

## **National Ocean Sciences Bowl in 2013: A National Competition for High School Ocean Science Education**

Kristen Yarincik  
1201 New York Avenue, NW, Fourth Floor  
Washington, DC 20005  
phone: (202) 448-1237 fax: (202) 332-8887 email: [kyarincik@oceanleadership.org](mailto:kyarincik@oceanleadership.org)

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### **LONG-TERM GOALS**

- Develop knowledgeable ocean stewards that understand the ocean's impact on daily life and the importance of scientific research;
- Foster the use of the ocean as an interdisciplinary vehicle to teach science and mathematics and encourage the inclusion of the ocean sciences in curricula;
- Encourage and support the involvement of under-represented and geographically diverse communities in the ocean sciences; and
- Provide students interactive education that develops critical thinking and skills for the workforce and exposes them to ocean science professionals and career opportunities.

### **OBJECTIVES**

- Implement 25 interactive competitions around the country reaching approximately 2,000 students and involving over 1,200 professional science volunteers;
- Coordinate a meeting to train 25 Regional Coordinators and discuss best practices on how to engage and retain teams and volunteers;
- Hold the 2013 Finals Competition involving 125 students and 100 professional science volunteers and incorporate interactive field trips to inform about the Great Lakes;
- Complete Phase 3 of the online Ocean Sciences Quiz;
- Provide educational award trips to nationally winning teams, allowing them to gain hands-on experience with ocean scientists;
- Develop and review nearly 3,000 science questions that touch on all ocean science disciplines;
- Offer online professional development training to educators across the country on the program's theme and incorporate questions from the presentations into the competitions;
- Continue to implement a longitudinal study on alumni and their higher education and career paths;
- Support and promote the 25 regional sites that host the regional NOSB competitions;

# Report Documentation Page

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- Incorporate a career event at the NOSB Finals;
- Develop a career booklet to help guide students selecting a career related to ocean sciences; and
- Actively encourage students from diverse communities to participate in NOSB activities.

## **APPROACH**

The National Ocean Sciences Bowl<sup>®</sup> (NOSB<sup>®</sup>) is a nationally recognized high school academic competition. The NOSB provides a forum for talented students to excel in science and math and introduces team members, their teacher/coaches, schools and communities to ocean sciences as an interdisciplinary field of study and a possible future career path and stimulates broad interest in and excitement about science and the ocean. The overall program operates within a supportive ocean science learning community framework that involves the NOSB national office, managed by the Consortium for Ocean Leadership, 25 regional competition hosts in the research community in pre-college education and approximately 1,200 volunteers per year.

The NOSB national office: coordinates the development of the competition questions; trains the Regional Coordinators (RCs); manages the competition rules; coordinates and manages the Science Expert Briefing; plans and hosts the National Finals Competition, in conjunction with the regional host institution; manages the NOSB communications; and organizes the program's evaluation and longitudinal study; manages the enhancement activities.

The 25 regional hosts (see Appendix I) implement their individual competitions each February and/or March on one of two provided dates. Each host site has at least one designated staff member who serves as the primary coordinator. The RCs are trained by NOSB staff on how to organize and administer a regional competition, but are given flexibility to arrange events that are regionally unique. Some regional competitions include mandatory projects, a poster session, participation in a lecture series, or other activities. Regional hosts are responsible for recruiting at least eight teams from eight different schools and 50-100 volunteers as competition officials to ensure their competition rooms run smoothly. They are also expected to coordinate speakers, presenters and activities for non-competing students during their regional competitions.

The overall coordination and partnership between the NOSB staff, the 25 RCs and the 1,200 annual volunteers each year ensures the successful engagement of over 2,000 students in ocean science education and STEM career exploration.

## **WORK COMPLETED**

Question Development: Competition questions, received from hired question writers and the RCs, were edited for scientific accuracy and level of difficulty by the Technical Advisory Panels (held September - October 2012). The NOSB staff then sorted them into rounds for each competition date. Overall, nearly 3,000 high quality buzzer questions and 216 TCQs were written, compiled, reviewed, and accepted for use in the 2013 regionals and National Finals Competition.

Regional Competitions: The 2013 regional competitions were held on February 9 and 23, 2013. Numerous bowls in the New England area scheduled for February 9, 2013 were postponed due to a blizzard. All 25 regional competitions were completed by March 3, 2013. Over 300 schools (1,929

students / 389 teams) competed during the 2013 regional competitions. In all, 33 states plus the District of Columbia participated in the 25 regional competitions.

National Finals Competition: NOSB culminated, as it does every year, with a National Finals Competition in which the top teams from each region competed for nation-wide recognition. The 16th Annual NOSB Finals Competition, themed “The Great Lakes: A Window into Freshwater Science,” was held in Milwaukee, WI from April 18 to 21, 2013, hosted by the University of Wisconsin Milwaukee’s School of Continuing Education. This was the first ever Finals Competition held on a Great Lake’s shore, so the students were immersed accordingly in activities, presentations and questions that highlighted the interconnectedness of freshwater and marine systems, including our understanding of freshwater processes, the Great Lakes’ connection to the ocean, human impacts on freshwater ecosystems and the effects of invasive species.

After a nail-biting final round, the top three teams at the Finals Competition were: 1st Place -Arcadia High School, Arcadia, CA; 2nd Place -Lexington High School, Lexington, MA; and 3rd Place -Juneau-Douglas High School. Juneau, AK. The Scientific Expert Briefing winner was Neah-Kah-Nie High School from Rockaway Beach, OR, and the James D. Watkins Sportsmanship Award winner was Annapolis Christian Academy from Corpus Christi, TX. More information is available at <http://nosb.org/competitions-2/finals-competition/2013-nosb-finals/>.

Enhancement Activities: These additional enhancement activities, although supported by leveraged funds from other federal agencies, remain integral pieces to the overall NOSB program.

NOSB hosted its annual Professional Development Webinar Series from December 19, 2012 through January 31, 2013 on the year’s theme, “The Great Lakes: A Window into Freshwater Science.” The series provided teachers with the opportunity to enhance their knowledge of topics related to freshwater environments, as well as science and policy issues relevant to the Great Lakes. The seminar’s guest experts also provided questions for the 2013 NOSB competitions. All webinar recordings can be viewed at <http://www.nosb.org/professional-development/>.

The NOSB, in partnership with the National Marine Educators Association (NMEA), sponsored the 2013 “Living on the Ocean Planet” video contest. Any students enrolled in high school were eligible to submit a 1-3 minute video. Fifteen submission were received and the national winners were “A Freshwater Perspective,” from Mark Keppel High School in CA. The winning video, as well as all submissions can be viewed at <https://www.youtube.com/user/theNOSB/videos>.

The Ocean Sciences Quiz, NOSB’s online game that simulates the buzzer rounds of the traditional competition, continued to be enhanced during 2013. Phase III, allowing students to play across the internet, was finalized with Massachusetts Institute of Technology Sea Grant in April. Users now have the option to play the game alone against only the clock or with two users, playing against each other on the same computer or try their chances against an opponent in another city, state or country. The game can be accessed at <http://osq.nosb.org/>.

Lastly, the NOSB, with support from the National Science Foundation, developed a career resource for students interested in learning more about school and job opportunities related to ocean and aquatic sciences. Our new publication, *An Ocean of Possibilities! Careers Related to the Ocean and Aquatic Sciences* (<http://nosb.org/ocean-careers/career-resources/>) gives students a sense of what opportunities exist so that with a mind open to possibility, they can chart their own course to success.

## RESULTS

Regional Competitions: The 2013 regional competitions highlighted how important students and educators around the U.S. find participating in the NOSB and how the program impacts the participants academically, socially and personally. Students showed extreme dedication to their preparation for competition and increased environmental stewardship, and they helped excite other students at their schools about marine science and the ocean in general.

“Superstorm” Sandy struck the New Jersey shore on October 29, 2012 and many NOSB teams that attend the Shore Bowl at the Rutgers University’s Jacques Cousteau National Estuarine Research Reserve were deeply affected as they dealt with losing their schools and homes and enduring months of clean up. Although some schools opted not to participate in the Shore Bowl, others did, as it gave the students and teachers something to look forward to and provided a reason for them continue their studies during a challenging time. One student specifically commented to this effect:

*“The NOSB program has truly done fantastic things for me. Through the program I have been able to find what I want to do with my life in the future as well as find something that I truly enjoy doing. After “Superstorm Sandy” one of the main things that helped my teammates and I return to a sense of normalcy was being able to go back to practicing and preparing for the Shore Bowl competition.”*

Student participation in the NOSB competitions often results in greater appreciation for both the program and the study of marine science in the high schools of competing students. Anecdotally, we have learned that at least 19-20 schools/districts have implemented a marine science class due directly to the high schools’ participation in NOSB.

*“NOSB has triggered a “buzz” about marine science on our campus. The school even has begun to list oceanography as an extracurricular activity in its advertisements! I have seen firsthand how NOSB has raised an appreciation of the oceans and an awareness of science and environmental issues at our school.”*

Lastly, coaches often comment that their students that compete in the NOSB have become more active in ocean stewardship and want to participate in learning and research opportunities outside of their high school:

*“[NOSB] has resulted in our school becoming involved with eelgrass restoration work in Frenchman Bay. Students have spent a week at a time...learning about eelgrass and working to restore it.”*

National Finals Competition: The 2013 National Finals Competition was the first Finals to take place in the Great Lakes region. While two regional competitions are held along the Great Lakes, the majority of the NOSB students compete along the U.S. shore line. Hosting the bowl along the shore of Lake Michigan provided a great opportunity for students to make a stronger connection between fresh and ocean water.

To prepare the teams for a greater number of freshwater-related questions during the competition, the Professional Development Webinar Series focused on Great Lakes geography, history, current research and water use. Coaches participated live in the webinars and also viewed the recordings with their teams and classes. The webinars, and resources provided by the presenters, really helped the teams prepare for the regional and National Finals competitions:

*“From my standpoint as a coach, the webinar series was valuable because it guided me on what to have the kids focus on for preparing for competition [as] I have no background in freshwater ecosystems.”*

The Science Expert Briefing (SEB) on invasive species, completed by teams competing at the Finals Competition, was amended in 2013 to place a more significant emphasis on science. During the 2012 Finals Competition, the SEB judges reported to the national office that students were confusing the topics of policy and science and often spent too much time addressing the policy implications rather than the scientific requirements to address the piece of legislation they were provided. Therefore, in 2013, the teams were clearly instructed to focus on informing policymakers on the science requirements needed to address the Invasive Fish and Wildlife Prevention Act of 2012. The 2013 SEB judges did not report student confusion on policy vs. science, meaning the instructions were much more succinct and easier to understand. Coaches responded that the 2013 SEB was an extremely worthwhile activity for their teams as it continued to provide the students with researching, writing, critical thinking, communication, presentation and cooperative learning skills:

*“A few of my students said [the SEB] was one of their favorite parts of their stay in Milwaukee. They were quiet during the discussion [with the Judges], but apparently absorbed a lot and talked about it later. The panel was excellent. My students left the entire experience with a strong appreciation and respect for the judges/scientists and for the complexity of the issues related to invasive species.”*  
*“The SEB is the most meaningful, long-term impact part of Finals!”*

Communication: Ocean Leadership, worked closely with the RCs and NOSB staff to ensure that each regional competition and the National Finals received media coverage. Regional competitions received 11,206,657 media hits; the National Finals Competition received 14,797,775 media hits, resulting in a total of 26,044,432 media hits for the 2012-2013 competition year.

## **IMPACT/APPLICATIONS**

To evaluate the long-term impact of the NOSB program, the NOSB Longitudinal Study was conducted in partnership with the College of Exploration and Ashland University. In order to identify and describe the link between NOSB participation and the educational and career pathways of the high school students in the program, the research addressed content learning and examined the program to ascertain its impact on the community of constituents, and how this competition impacts students' career decisions. The study incorporated surveys, cognitive tests, interviews, focus groups, video biographies and self-authored narratives from multiple stakeholder groups.

In 2013, Student Email Surveys were conducted and tracked the NOSB alumni as they migrated from high school into college, graduate school or the workforce. An additional study on the impact of the NOSB program on the 2013 coaches was also conducted. Findings indicated that the many thousands of young adults, classroom teachers, scientists and volunteers associated with the NOSB over the years were benefiting from more than just the immediate effects of participating in the competitions.

The research and evaluations have indicated that past participants who entered STEM careers were provided meaningful support, mentoring, and career guidance by the coaches who oversaw their years of competition, and enhanced ocean science knowledge. It is clear that all of the students who participated benefitted from leadership development, team development, and study skills support for detailed and deep science content learning. Additionally, many students reported an enhanced interest

in ocean related hobbies and environmental stewardship. Coaches reported that working with the high ability NOSB students required them to engage in a high degree of self-directed learning in the ocean science fields, in order to prepare to engage with the students at the content level required by the NOSB. Teachers that were responsible for advising and guiding individual NOSB teams reported that they regularly infused ocean sciences content into regular course instruction for all of the other students enrolled in their classes. In addition, a number of teachers reported that they eventually created new ocean science courses in their high schools because of NOSB involvement.

The Longitudinal Study emphasizes that the NOSB is more than an academic competition. The NOSB is a community of multiple stakeholder groups – students, educators, scientists, federal agencies, and sponsors - who all benefit from the interactions with one another through question development, competition preparation and participation, and other enhancement activities. The full five-year Longitudinal Study can be found online at <http://www.nosb.org/alumni-2/alumni-study-archives/>.

## **TRANSITIONS**

Dr. Steven Ackleson, Associate Director for Research & Education, left Ocean Leadership in 2013 and is therefore no longer a PI of this award.

## **RELATED PROJECTS**

None

## **APPENDIX I**

Regional NOSB bowl names, regional coordinator(s) and host institutions for the 2013 competitions included:

- Aloha Bowl (Hawaii) – Marci Grabowski, University of Hawaii, Manoa
- Bay Scallop Bowl (New York) – Dr. Bill Wise and Kim Knolls, Stony Brook University
- Blue Crab Bowl (Virginia) – Dr. Carol Hopper Brill and Dr. Victoria Hill, Virginia Institute of Marine Science at the College of William and Mary
- Blue Heron Bowl (North Carolina) – Janelle Fleming, North Carolina State University
- Blue Lobster Bowl (Massachusetts) – Judith Pederson, Massachusetts Institute of Technology Sea Grant College Program
- Chesapeake Bay Bowl (DC, Maryland, Northern Virginia & Delaware) – Lisa DeJardins, George Mason University
- Dolphin Challenge (Galveston, Texas) – Terrie Looney, Texas A&M University – Galveston and Texas Sea Grant
- Great Lakes Bowl (Michigan) – Maureen Lynch, Kevin Keeler and Whitney Conard, University of Michigan and Michigan Sea Grant
- Grunion Bowl (San Diego, California) – Judith Coats, Birch Aquarium, Scripps Institution of Oceanography, University of California, San Diego

- Hurricane Bowl (Central Gulf Coast) – Elizabeth Jones, Gulf Coast Research Laboratory, University of Southern Mississippi
- Lake Sturgeon Bowl (Wisconsin) – Elizabeth Sutton, University of Wisconsin, Milwaukee, School of Continuing Education
- Loggerhead Challenge (Corpus Christi, Texas) – Terrie Looney, Texas Sea Grant – held at the University of Texas Marine Science Institute
- Los Angeles Surf Bowl (Los Angeles, California) – Ann Close and Kimberly Lievens, Jet Propulsion Laboratory and University of Southern California’s Wrigley Institute of Environmental Sciences
- Manatee Bowl (South Florida) – Laura Bracken, University of Miami-Rosenstiel School of Marine and Atmospheric Sciences
- Nor’easter Bowl (Northern New England) – David Guay, University of New England
- Orca Bowl (Washington) – Maile Sullivan, University of Washington-College of Ocean & Fishery Sciences
- Penguin Bowl (Ohio & Pennsylvania) – Dr. Ray Beiersdorfer and Margie Marks, Youngstown State University
- Quahog Bowl (Rhode Island & Connecticut) – Diane Payne and Thaxter Tewksbury, University of Connecticut at Avery Point, Connecticut Sea Grant Program and Project Oceanology
- Salmon Bowl (Oregon) – Michelle Fournet, Oregon State University, College of Oceanic and Atmospheric Sciences Conservation Biology Institute
- Sea Lion Bowl (San Francisco, California) – Brandy Wieggers and Tatiane Russo-Tait, San Francisco State University, Center for Science and Mathematics Education
- Shore Bowl (New Jersey) – Melanie Reding, Rutgers, The State University of New Jersey, Institute of Marine and Coastal Sciences
- Southern Stingray Bowl (South Carolina & Georgia) – Dr. Dionne Hoskins, Savannah State University
- Spoonbill Bowl (West Florida) – Dr. Teresa Greely and Paul Suprenand, University of South Florida, School of Marine Sciences
- Trout Bowl (Colorado & Central States) – Emily Kellagher and Amanda Morton, Cooperative Institute for Research and Environmental Sciences (CIRES) at the University of Colorado at Boulder
- Tsunami Bowl (Alaska) – Phyllis Shoemaker, University of Alaska Fairbanks, Alaska Sealife Center