

**Ocean Science Education and Outreach Testimony
to the
U.S. Commission on Ocean Policy**

Offered By

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Mr. Chairman, Members of the Commission, and Staff... it is an honor and a pleasure to have the opportunity to discuss ocean sciences education and outreach with you this morning. For nearly three decades, I have been working at the “grass roots” level with both preK-12 teachers and students and for the last 15 years I have had the added opportunity to work with the general public about global climate change, ocean sciences, and coastal processes—across all disciplines. It is also noteworthy to mention that I am a Past-President of the National Marine Educators Association (NMEA) and the Mississippi Science Teachers Association. And, I have been the Education Chair for the Marine Technology Society for the last nine years. I also served on a one-year Interagency Governmental Personnel Act as the Director of Education for the National Oceanic and Atmospheric Administration’s (NOAA) National Sea Grant College Program.

I have also been very fortunate in always having support from my bosses, my family, and the community. I thoroughly enjoy “getting up” and going to work everyday. I want to share three priority educational recommendations with you this morning and I’d like to begin with an excerpt from NOAA’s Office of Global Programs (1991)...

The Earth, for all we know, is a unique planet, where a thin blanket of air, a thinner film of water, and the thinnest veneer of soil, combine to support a web of life of wondrous diversity and continual change. The daily needs of nearly seven billion people now stress the limits of this naturally regulated system.

I realize I am “preaching to the choir” by stating the oceans are important because they cover 71% of the Earth’s surface. And, you are certainly more cognizant than I about the oceans; however, they are critical to our national defense and security, the nation’s economy, human health, global transportation, fisheries products, our social structure, and they have provided an innate tranquility and serenity to each of us since the beginning of our existence on this planet. Further, as you know only too well, we all take the oceans for granted. I believe too few people know or appreciate the fact that 70-80% of the oxygen we all breathe is derived from the oceans; oceans drive our weather; and they serve as a “sink” for carbon dioxide; very simply, the oceans are the cornerstone for our life support system!

Therefore, my recommendations are to:

- **mandate appropriate federal agencies implement ocean sciences education programs to “bridge the gap” between scientists, their research, and the interpretation of those data, so ALL people are more aware and better understand the relevance of the oceans to their everyday lives** (i.e. for all sectors of our community, such as: preK-12 students, precollege teachers, undergraduate and graduate students, underserved and underrepresented groups, informal audiences – to include the media, and information technology personnel). This recommendation, to mandate appropriate federal agencies implement ocean sciences programs from the “cradle to the grave,” should have a common focus between and within agencies. The National Oceanographic Partnership Program (NOPP) is an excellent example of 14 agencies having a common focus that is working well but needs increased funding, so exemplary research and educational projects can be sustained over longer periods of time and, new areas of ocean sciences research and education can be initiated.

As you are aware, a National Science Foundation (NSF) Announcement of Opportunity for Centers for Ocean Sciences Education Excellence (COSEE) was advertised in the fall of 2001. Letters of Intent were requested by November 30, 2001 with proposals being due January 18, 2002. Approximately 25 submissions were received by the NSF Ocean Sciences Division with funds available for only three Centers, those being represented by one Central Coordinating Office and two Regional COSEE. This COSEE effort should be initiated with additional funding to enhance education excellence. I believe—as do many others—the need exists for at least 20 to 25 COSEE. And, this increased funding could become a reality **IF** other appropriate agencies embrace the COSEE concept, for this concept is not “NSFcentric!”

My second recommendation is to:

- **promote ocean literacy within the national standards and through enhanced training and professional development programs for teachers...**the need for science literacy, in general and ocean literacy in particular, has never been more critical for our citizenry than it is today. The evidence is clear. With continued new and advanced technologies; increased global environmental stresses; K-12 teachers shortages (200,000 teachers per year for this decade); systemic educational reform initiatives at the state level in rural and urban areas; the implementation of *National Science Education Standards (NSES)*; and the need for increased numbers of underrepresented and underserved groups in the fields of science, engineering, technology, and math—all require responsible decision-making at all levels of academia, government, industry, and the private sector.

As excerpted from the NOPP-funded *Consortium for Oceanographic Activities for Students and Teachers (COAST) Final Report*, (2000)...For the last 20 years, science education literature has been replete with research documenting that teaching and learning need to be improved nationally. Three landmark studies, *A Nation At Risk* (U.S. Commission on Education, 1983), the *National Science Foundation Survey Report* (1988), and *The Third International Math and Science Study [TIMSS]* (National Science Teachers Association Reports, 1996) have re-enforced our country’s awareness of the lack of competitiveness exhibited by this Nation’s public schools and its students in math and science when compared to other countries. Precollege math and science education is a local, state, regional, and national concern.

As stated by the National Science Board (1999), the future of this Nation depends on setting a primary goal of having a strong, competitive science and engineering workforce and a citizenry equipped to function in a complex world. And, to achieve this goal, educational excellence in math and science education at all levels should enhance every American’s life opportunities through productive employment, active citizenship, and lifelong learning.

Further, there exists today an achievement gap in math and science between majority and minority and/or disadvantaged students, which simply demands immediate action. As stated by the National Commission on Mathematics and Science Teaching for the 21st Century in *Before It's Too Late: A Report to the Nation* (2000), America's students must increase their performance in math and science if they are to succeed in today's world and if the United States is to stay competitive in an integrated global market. In 2000, the United States Commission on National Security/21st Century also supports the improvement in math and science education by this country's students as a national security issue. Therefore, in response to this national concern, in 2001 President Bush stated an educational vision in *No Child Left Behind* that among the underlying causes for poor performance by U.S. students in the areas of math and science, three problems must be addressed, i.e.,: 1) too many teachers teaching "out of his/her field;" 2) too few students enrolling in advanced coursework; and 3) too few schools offering a challenging curriculum and textbooks. President Bush's education reform agenda also recommends that partnerships between the preK-12 community and institutions of higher learning scientists, mathematicians, and engineers address the issues of improving teaching and learning in these areas for ALL children.

Similarly, the National Research Council (2001) reported that research clearly demonstrates that to deliver a competitive scientific and technical workforce, it is imperative to develop and implement national strategies to improve the preK-12 instructional workforce. Due to this close relationship between student achievement and teacher knowledge and teaching skills, fundamental questions have been raised relative to the recruitment, training, and professional development programs for pre-and inservice teachers. The National Commission on Teaching and America's Future (1996) determined that improving teacher preparation (preservice teachers) in institutions of higher learning is at the core of sustaining and improving quality education for all students. These findings have resulted in many states encouraging alternative routes for entry into the teacher profession that still require preservice teachers to spend significant time in higher education at the baccalaureate and master's degree levels. And, I can certainly testify that teachers require support throughout the professional education process – from recruitment, through preparation, induction, and continued professional development in order to create and sustain a high-quality teacher workforce. As stated by NSF in its Math and Science Partnership Announcement of Opportunity, "there is a shared, vested interest by preK-12 and higher education communities in providing the best education possible to all learners throughout the preK-16 and beyond continuum (2002).

But... teachers being well-prepared and well-supported will not by themselves improve student performance **IF** other components of the educational system that need to be addressed are not changed as well. These other components of the system include: the availability of challenging curricula and instructional materials; the appropriate use of technology to support instruction, evaluation, and assessment systems on "how" students learn; supportive administrative leadership; and a community that advocates and takes the responsibility for "raising the bar" for every student. It is well documented in science education literature, the future, well-being of our country depends not only on how well we educate our children in general, but on how well we educate them in math and science, specifically. The oceans are an unparalleled medium in which to excite and engage all audiences in learning all disciplines, but math and science specifically. [On a personal note, no one has probably had a greater impact on exciting and engaging our precollege students than Dr. Bob Ballard with the JASON Project.]

Further, in 2000 NSTA reported this nation's 52 million precollege students are taught sciences by 186,000 middle and high school teachers and 1.9 million elementary teachers. Of these numbers, 37% of high school, 83% of middle school, and practically all the elementary teachers

are teaching without degrees in science. Of those teachers with science degrees, too few have studied the ocean sciences and these sciences are almost non-existent in the *NSES* (National Research Council, 1996); however, the ocean sciences are represented in *Benchmarks – Project 2061* (American Association for the Advancement of Sciences, 1993). In 1996, during a Consortium for Oceanographic Research and Education (CORE) meeting, a group of educators acknowledged the results of most ocean sciences research and the subsequent interpretation of those data and their importance are neither widely known nor used by precollege teachers. Therefore, it is critical that national strategies and complementary plans be implemented to lessen the disconnect between researchers and educators/teachers, thereby allowing this country’s precollege students to become aware and to more fully understand the relevances of the oceans to each day of their lives.

To paraphrase a 24-year old quote by NSF (1978)...

what science education will be in any one year for any one child, is most dependent on what that teacher knows, does, and believes... or doesn’t know, doesn’t do, or doesn’t believe, for the teacher is the enabler, the inspiration, or the constraint for this nation’s students.

Teachers are the key to reversing this dangerous lack of scientific understanding by our school-age generation. [And, I would be remiss if I did not personally say thank you to ADM Gaffney, for he and the U.S. Navy have provided fiscal support for pre-and inservice teachers throughout all the coastal and Great lakes states through Operation Pathfinder Institutes since 1993—and through “teachers-to-sea” experiences since 1997. Operation Pathfinder expanded into the NOPP-funded Consortium of Oceanographic Activities for Students and Teachers (COAST) Project in 1997-2002. We have also been fortunate in Mississippi, in having been a JASON—Primary Interactive Network Site (PINS) since 1993—again, thanks to ADM Gaffney and other Navy Admirals since his “Change of Command.”]

This second request represents many, many informal and formal educators/teachers in soliciting your help in putting preK-12 education first in this country. With your help, we need to make ocean sciences an integral part of the *NSES* when they are revised in 2005. We don’t want or need a third set of science standards, i.e., ocean science standards in addition to the *NSES* and *Benchmarks*. However, it is critical for the oceans to be incorporated holistically as examples of case studies in all the standards, to include the revised *NSES*. [And, I should also mention that no one in this room is a stronger advocate on incorporating ocean sciences within the *NSES* than ADM Watkins.] In ADM Watkins’ keynote address to the National Marine Educators Association Annual Conference in 1997 in Chicago, Illinois, as the CORE President, he stated “that even though the ocean sciences comprise one perfect implementation mechanism to meet national standards, explicit references to the oceans are missing from the *NSES*.”

My third request is to:

- **establish and mandate funding for a nationally recognized Education and Outreach Office within the NOAA, Oceans.US, NOPP, or COSEE infrastructure to coordinate ocean sciences educational efforts.** This National Educational Outreach Office should encompass pre-and inservice teachers’ participation in and the public’s awareness and understanding of ocean exploration, through observation, modeling, and information technology management. This office should also have the responsibility of developing an Advisory Board—represented by all educational sectors and appropriate agencies—to place a “stamp of approval” on exemplary ocean sciences, Great Lakes, and coastal processes

curricular materials, and formal and informal evaluation and assessment methodologies. It should be noted this “stamp of approval” on exemplary ocean sciences, Great lakes, and coastal processes curricular materials, as well as “best practices” in formal and informal ocean sciences evaluation and assessment methodologies are components within the NSF – COSEE Announcement of Opportunity. And, as you all are also aware, excellent curricular materials have been developed in the ocean sciences, to include freshwater and coastal materials by NOPP-funded programs such as COAST, the JASON Project, Project Oceanology, and LEO-15, combined with other high-quality material-based on “sound science,” primarily funded by NSF, NOAA, the National Aeronautics and Space Administration (NASA), the U.S. Navy, the National Geographic Society, the U.S. Geological Survey, the Environmental Protection Agency, U.S. Soil and Water Conservation, Lawrence Hall of Science at Berkley, various aquariums and/or science centers, professional societies, and other similar agencies and/or organizations. The award-winning NOPP-funded BRIDGE has literally hundreds of these “tried and true” curricula on its website <<http://www.marine-ed.org/>>. This National Education and Outreach Office should help shape what our citizenry knows about the oceans.

We, in the ocean community, can use NASA’s success as a model relative to what the public knows about space to also be more aware and better understand the world's oceans. The ocean sciences community has missed too many windows of opportunity over the last 50 to 60 years; oceans desperately need to be “better marketed” through the print media by ocean literate journalists, within every home in our country through television, and through computers “virtually” with Internet capability. The “best” promotion strategy for this country’s school-aged children and adults within this country is to experience the oceans first-hand by visiting a beach with family members or friends; taking a school field-trip; going fishing, snorkeling, or diving; or any other related “hands-on” water/ocean encounter.

I was asked to provide testimony relative to specific issues and recommendations in my area of expertise relative to the charges presented to the Commission in the *Oceans Act*. In reviewing the *Oceans Act of 2000* relative to its eight objectives, I am of the opinion ocean sciences education and outreach are the foundations on which these objectives have been developed. Therefore, I have not looked specifically at Gulf of Mexico issues but rather at national issues. These national science issues have addressed math and science education in general; however, there is not a more appropriate vehicle to “whet students’ appetites” and create an environmental ethic than through the use of ocean sciences.

Lastly, there are no singular simplistic solutions for ocean sciences education and outreach. Only carefully considered, multiple proactive education and outreach approaches with sustained funding will lead to substantive improvements in our world’s oceans.

Thank you for allowing me the opportunity to speak to you this morning.

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