality control on data collection, analysis and presentation. The research topics are not only relevant, but students care about them.

AP is a chance for teachers and students to job shadow a scientist where there are no canned problems and no canned solutions. “Kids get to see what the craft of a research scientist is, and how they deal with success and also with failure when things don’t go as planned on a research cruise. Things like poor visibility and seasickness certainly factor into a mission,” said Ivar Babb, director of NURP’s North Atlantic and Great Lakes Center at the University of Connecticut at Avery Point. As a result of their efforts, teachers generally return to their classroom with fresher outlook on

science, armed with new resources to develop marine science projects that they might not have thought of before. Student aquanauts often return to their high schools with better attitudes that result in better grade point averages, said Peter Scheifele, director of the Aquanaut Program based at NURP’s North Atlantic and Great Lakes Center. A random survey of 100 aquanauts taken by NURP a year after they left the program showed that 92 percent of the students had gone on to college, with 48 percent choosing to major in math, science, and engineering as a direct result of participating in the program.

“It’s really interesting to see the light bulb go on in students’ heads,” Scheifele said. “Whereas many of the students, before becoming Aquanauts, had no idea of the problems confronting the environment, they soon realize they can become a force in protecting the environment in their own daily lives.”

Interactive Science

Underwater Web Sites Take Students to the Ocean Floor

Internet history was made in 1996 when the world’s only undersea laboratory devoted to science became the world’s first underwater web site. Hundreds of thousands of students had a virtual porthole via video screens to experience how scientists conduct research from a specially designed underwater habitat called *Aquarius*, owned and operated by NURP. Understanding problems and opportunities in the oceans requires first-hand experience. Although the whole earth is impacted by the oceans, few people have the fortune to be on or in the ocean. “Since few teachers and students will ever go to sea,” said Steven Miller, associate director of NURP’s Southeastern and Gulf of Mexico Center, “we propose finding effective ways to bring the sea to them.”

The *Aquarius* is a cylindrical chamber anchored to the seafloor in 15 m (50 ft) of water at the base of a coral reef off Key Largo, Fla. It enables scientists to live and work for up to ten days on the bottom. For two weeks in 1996, students, teachers, and researchers from all over the world joined together for a live broadcast of a scientific experience at the *Aquarius* as part of the Jason Project VII: Adapting to a Changing



American School for the Deaf students operating the passive sonar suite tracking vessels and whales.

NURP/UCAP



DOUG KESSLING

Dr. Gerald Wellington gives watery lecture to high school students participating in Jason Project off Key Largo.

Sea. The Jason Project transports students via satellite to remote sites where scientists are engaged in research so they can closely examine the biological and geological development of the earth.

Video, telepresence, and web-based programs will be used to launch more education and outreach opportunities in marine science from the *Aquarius* in a way similar to that used in the Jason project. *Aquarius* was recently refurbished with state-of-the-art video, data and voice communications systems provided by the Harris Corporation, an international electronic communications company. Marine scientists will now be able to communicate underwater during excursions and transmit data in real time from a buoy secured to the seafloor to a shore base 13 km (8 mi) away. Announcements will be posted related to events of wide interest like coral disease epidemics and upwelling. News media with access to satellite transmission equipment will be able to present real-time views of scientists living and working underwater.

By training teachers to participate in at-sea scientific missions based at the *Aquarius* habitat and broadcasting their experiences at the *Aquarius* web site (<http://www.uncwil.edu/nurc/Aquarius>), the importance of marine science will be communicated in an exciting new way.

Mounting demands placed on marine and coastal resources have made it particularly important for students of all ages to understand how the environment and science effect their lives and future choices. The Institute of Marine and Coastal Sciences (IMCS) at Rutgers University has developed a professional development program for K-12 educators called Project Tomorrow to meet these growing needs.

Project Tomorrow offers classroom lessons and field trips for K-8 students that integrate the study of the ocean with the school's existing curriculum. IMCS is currently working with 15 schools throughout New Jersey in the creation of Ocean Weeks, where the school is immersed in the study of the ocean. IMCS also recently developed an innovative series of Internet-based instructional modules, which link classrooms with active research investigations at the Long-term Ecosystem Observatory (LEO-15), 15 m (50 ft) in the ocean. Because data is collected continuously and long-term at the fixed LEO-15 location, scientists, educators, and students have the ability to get a common sense view of the ocean via the Internet. Like the terrestrial ecologist who can walk along the forest floor, LEO-15 provides students with the ability to get a real-time connection to the ocean. These LEO-15 modules target middle school (6-8 grade) students and focus on teaching children how to think critically about the world around them.

This summer, IMCS is offering K-12 teachers research experience at the LEO-15 site. This program, funded through NURP and the National Ocean Partnership Program (NOPP), will partner classroom teachers with marine scientists working at the LEO-15 site. Together, this consortium of scientists and educators will develop new Internet materials to be used via the Internet global school network. Through LEO-15, real-world research experiences and training will be made available to students, some of whom will become tomorrow's scientists and engineers and all of whom will be challenged to make informed decisions on future environmental issues.



J. MCDONNELL

Hands-on Internet lessons focus on development of problem-solving and decision-making skills.