DEVELOPING AN OCEAN SCIENCES BOWL TEAM:
LESSONS FROM THE WASHINGTON, D.C. PUBLIC SCHOOL SYSTEM

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A STRONG SHOWING FOR D.C. STUDENTS IN THE NATIONAL OCEAN SCIENCES BOWL PROGRAM

It's February 21, 2009 and 10 students sit in a classroom at American University, anxiously awaiting the results of the last round of a mid-Atlantic regional competition for high school students in the ocean sciences. Five students are on a team from Woodrow Wilson Senior High School, a Washington, D.C. public high school, and the other five students are on a team from the nation's top-ranked high school by U.S. News and World Report (2009). The Wilson team had just participated in the competition for the first time the previous year. The opposing team had won the competition for the last several years, earning several previous opportunities to participate in the national competition. Moments later, competition staff entered with the results in hand and a hush fell over the room. They began to post the scores with their backs to the audience so nobody could yet see the results. As they stepped aside, the results came into view—the Wilson team had defeated the former champions. Although the Wilson team did not win the entire competition, the team's strong showing highlights an outcome of a unique partnership between a Federal science agency and students and teachers from an inner city school district. Details of this partnership and the journey of the Wilson team, from competition observers to challengers of some of the nation's top students in just a three-year period, will be the focus of this article. The emphasis will be on how marine educators and teachers at schools like Wilson can support and create teams to participate in ocean science competitions with minimal resources.

A MISSING LINK

The National Ocean Sciences Bowl® (NOSB or "Bowl") is a nation-wide competition for high school students in the ocean sciences. Each year, thousands of students across the country participate in one of 25 regional competitions hoping to qualify for the national competition. The regional qualifying competition for Washington, D.C. area students has typically been held at various locations throughout the Baltimore-Washington area, most recently at American University in Washington, D.C. just minutes from the District of Columbia Public Schools (DCPS). The DCPS comprise an inner city school district with large numbers of minority students, including African Americans and Hispanics all of which are underrepresented in the ocean sciences. Although D.C. area students are invited to participate in the regional qualifying competition, prior to 2008 no DCPS teams had ever competed.

Staff from NOAA Fisheries Service (NOAA Fisheries) headquarters, in the Washington, D.C.-metro area, who were past NOSB volunteers, noticed the absence of DCPS participation in the NOSB Program. Two NOAA Fisheries scientists, including the author, proposed a small-scale partnership between NOAA Fisheries and DCPS that would both promote ocean literacy in DCPS and initiate DCPS participation in a NOSB competition. The proposal was accepted and NOAA Fisheries provided a small amount of funding to support the effort.

FIRST STEPS

As a first step toward increasing ocean literacy within a large, diverse school district, NOAA Fisheries staff sought to identify teachers with an interest in the ocean sciences and who could formulate a program with the potential to interest DCPS students in oceanography and to produce the first ever DCPS teams in a NOSB competition. The teachers were motivated by the chance to provide new and unique opportunities to their students along with the potential to lead the first ever DCPS teams to a NOSB competition. NOAA staff identified teachers with the help of other programs currently working with DCPS and also contacted each DCPS school, often speaking to the Science Department Chairs. In some cases, teachers recruited additional teachers. Ultimately, NOAA staff had a small group of DCPS teachers, each from a different high school.

The next step was to develop a program to provide the best chance of success. Options ranged from offering a class to developing an after school program. The teachers did not have
extensive experience in the ocean sciences, but all had science education backgrounds and taught subjects ranging from biology to environmental science. NOAA staff operated under the premise that while they could provide the expertise in the ocean sciences for the program, the teachers knew the schools and students best and, to therefore, “let the teachers be the guides.” It was determined that creating an after school program, facilitated by NOAA Fisheries staff, would be the most practical and effective program format. And so the pilot program, NOAA and D.C. Educators Moving Ocean Science Forward (NEMO) was born.

A student holds up one of their “catch of the day,” a blue crab from the Chesapeake Bay.

DEVELOPMENT OF THE NEMO PROGRAM

The concept was simple—an after school program in which teachers met weekly with students to teach marine science and to prepare students for the Bowl. In practice, several challenges were addressed. At the onset of the program, many of the schools did not have easy access to computing resources and the internet. Some schools also had laboratories lacking running water and other capabilities to conduct experiments. Yet, utilization of many pre-existing lessons in marine science required students to download and analyze data from a website, or alternatively to conduct laboratory experiments and analyze the results. Lastly, the teachers who volunteered to participate in the program lacked experience in many aspects of marine science, so lessons needed to be developed to provide them with the necessary background to teach their students.

NOAA Fisheries staff tested a number of weekly lesson options to create effective, interesting, and practical activities to meet the needs of the DCPS teachers and students, given the above requirements. Based on feedback from the teachers and students, activities that were short, contemporary, targeted at Bowl preparation, including practice Bowl questions, in the form of a game or competition, were most effective. Teachers preferred shorter lessons, no more than four to five pages long, with one to two paragraphs of background information, and focused on one to three main points. Contemporary lessons that centered around an ocean science topic in the news, either locally, nationally, or internationally, such as an article from the Washington Post on the snakehead fish. Other lessons targeted preparation for the Bowl and were entirely based around a concept; students would likely see at the Bowl. For example, questions on navigation are likely to come up at the Bowl, so NOAA created a handout on navigation along with a set of questions that students could use to test their knowledge of the handout. Lessons that included questions in Bowl format such as buzzer questions (multiple choice questions) and team challenge questions (e.g., essay questions that need to be completed by the team in a designated time period) allowed teachers to hold a short mock bowl at the end of a lesson and test students knowledge of concepts. Students typically enjoyed this aspect because of the chance to test their abilities in answering questions under simulated competition conditions.

Finally, game-oriented activities were a huge hit with the students. An excellent example is the “Voyage on the High Seas Game” created by NASA Jet Propulsion Laboratory (http://topex-www.jpl.nasa.gov/education/jason-1-game.html). The objective of the board game is for students to use game pieces to race around the world, by way of ocean currents, using a map of the world’s ocean basins and thereby learn about ocean currents in the process. Another excellent example is NOAA Jeopardy (http://coastalscience.noaa.gov/education/jeopardy/welcome.html), which is in the same format as the television game show and tests students’ knowledge of the oceans. Both games can be obtained free, don’t require a computer or internet (once downloaded and printed), and are easy to use, learn, and play.

NEMO IN ACTION

The NEMO program was designed to run over the course of a year and culminate with DCPS participation in a NOSEP competition. It began with a kickoff event to excite students about marine science and included an opening speaker and a mock Ocean Sciences Bowl competition. Philippe Cousteau (grandson of Capt. Jacques-Yves Cousteau and co-founder and president of EarthEcho International) served as the keynote speaker for its opening event in January 2007, although a practicing scientist who is a dynamic speaker could equally motivate young students. The event concluded with a mock-NOSEP competition for students to participate in, complete with a buzzer system and competition volunteers to simulate the rules. The questions for the mock-NOSEP competition included many ocean science references to movies and other popular culture. For example, “What type of fish is “Nemo” in the movie Finding Nemo?” Holding a mock-NOSEP tournament is a tool that can be used to pique student interest in a NOSEP competition. The next cornerstone event was to have students attend a NOSEP competition as observers, so they could see how it worked in practice and get a sense for the level of competition.
A student tosses a net into the Chesapeake Bay for a sample.

Several field trips provided hands-on experiences in biological, chemical, geological, and physical oceanography. Examples included research cruises on the Chesapeake Bay, Potomac, and Anacostia Rivers to conduct biological sampling and water quality testing, and a visit to the U.S. Naval Observatory to help students understand concepts about celestial navigation and focus on navigation tools and research. Students also had opportunities to meet prominent scientists and leaders in oceanography. Evaluations indicated the elements of a successful field trip included a hands-on component (e.g., a dissection, outdoor field sampling) and/or an opportunity to meet and interact with a well-known scientist, activist, or political figure.

The culmination of these activities was DCPS' inaugural participation in a 2007 NOSB competition. A total of five DCPS teams have participated in NOSB competitions since NEMO began in 2007. Altogether, over 80 DCPS students have participated in one or more NEMO activities since 2007.

Program evaluation is a key element of NEMO to determine overall program impacts and the effectiveness of various components. Anonymous surveys were given to students and teachers following each field trip, and exit surveys were given to students and teachers after the first year and during other program milestones. Of the DCPS students surveyed, who participated in or attended the 2008 NOSB competition through NEMO: 1) 43% said NEMO interested them in studying marine science in college; 2) 21% said NEMO interested them in pursuing marine science as a career; and 3) over 78% said NEMO helped them with coursework from other classes. Qualitative data gathered in conjunction with the surveys is being analyzed to provide a more in-depth understanding of these results. Program observations suggest the combination of DCPS teachers in conjunction with the NEMO mentors is helping students learn through the process of training students for the Bowl. Teachers and scientific staff worked with the students to help them apply existing knowledge and strategies to reason their way through difficult questions. Such Bowl training exercises may be helping students to better answer homework and exam questions in their regular classes.

The NEMO program will be continuing into the 2009-10 school year and will also be incorporating a middle school. The participating middle school is a large pipeline for students to the participating high schools, so the NEMO program is evaluating how introducing marine science and the Bowl at the middle school level influences students' interest in participating in the Bowl and NEMO at the high school level. In addition, the program is putting together a curriculum of lessons from NEMO that can be used to prepare teams for NOSB and will also be aligned to national and DCPS science standards.

LESSONS LEARNED

In general if you have an interest in initiating an ocean science club or NOSB team at a school, but only have minimal resources, here is a summary of tips that may help you get started.

1. Identify and locate interested teachers and mentors for your Ocean Sciences Club or NOSB team

Start with organizations working with the school or Science Department Chairs. Then locate a mentor to help with your club or new NOSB team. Mentors do not need to be aquatic scientists, but could be involved in a related field such as environmental science, biology, or geology. Places to look include a local environmental resource agency (e.g., state Department of Fish and Game or Natural Resources) or a local university (a professor or graduate student). Mentors can provide assistance with content and subject preparation for the Bowl, as well as help to further engage and inspire students.

2. Let the teachers be your guide

NOAA staff based the format of the NEMO program around the needs and requests of the DCPS teachers volunteering to participate in the NEMO program. Talk to the teachers involved to identify the factors they feel are most important to successfully create an ocean sciences club or NOSB team. While the after school format has proved successful for DCPS, other formats, such as a class or science camp, may better apply to different schools or student groups.

3. Identify resources for developing marine science activities and lessons

Many activities are available free online and require minimal preparation. Easily accessible news sources such as newspapers and scientific journals can be used to identify contemporary marine science topics for discussion-based activities. Bowl-specific preparation can be accomplished using practice NOSB questions (pre-existing or newly created) to test student knowledge of concepts and also provide experience with competition rules. Many educational materials, including lesson plans and supporting materials like posters, are also available to supplement an ocean science club for little to no charge. In addition, buzzer systems can help simulate NOSB competitions with students.

4. Identify field trip resources

Field trips provide valuable learning opportunities for students outside of the classroom and do not require extensive resources.
Many science and environmental resource agencies offer tours or educational programming free of charge. Inland locations could benefit from informal science institutions or other organizations that help students understand ocean science in a broader context. A weather station, for example, could be used to understand the relationship between ocean and climate; or measuring the water quality of a local stream to help students understand the parameters and analyses scientists might use to assess ocean health. In addition, agencies that provide educational programming in the aquatics sciences for students may also offer discounted rates.

ENDNOTES

1 More information about the National Ocean Sciences Bowl can be found at www.nosb.org.

2 When the general term "marine science" is used from this point on, it is meant to refer to all the ocean sciences such as biological, chemical, physical, and geological oceanography.

REFERENCES

General Data about DCPS: Schools, Demographics and Performance found at www.dcps.gov

LAURA OREMFLAND has a bachelor's degree in Mathematics from the University of Kentucky and a master's degree in Marine Environmental Sciences from the State University of New York at Stony Brook. She has been with the NOAA Fisheries Service Office of Science and Technology since 2002 where she began her career at NOAA through the John A. Knotts Marine Policy Fellowship Program. She and Dr. Bonnie Ponwith, now Director of the NOAA Southeast Fisheries Science Center, created the NOAA and D.C. Educators Moving Ocean Sciences Forward (NEO) Program with the District of Columbia Public Schools (DCPS) in 2006 to promote ocean literacy and initiate DCPS participation in the National Ocean Sciences Bowl Program.

If you have questions about the NEMO Program, please contact NEMO Program Coordinator, Laura Oremland at laura.oremland@noaa.gov or 301-713-2317, ext. 151.

PHOTO CREDITS

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MARINE SCIENCE SUPPORTING EDUCATION MATERIALS

The NOAA Education Outreach center has extensive marine and atmospheric education and outreach materials available free of charge at http://www.education.noaa.gov or (301) 713-1208.

IN MEMORIAM

The success of the NEMO program relies on the passion and hard work of the teachers in the D.C. public school system. Sarah Tilman was a biology teacher at Wilson High School in Washington, D.C. who helped start the NEMO program. Sadly, Sarah passed away in February of 2009 at the age of 27 just two weeks before her students were to compete in a 2009 regional NOSB competition due to complications from the flu.

Sarah's contagious enthusiasm for science, and life in general, helped bring together, in January of 2007, a small group of students at Wilson High School who were interested in marine science. After a year of dedicated training, five of her students became one of the first ever DCPS teams to participate in a NOSB competition. Sarah's commitment to ocean literacy helped grow the NEMO program at Wilson, and by 2009 two Wilson teams were scheduled to participate in the February NOSB competition. But less than two weeks before the competition, the devastating news came that Sarah had passed away.

Would the students continue on or sit this year out? One of the team's captains captured the team's spirit. "They would continue on," he said, "they had trained too hard, and it was what she (Sarah) would have wanted." On February 21, 2009, the two Wilson teams went on to compete. They proudly represented their school, and most of all their teacher and leader, Sarah Tilman. And in one round of competition, a Wilson team defeated the nation's top-ranked school. Sarah's lessons had extended far beyond the oceans--she had taught her students about character, and how to continue on in the face of adversity with strength, class, and resilience--lessons that will stay with them in the years to come. NOAA salutes Sarah and her contributions to ocean literacy--and most of all her students.