

Reaching Out in New Ways: Working with Alternative Schools and Underrepresented Groups to Improve Ocean Literacy Through the National Oceanic and Atmospheric Administration's Office of Ocean Exploration

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Abstract

The National Oceanic and Atmospheric Administration's Office of Ocean Exploration (OE) was born out of a growing national concern over the state of the ocean, and out of the urgent need for a better understanding of our ocean globally. The US Government empowered a panel of experts in 2000 to develop a national strategy for ocean exploration and the result was a report titled *Discovering Earth's Final Frontier: A U.S. Strategy for Ocean Exploration* [4]. Created in direct response to the recommendations of this panel, OE has funded a multitude of expeditions and projects to gain a more thorough understanding of little-known or unknown ocean regions. With the establishment of OE, NOAA developed an opportunity to reach out in new ways to teachers, students, and the general public to share the excitement of daily discoveries while at sea and to demonstrate the cutting-edge technology and science behind these exploration initiatives. Ten percent of OE program funds are invested in a robust and diverse Education and Outreach Program designed to support Key Objective 4 of the President's Panel Report. This objective specifically calls for reaching out in new ways to stakeholders to improve the literacy of learners with respect to ocean issues. As exciting expeditions are the core of our NOAA program, education and outreach efforts are focused around these missions. Through various initiatives, OE works with traditional and non-traditional programs to provide opportunities to enhance ocean literacy.

I. Introduction

'An understanding of the ocean's influence on you and your influence on the ocean' is a working definition of ocean literacy recently developed during the 2004 Ocean Literacy Online Workshop sponsored by the National Geographic Society's Oceans for Life Initiative, the National Oceanic and Atmospheric Administration, and the College of Exploration [9]. The Workshop brought together approximately 100 scientists and science educators to build upon earlier efforts to address the arduous task of defining exactly what an ocean literate person should know and understand about the lifeblood of the planet on which we live. As determined by the community-wide consensus building process facilitated during the Workshop, an ocean-literate person

understands: 'the essential principles and fundamental concepts about the functioning of the ocean; can communicate about the ocean in a meaningful way; and is able to make informed and responsible decisions regarding the ocean and its resources [9, p. 2].' Along with this working definition, they suggested essential concepts with which individuals should be familiar to be considered fully ocean literate [9]. This dedicated group took on the task of defining ocean literacy in response to the increased national awareness of the critical need to build an ocean literate society.

The U.S. Commission on Ocean Policy reported that the high rate of science illiteracy recently documented in U.S. high schools [3] was a potential threat to undermining the Nation's health, safety, and security, as it is perceived as 'weakening' the overall mathematics and science foundation in the U.S. [12]. Both Reports by the Pew Commission [10] and the U.S. Commission on Ocean Policy [12] state that the oceans are in crisis, that resources for ocean-related issues are dwindling, and that a key component to reversing potentially catastrophic trends is to develop our next generation as one with a clear understanding of ocean-related issues. Members of this next generation must become our environmental stewards. They should have an excitement about the ocean and its basins and what these massive, but fragile water bodies contribute to all life on our planet. They must become fully informed, so as to make good choices for a healthy and sustainable environment while considering the economic aspirations of the Nation. Clearly, it is essential that educators and scientists work together to develop a more ocean literate student population, as students are our future workforce, and thus our future ocean leaders.

II. NOAA's Office of Ocean Exploration

OE was developed with many of the aforementioned concepts in mind, at a time when the growing national concern over the declining state of the world's ocean was growing. OE was developed as a granting office to provide financial and operational support to the scientific community to explore little known or unknown regions of the world's ocean. The OE program objectives are to

explore and map the ocean's living and nonliving resources and to gain new insights about its physical, chemical, biological, and archaeological characteristics. Thematic priorities have evolved over the past few years, and include habitat and ecosystem characterization; marine life inventories; ocean mapping; new ocean resources; and marine archaeology. These thematic priorities are consistent with NOAA's 5-year Research Strategic Plan [11] and were established in part from the 2000 President's Panel on Ocean Exploration [4]; eight regional NOAA-hosted ocean exploration workshops (<http://www.explore.noaa.gov/workshops/welcome.html>) and a 2003 National Academy Report, *Exploration of the Seas* [5].

Beyond the robust scientific agenda supported through the Office, 10 percent of OE program funds are invested in a diverse Education and Outreach Program designed to support Key Objective 4 of the President's Panel Report [4]. This objective specifically calls for reaching out in new ways to stakeholders, in both formal and informal settings, to improve the literacy of learners with respect to ocean issues. In the U.S. Administration's response to the report of the U.S. Ocean Commission, official support was garnered to promote ocean literacy and ocean education in both formal and informal settings [13]. A law was also passed in December, 2004 (the FY 2005 Consolidated Appropriations Act) that expands NOAA's authority to engage in formal and informal education activities [13].

III. Education and Outreach through Expeditions

As exciting expeditions are the core of the OE program, education and outreach efforts are often focused around these missions. Through the award winning NOAA Ocean Explorer Web site (<http://oceanexplorer.noaa.gov>), students, teachers, and the general public can follow missions as they unfold through background essays and participant biographies posted on the site prior to each major expedition, and through daily logs, images, and videos posted daily during cruises. There is also a live 'Ask a Scientist' link on the Web site for near-real time correspondence with the scientists, educators, and other cruise participants while at sea.

Other Web initiatives include OceanAGE (Another Generation of Explorers) Careers, which highlights marine scientists through video biographies and live chat sessions, virtual teacher workshops, online courses, and a list-serve to notify participants of all OE related activities. Many OE cruises are utilized as 'training platforms' for educators, students, and interns, associated with various partner institutions and educational programs across the country, and special satellite phone calls are conducted from sea to pre-arranged groups on shore during several OE sponsored expeditions each field season.

Scientists and educators collaborate to develop lesson plans associated with each major cruise. A collection of these lesson plans have been published as a curriculum for Grades 6-12 entitled, *Learning Ocean Science through*

Ocean Exploration

(<http://oceanexplorer.noaa.gov/edu/curriculum/welcome.html>).



Fig. 1. NOAA Ocean Explorer Web site featuring the 2004 Gulf of Alaska Seamount Expedition.

OE is developing alliances with aquariums and science centers to offer professional development to teachers in the use of this curriculum, and several short courses are offered each year at National conferences to help build cadres of ocean exploration teacher leaders.

Through these initiatives, as well as others more specifically tailored to individual needs, OE works with traditionally as well as non-traditional educational institutions and programs to provide exciting programs and products to enhance ocean literacy across the U.S.

IV. Early Exposure to Science

In the fourth annual survey by BAYER regarding science education in the U.S., scientists reported overwhelmingly, that their fascination with science began at an early age, with approximately 80 percent reporting that they first became interested in science before entering high school [2]. It is well understood that children should be introduced to essential subjects such as mathematics and science early in their education, and that exposure should continue throughout their schooling. Exposure should include practical application and significance (the 'me' factor), and in high school years, should also include demonstration of career options.

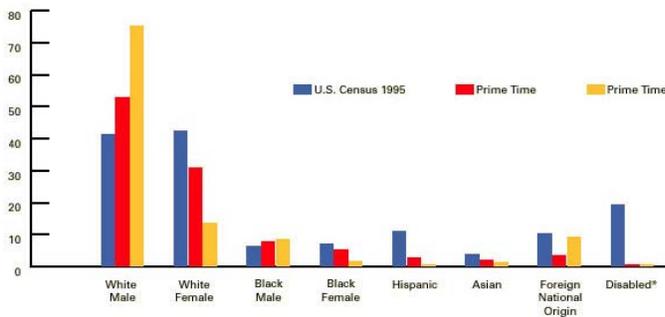
OE lesson plans focus on grades 6-12, are all inquiry-based, and are correlated with the National Science Education Standards. Scientists featured on the OceanAGE Careers page are linked with major expeditions, and by video, demonstrate the practical application of their education and career choices. Professional Development Institutes are hosted in regions associated with specific expeditions for that 'in my own

back yard' connection, and ship tours are offered in local ports to provide the same type of connection to a broader audience. The excitement of deep ocean discovery is shared near-real time through the NOAA Ocean Explorer Web site, and through partnerships with other media and outreach groups such as the JASON Foundation for Education, Immersion Presents, and National Geographic Society.

V. Serving the Underserved

Although the suggested concepts for defining an ocean literate individual [9] may be perceived as fundamental to those of us with some understanding of ocean sciences and ocean related issues, to the growing population of underserved and underrepresented students in our Nations' classrooms [8], many of these concepts can be totally foreign.

Minorities and women are traditionally underrepresented in mathematics and science fields, including ocean sciences [1]. Role models are typically white males in most science related fields, even on television (Table 1), and so not surprisingly, it is no small task to foster an appeal and interest in ocean-science related careers within non-majority populations.



* Estimate not from U.S. Census data.
Source: Gerbner and Linson, Department of Commerce report, 1999.

Table 1. Representation of groups in the U.S. population (1995), the incidence of their portrayal on Prime Time television, and their representation as scientists from samples of Prime Time television (1994-1998) [6].

A. Striving for Equity in Access

It is important to understand the range of effort and resources necessary to reach diverse groups, and to be aware of the social, cultural, economic, political, and environmental differences within which various populations exist. For example, access to basic resources such as funding for teacher professional development and computer access in classrooms varies widely among school districts, and so accommodations should be made for inclusion of these underserved communities. As such, OE has looked to develop alternative methods to deliver information and products to those who do not have high-tech capacity in their classrooms, who do not have the resources to purchase educational materials, and who can't travel to acquire experiences first-hand.

OE provides CD ROM's of the Ocean Explorer Web site and curriculum and companion CD-ROM for Grades 6-12, entitled *Learning Ocean Science Through Ocean Exploration*, at no cost so that all classrooms can have access to information and products developed around the exciting expeditions, regardless of Web or computer access. Each lesson plan can also be downloaded as a PDF document from the NOAA Ocean Explorer Web site, and teachers (and the general public) can sign up on a list-serve for notification of all events and activities associated with the office. Virtual events such as teacher workshops, online courses, and Web chats through OceanAGE Careers have been extremely successful, and have proven to be effective methods of linking scientists and classrooms remotely. Satellite phone calls from sea, and near real-time access to expeditions through the live 'Ask a Scientist' Web link have also been effective in establishing remote links between the science community and students and teachers in their classrooms.

OE encourages educator participation at sea on all major expeditions, and is partnering with the NOAA Teacher at Sea Program. OE is also working to develop a partnership with the University of Rhode Island's ARMADA Project to provide broader access to at-sea opportunities.



Fig. 2. UCAP science teacher, Carey DeLauder hosting a satellite phone call from Top Lab on the Woods Hole Oceanographic Institution's R/V *Atlantis* between UCAP students on shore in Providence, RI and scientists and *Alvin* pilots in Top Lab and the DSV *Alvin* submersible at 2400 meters depth in the Gulf of Alaska.

Informal outreach efforts can play a major role in initial exposure of ocean science and ocean-related issues, and methods can be flexible and accommodating, depending on the target audience.

OE has worked specifically with alternative schools and underrepresented groups. Examples include:

* In 2004, a science teacher from the Urban Collaborative Accelerated Program (UCAP), an alternative middle school for students at serious risk of dropping out of school in Providence, RI was invited to participate in a month-long expedition to explore seamounts in the Gulf of Alaska. Several satellite phone calls were made to UCAP students on shore during the cruise, and one call was

patched down to the Alvin submersible while at 2400 meters depth on a seamount. Media, including Associated Press, covered the call. An OE scientist visited the classroom prior to the start of the expedition, and worked with the teacher post-cruise to present her experience to the students (and others), and to develop a plan for implementing what she learned into the classroom.

* At-risk students from the Wayne Enrichment Center, in Indianapolis, IN also spoke with scientists and submersible pilots in 2004.

* Live chat sessions were organized between various groups of students with scientists highlighted on the NOAA OceanAGE Web site.

* Shipboard tours were provided that allowed students and teachers to interact with scientists and ship operators, while covered by invited media.



Fig. 3. NOAA Corps Officer Jennifer Pralgo introducing students to the bridge and explaining the high tech navigation capability of the NOAA ship *Ronald H. Brown*. Image courtesy of NOAA FGBNMS.

* OE is working to develop new partnerships and products to serve the deaf and hard of hearing community. The newly edited version of the Ocean Explorer curriculum now contains "Suggestions for Teachers of the Deaf" for each lesson plan.

* OE is partnering with Immersion Presents to expose underserved populations of school children in after school programs and the Boys and Girls Clubs of America to the excitement of ocean discovery through live broadcasts and education 'modules' developed for elementary school-aged children.

* Guidance and training was provided to urban school teachers to develop field programs that allow students to 'explore their own backyards.'

* Several urban alternative schools were involved with OE expeditions through visits to classrooms and the development of action plans.



Fig. 4. OE scientist, Catalina Martinez, leading a field program with UCAP middle school students and teachers to observe harbor seals and explore RI's rocky shore. Image courtesy of T. Hotchner.

VI. Conclusion

'The chance of birth [7],' can result in enormous advantage or incredible disadvantage. The social/economic structure a child is born into is likely to dictate access to opportunities and resources on all levels, including quality of education, and thus future prospects. Clearly it takes more effort and resources to reach underserved and underrepresented populations. Unfortunately these efforts are often not well understood or even considered, which only perpetuates the problem. As educators, we can work to narrow the gap of disadvantage by providing more effort and resources where and when they are needed. We can provide alternatives and be flexible in the methods we use to deliver information. We can develop additional opportunities to expose students and teachers to the fascinating world of ocean science.

We have not solved any significant national problems in OE with the efforts made to serve the underserved, but we are taking steps in the right direction by addressing key issues such as lack of access to resources, and by sharing the excitement of ocean discovery through a variety of direct and indirect methods.

Working together, educators and scientists can help develop the next generation of ocean leaders who are well informed, and thus well equipped to make good decisions about the future of our global ocean. In this regard, we must not limit our efforts to traditional methods, and we must not limit exposure to those with easy access. Our greatest challenge is to work together to tap into a vast, untapped resource for ocean sciences – women and minorities, and all those who exist within underserved communities. It was best said by Rob DeBlois, Director of UCAP School in Providence, RI after UCAP participated in an expedition. "I hope the kids will see how fascinating the world is and what they can do when they are educated. . . The more they see beyond the boundaries of their neighborhoods, the farther they can go and they'll see possibilities instead of limitations."

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