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The National Ocean Sciences Bowl 1998-2001

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Abstract

The National Ocean Sciences Bowl is an academic competition that promotes the study of ocean sciences in high schools and provides a forum for students to excel in math and science. The format is a timed competition in which student teams answer questions within several broad categories related to the oceans.

The Consortium for Oceanographic Research and Education (CORE) established the National Ocean Sciences Bowl (NOSB®) in 1998 as part of its Year of the Ocean activities. Building upon the success of the inaugural year, CORE received a grant through the Office of Naval Research to continue its expansion.

During the period of 1998-2001, between 16 and 20 regional competitions were held each winter and were followed by a national competition in April.

The NOSB® generates and increases knowledge of the oceans for science teachers, their schools and communities, forges linkages with regional institutions of higher learning, and raises the visibility of the Federal agencies' investment in ocean-related research to these audiences.

An assessment conducted in 2000 demonstrated that the NOSB® has a positive, measurable impact on participants' scientific knowledge of the oceans, as well as their interest in the marine sciences and related careers. The NOSB® provides a mechanism to cultivate future scientists and technical experts through the program's educational and unique experiential opportunities. Since 1998, the NOSB® has involved approximately 5,870 students and teachers in 20 sites around the United States.

With guidance from a strategic plan created during 2000 and lessons learned during the first four years of the program, CORE and its partners continue to strengthen the program by making it more accessible to different types of students and those who live inland.

What is the National Ocean Sciences Bowl?

The National Ocean Sciences Bowl is an extracurricular academic program for high school students focusing on ocean sciences, technology, and related topics. The central piece of the program is a competition in which teams of high school students are asked questions in a rapid-paced, timed, question-and-answer format. In addition to the competition, the regional hosts and national office at CORE provide opportunities for teacher professional development, field trips to marine and coastal environments covered by the competition, internships at aquaria and in research labs, and material resources for school libraries and classrooms.

The NOSB[®] was inaugurated during the 1998 Year of the Ocean with 16 regional sites hosted by 22 institutions of higher learning and research from among the CORE membership. Initial support for the program came primarily from the six federal agencies provided through this grant from the Office of Naval Research (ONR).

Competition Structure 1998-2001

During this time period, the NOSB[®] was a timed competition using lock-out-type buzzer systems and clocks and consisting primarily of a series of toss-up and bonus questions. The questions were either multiple-choice or short-answer, with bonus questions going to the team that correctly answered the toss-up question. Feedback from the 1998 participants highlighted the desire for the students to have more opportunities to demonstrate and be judged on their knowledge of the ocean sciences and related topics. As a result, CORE now has added a "team challenge" question to the standard competition format. During this portion of the competition, each team is given a written question that is timed but allows for collaboration among the team members and requires the analysis of the data presented and the synthesis of several scientific or mathematical concepts. The teams have three to five minutes to work on the "team challenge" question before answering. Both teams are allowed to give an answer and win points. This section is an excellent enhancement since it requires analytical thought in addition to memorization of facts. Since its introduction in 2001, the use of team challenge questions has been mandatory only at the final competition. Nevertheless, several regional hosts decided to include this type of question in their competitions and continue to do so.

Each match at the regional and national final competitions involves two teams. Every match in a competition consists of two eight-minute halves with a two-minute break. Additional time is added to the breaks that occurred during the final competition to allow adequate time for "team challenge" questions to be answered by each team and graded by a science judge. A match comprises a maximum of 25 toss-up questions and an equal number of bonus questions. Regional competitions are completed within one day (although several sites choose to extend them through the weekend in order to incorporate other educational activities). The final competition is held over a two-day period. The standard (i.e., quiz-bowl style) competition at both the regional and national competitions consists of up to 20 matches (or rounds) including tie-break rounds, as necessary. The regional and final competitions often incorporate two parts. Early rounds use a round-robin structure in which every team plays every other team. Final rounds employ a double-elimination feature, in which teams continue to advance until they have

lost two consecutive matches. CORE project staff, with the assistance of the regional coordinators and the NOSB[®] Technical Advisory Panel (see below), have been responsible for any modifications to the competition rules and regulations.

For a one-day competition of a mixed format (round-robin with double-elimination) each regional host is encouraged to hold a competition with a minimum of sixteen high school teams participating. This number allows teams to participate in the maximum amount of matches in the initial rounds while leaving a large enough field to draw from for the double-elimination rounds. However, the maximum number of participants is dependent on the facilities at the host site (e.g., conference rooms for competitions, number of volunteers, etc.). In some instances, regional hosts choose an all round-robin format. This has occurred when fewer than 14 teams registered in a given school year.

Registrations of school teams have varied from site to site and from year to year for individual sites. Several factors appear to influence team participation. One impediment can be the distance to the regional site and the associated travel. In addition, while ocean sciences subject matter is attractive to many would-be participants, the quick-response question-and-answer format is an impediment to those who have not also mastered the game strategy or whose learning styles are better suited to collaborative problem-solving that relies upon analysis and synthesis of data. In the future, the competition structure will be modified to incorporate more elements like team challenge questions and de-emphasize simple recollection of facts.

Regional Competitions

The regional NOSB[®] sites have been hosted by research institutions, Federal laboratories, aquaria, and science centers and distributed around the United States to optimize the outreach effort (Appendix A). Initially, regional site hosts were recruited only from CORE membership. However, this requirement was dropped early on in order to reach geographical populations that otherwise would not be represented (e.g., Colorado). Sites were chosen primarily on the basis of the enthusiasm of the hosts for the project, the ability of hosting institutions to coordinate the event, the geographical location of the prospective site, and the ability of a site to engage students and teachers from populations under-represented in the sciences. To ensure that the broadest audience for the program and the ocean sciences is reached, CORE is directing its current efforts toward increasing participation by land-locked sites and other locations where the program can reach student populations that are under-represented in the sciences.

Each regional NOSB[®] site has designated staff member, or regional coordinator, who serve as the primary point-of-contact both for CORE and the high schools located in the geographical area to be served by the hosting institution, e.g., Alaska, Southern California, New England, Gulf Coast, etc. The regional coordinator receives training from CORE on how to organize and administer the regional competition¹. Each regional event and the final competition are staffed and run by approximately 75 volunteers (e.g. faculty members, students, Federal employees in the area, administrative staff, etc.). These volunteers serve as moderators (i.e., question readers) scientific judges, rules judges, timers and scorekeepers. Invitations to participate in the regional

¹ A time line of tasks associated with coordinating a regional and national competition is listed in Appendix B.

bowl are sent by the regional coordinator to high schools located in that region. High schools interested in participating in the regional bowl are responsible for their own expenses (travel, lodging, etc.) to the regional competition, although regional sites sometimes chose to cover some of those costs.

Each regional competition site has received program funds from this grant to defray local labor and materials costs for the regional competition. Program funds also have supported travel for the regional coordinators to attend an annual training meeting in September. The purpose of the training meeting is to review operating requirements for the coming year (i.e., what does CORE expect them to deliver), competition format, competition rules, and plans for regional promotion and marketing of the program. This meeting was held in Washington DC during the first two years but moved to the site chosen for the final competition after 1999 (Baltimore, Miami and Providence) to familiarize regional coordinators with the locations. The grant also has covered the cost of team and regional coordinator transportation to and from, and room and board at, the national final in April.

Each regional coordinator has been responsible for raising local funds to cover any costs not covered by the program funds. These costs have included printing of programs, copying of questions for moderators, meals and snacks for the competition participants, photography and videography of the event, and trophies, awards and prizes for the regional teams.

The oceanographic community has supplied several of the educational prizes offered to the regional and winning teams. These experiences have been extremely valuable, introducing students and teachers to ongoing ocean science research and leading scientists, and allowing them to visit the estuarine and marine environments that they studied during their preparations for the competition. Many prizes incorporated visits to top national oceanographic institutions and aquaria, where the team members took behind the scenes tours, collected field samples beside marine scientists, and took short research cruises.

Preparation of Questions and Resources Guide

Questions are drawn from the scientific disciplines within the ocean sciences (biology, chemistry, geology, and physics) as well as from topics on the contribution of the oceans to national and international economics, history, culture and technology. Each year the NOSB[®] requires approximately four sets of 700 questions for the regional competitions, held on one of three dates early in the calendar year, and the final competition in April. Thus a total of 2800 questions had to be developed each year.

Obtaining and vetting questions has been an ongoing challenge during the past four years of the program. CORE has tried a number of methods for question development. The arrangement that seems to provide the best (although not foolproof) method for quality control is to maintain a database of questions from which a set of essential questions covering the basic concepts of ocean and coastal sciences, marine technology, and maritime history and culture can be drawn each year. Each year, CORE augments this database by contracting with expert individuals to write new questions based on articles in a prescribed set of magazines and journals issued during

the previous five years. The question writers are provided with guidelines and instructions for submitting questions into an on-line database in order to ensure that the appropriate format and level of difficulty—that of an introductory undergraduate course—are maintained. The periodicals (e.g., *National Geographic*, *Discover*, *Science News*) are chosen that are likely: (1) to contain relevant topics; and (2) to be accessible to the regional high school teams. Questions are then sent to relevant members of the Technical Advisory Panel (see below). Approximately three to four weeks later, the Panel meets to review and edit the questions.

Question packets for the regional competitions are distributed to regional coordinators in January. CORE program staff handle the final editing and collation of the question packets before distribution. For the first three years of the competition, this collating and distribution occurred on paper and through the mail, but in 2000, regional sites were required to purchase the necessary software to distribute the questions electronically. A separate meeting dealing with the development and editing of the “team challenge” questions was held in early winter to allow adequate time for their printing prior to the final competition in April.

To help participating teams prepare for the topics that are addressed in the NOSB[®], a resources guide is provided to direct interested students and their teachers towards key information and materials on ocean research and related topics. It is necessary to provide this guide since most high school science courses do not include marine science content. Students often study weather formation, global climate issues, marine mammals and earth sciences, but general ocean sciences (physical and chemical oceanography, etc.) and specific ocean phenomena (currents, heat transfer mechanisms, etc.) are rarely studied at all. The resources guide includes citations to a number of key sources of information on the oceans--textbooks, popular guide books, magazines and journals, and reliable information sources on the World Wide Web (e.g. the BRIDGE). This guide has been prepared and updated annually by CORE staff, regional coordinators, and the Technical Advisory Panel. The resources guide, along with a set of practice questions, registration information and forms, and any other pertinent information related to participation in the NOSB[®], is published, both in print and on the NOSB[®] web site (www.NOSB.org), and distributed by the regional coordinators to schools in their area.

The Technical Advisory Panel

Since the program’s inception in 1998, CORE has relied upon the expertise of a Technical Advisory Panel. The Panel serves several functions: (1) annual review of competition questions; (2) generation of the “team challenge” questions; (3) guidance on question content and competition format; and (4) guidance on program infrastructure.

The Technical Advisory Panel is selected in the Fall each year and is composed of up to 20 ocean scientists, university-level educators and high school teachers, and representatives of the National Marine Educators Association. Generally, the Panel meets at least twice annually and in small subgroups based on sub-discipline to discuss and correct competition questions. In addition, a multi-disciplinary subgroup of the Panel will meet annually for one day to edit the “team challenge” questions. These meetings provide an opportunity for Panel members’ input

on the program's overall direction, and electronic communications are used throughout the year to solicit their comments on an *ad hoc* basis.

Impact of the National Ocean Sciences Bowl 1998-2001

The National Ocean Sciences Bowl generates and increases knowledge of the oceans by teachers, their students, and school communities; forges linkages between regional institutions of higher learning and high schools; and raises the visibility of the Federal agencies' investment in ocean-related research and marine education to these audiences. These accomplishments were quantified during a comprehensive evaluation of the NOSB[®] that was conducted in 2000 to measure the program's impact on the participating high school teachers and students.

2000 Evaluation

CORE contracted with the University of Southern Mississippi to design and implement the independent evaluation. The evaluation consisted of several parts: (1) pre-testing and post-testing of the students knowledge about ocean sciences; (2) survey of general science literacy of the NOSB[®] participants; (3) collection of demographic data; (4) attitudinal surveys of the students and coaches; and (5) interviews at the five regional and final competitions.

Key findings of the independent evaluation were as follows:

- Although most students who participated in NOSB[®] 2000 had never taken a marine science course, they demonstrated a significant increase in ocean science knowledge between the regional and final competitions as measured by the pre- and post-tests. NOSB[®] participants also had the highest mean scores on a science literacy survey that was given to a subset of the regional participants. The scores of the NOSB[®] participants were compared to those of one group of undergraduates who had taken a 100-level oceanography course and nine other high school marine science classes in Florida.
- 52% of the students and 93% of the coaches said that participation in the NOSB[®] increased the students' interest in science.
- 45% of the students stated that their preparation for the NOSB[®] helped them in other non-marine science courses.
- 90% of the students said that participation in the NOSB[®] increased their interest in a marine science-related career; 49% of the coaches said participation increased their students' awareness of marine science-related careers.
- 84% of the coaches responded that as a result of their participation in the NOSB[®], they had infused more ocean sciences content into their classroom teaching.
- Almost a third of the coaches said that participation in the NOSB[®] at their school extended beyond the students on the team. However, when asked whether or not the NOSB[®] resulted in increased emphasis on marine science for *all* students (not just NOSB[®] participants or students in their classroom), 46% of the coaches responded "yes".
- Coaches' top reasons for participating in the NOSB[®] were: (1) to challenge top students; (2) to emphasize marine science; and (3) to stress academic achievement.
- Coaches indicated that the regional coordinator is an important source of information about the Bowl

and that directions and information for participation in the NOSB[®] were clear and delivered in a timely manner. Lack of time and the expense of traveling to the regional competition were the most frequently cited obstacles to participation.

- Future participation of a high percentage of NOSB[®]2000 competitors and coaches is assured.

These data provide evidence that the National Ocean Sciences Bowl is deemed by students and teachers to be a well-organized, challenging, but enjoyable event that is making a positive impact on their understanding of the ocean sciences and their general interest in the oceans. The impacts can be seen most dramatically in terms of an increased awareness of marine science-related careers by students and an increased incorporation of marine science-related topics into the coaches' classroom teaching. This last point is particularly remarkable because not all NOSB[®] coaches are science teachers. To a lesser extent, the NOSB[®] is reinforcing students' interest in science and in some cases is helping the students prepare for non-marine science classes. A full report on the evaluation is attached as Appendix C.

Strategic Planning for 2002-2006

The initial success of the NOSB[®], evidence from the independent evaluation, and affirmation from the oceanographic community demonstrated that the program had met its management goals and was achieving the desired academic objectives. In 2000, CORE made an internal commitment to continue the NOSB[®] and recognized the need for a long-term strategic plan.

In the fall of 2000, CORE obtained a grant from The David and Lucile Packard Foundation under the Organizational Effectiveness & Philanthropy Program to support a workshop. The purpose of the workshop was to explore the future of NOSB[®] and to formulate a 5-year strategic plan, including a 1-year business plan. The workshop participants represented all facets of the program (NOSB[®] coaches, regional coordinators, educational specialists, information technology specialists, representatives from the Federal agencies, Technical Advisory Panel members, and key members of the CORE staff).

Five strategic goals and objectives were identified:

- Double the regional sites to 40 by the 2005-2006 school year (i.e., FY 2006), including inland states and populations of students under-represented in the sciences.
- Secure funding to ensure long-term sustainability and growth of the NOSB[®] program.
- Achieve fairness and equity throughout the program, while retaining regional flexibility.
- Strengthen the total program infrastructure to support enhanced teaching, learning and growth within the NOSB[®] program.
- Expand and tailor educational and outreach activities to meet program's targets for growth.

CORE then began the process of implementing a business plan to achieve to the goals outlined in the 5-year strategic plan. The business plan projected a need for additional funding of \$600,000 annually. The increase in resources was needed to add five additional sites (beginning with the 2001 base of 19 sites), procure development and marketing expertise, increase CORE staff support, expand partnerships, and significantly enhance the web site and other informational links for program participants. In order to realize the funding goal, it was necessary for CORE to

submit proposals and requests totaling \$1 million to non-Federal foundations and corporations by the end of December 2001.

During the 2000-2001 school year CORE made a major commitment of its own funds to support fundraising from private foundations, individuals and corporations. This effort provided CORE with its most diverse funding sources to date. However, the Federal agencies continued to provide the largest portion of the program support along with matching funds from the NOSB[®] regional sites. In addition, CORE established the James D. Watkins Fund in the fall of 2000. To date, numerous CORE institutions have contributed to the Fund and CORE will continue to solicit contributions. The intent of the Fund is to generate revenue to augment the NOSB[®] budget. Prizes and awards were provided in-kind or through cash donations made by non-Federal organizations and corporations including CORE.

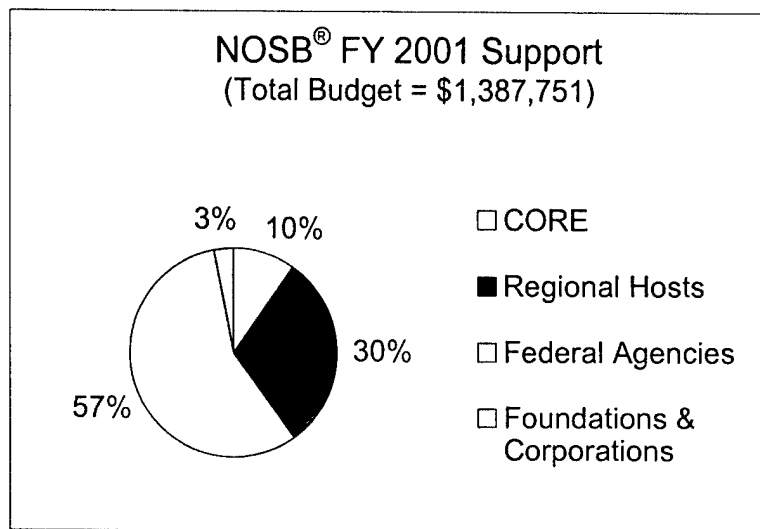


Figure 1. Graph of FY 2001 support by group.

Future Directions Based on Lessons Learned

CORE continues to manage the National Ocean Sciences Bowl and has recruited five new sites since the 2000-2001 school year. The recruitment of new sites has taken 9-18 months longer than anticipated when the strategic plan was formulated. Reasons for the longer start-up time vary from location to location and host to host. Often, it is difficult to find an appropriate institution to serve as host in the desired geographical region. In some cases, an institution's staff is already committed to other educational programming. In others, the financial situation of the institution may disincline staff from taking on any new programs that may require additional fundraising.

During the period 1998 to 2001, the NOSB[®] became a well-liked extracurricular program with strong grass-roots support both from participants, sponsors, and regional hosts. Building upon the baselines established with the 2000 evaluation of the program, CORE recently contracted for an additional study. The new assessment will assess the impacts of the program on past participants several years later and provide preliminary research on motivation and learning through academic competitions such as the NOSB[®].

The NOSB[®] will continue to evolve over time just as it did during the first four years. Assuming that current funding levels are maintained, CORE and its regional partners will continue to improve upon the existing program, keeping the most attractive and valuable aspects of the program while changing those that have proved to limit the potential audience. All this will be done to continue striving for our ultimate goal of making students, teachers and, perhaps, parents better informed about oceans and ocean sciences.

Table of NOSB Partnerships 1998-2001

The table below includes the regional site hosts that held regional competitions at some point during the four-year period. CORE initially began with 16 regional sites and added four more during the two years that followed. However, during 2001, the total number of regional sites declined to 19 due to the cancellation by one host late in the planning cycle for that school year. Regional sites were initially provided with \$5,000 in site support plus the cost of team travel to the final competition and attendance of the regional coordinator at the annual September training meeting. However, this amount was deemed grossly deficient given the actual costs of the regional events (which averaged \$25,000 per site in 1998), so in 1999 regional competition sites received \$10,000 in site subsidies per year in addition to the travel support mentioned above.

All regional sites were required to have at least one individual to provide coordination and oversight of the regional competition. This person's duties were similar among all regional NOSB sites and can be described as follows:

- Coordinating of all aspects of the regional competition including the recruitment of high school teams and volunteers to participate in the events;
- Training volunteers;
- Soliciting support from additional (local) sponsors;
- Serving as the liaison between the national office and partnering institutions;
- Overseeing local public relations and media contact;
- Attending the national final competition with and serving as a chaperone for the winning regional team.

Regional NOSB® Partners	Years of Participation
Alaska Regional Ocean Sciences Bowl University of Alaska-Fairbanks (UAF) Alaska Sealife Center	1998-2001
California: Los Angeles Regional Ocean Sciences Bowl Jet Propulsion Laboratory (JPL) University of Southern California's Wrigley Institute of Environmental Sciences (USC)	2000 & 2001
California: San Diego Regional Ocean Sciences Bowl Birch Aquarium of Scripps Institution of Oceanography, University of California, San Diego	1998-2001
California: Santa Cruz Regional Ocean Sciences Bowl University of California at Santa Cruz, Institute of Marine Sciences and Seymour Marine Discovery Center at Long Marine Lab	1998-2001

Table of NOSB Partnerships 1998-2001

Central Gulf Coast Regional Ocean Sciences Bowl J.L. Scott Marine Education Center and Aquarium University of Southern Mississippi	1998-2001
Colorado Regional Ocean Sciences Bowl Cooperative Institute for Research and Environmental Sciences (CIRES) at the University of Colorado at Boulder	1999-2001
Florida Regional Ocean Sciences Bowl Harbor Branch Oceanographic Institution (HBOI) University of Miami-Rosenstiel School of Marine and Atmospheric Sciences (RSMAS)	1998-2001
Maryland-Delaware Regional Ocean Sciences Bowl National Aquarium in Baltimore (NAIB) U.S. Naval Academy (USNA)	1999-2001
Massachusetts Regional Ocean Sciences Bowl New England Aquarium (NEA) Woods Hole Oceanographic Institution (WHOI)	1998-2001
Midwest Regional Ocean Sciences Bowl University of Michigan, Ann Arbor NOAA's Great Lakes Environmental Laboratory (GLERL)	1998-2001
New Jersey Regional Ocean Sciences Bowl Rutgers, The State University of New Jersey, Institute of Marine and Coastal Sciences	2000 & 2001
Northern New England Regional Ocean Sciences Bowl University of New England (UNE) Bigelow Laboratory for Ocean Sciences University of Maine Univ. of New Hampshire (UNH) & ME-NH Sea Grant	1998-2001
North Carolina Regional Ocean Sciences Bowl University of North Carolina at Chapel Hill, University of North Carolina at Wilmington and North Carolina State University (NCSU)	1998-2001

Table of NOSB Partnerships 1998-2001

Oregon State Regional Ocean Sciences Bowl Oregon State University, College of Oceanic and Atmospheric Sciences Conservation Biology Institute (CBI)	1998-2001
Pennsylvania State Regional Ocean Sciences Bowl Pennsylvania State University's Applied Research Laboratory	1998-2000
Rhode Island/Connecticut Regional Ocean Sciences Bowl University of Rhode Island (URI) Mystic Aquarium	1998-2001
South Carolina-Georgia Regional Ocean Sciences Bowl University of South Carolina Belle W. Baruch Institute for Marine Biology & Coastal Research Marine Science Program	1998-2001
Texas Regional Ocean Sciences Bowl Texas A&M University-Corpus Christi Texas A&M University-College Station	1998-2001
Virginia Regional Ocean Sciences Bowl Virginia Institute of Marine Science at the College of William and Mary (VIMS) Old Dominion University Center for Coastal Physical Oceanography (ODU)	1998-2001
Washington State Ocean Sciences Bowl University of Washington-College of Ocean & Fishery Sciences	1998-2001

Appendix B

Time Line of Key Tasks Performed Each Year

May (Month 1):

- Update web site with final competition information;
- Contact current and newly recruited regional hosts regarding participation for upcoming school year; and
- Finalize logistics for winning team trips.

June (Month 2):

- Schedule briefings for points-of-contact at supporting agencies as needed;
- Final confirmation of returning regional hosts and new regional hosts;
- Selection of site for national finals;
- Initiate question generation and editing for National Ocean Sciences Bowl (NOSB[®]) competition;
- Begin revision of forms, brochures and any other standardized documents;
- Establish dates of the regional competitions;
- Renovate NOSB[®] web site; and
- Preliminary assessment report.

July (Month 3):

- Submit final report on current grant year to Office of Naval Research and other supporting agencies;
- Prize trips are taken and evaluated by CORE staff;
- Continue fundraising from private corporations, foundations, and individuals;
- Finalize brochure for printing;
- Complete assessment report;
- Host institutions of previous year's regional competitions submit financial status reports to Consortium for Oceanographic Research & Education (CORE); and
- Promote NOSB[®] at the National Marine Educators Association's annual conference.

Aug. (Month 4):

- Mail invitation letters from regional competition hosts to regional high schools announcing the NOSB[®], dates for the regional competitions, and application procedures;
- Continue CORE fundraising by CORE and determine suitable prizes for finalist teams;
- Update of NOSB[®] Resources Guide; and
- Finalize forms and other standardized documents for regional coordinators.

Sept. (Month 5):

- Assess status of new questions for 2002 competitions;
- Begin development of Team Challenge questions;
- Hold regional coordinators' training meeting (mid-September); and
- Develop marketing campaign.

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Oct. (Month 6):

- Mail checks to the regional sites to support their regional operations. (*Timing dependent on receipt of funds from NOPP agencies*);
- Promote NOSB[®] at regional National Science Teachers Association's conferences or the annual conference of the North American Association of Environmental Educators;
- Regional hosts contact area businesses and other organizations to seek sponsors for the regional competition to cover costs of meals for participants, prizes, promotional literature, etc.;
- Initiate volunteer recruiting at regional sites (moderators, scientific and rules judges, timers, scorekeepers, and other expenses);
- Select schools by late October (first come, first served) for participation in regional competitions; distribute the NOSB[®] Resources Guide and various administrative information to the schools;
- Complete preparation of questions, compile questions by topic, and mail to subgroups of Technical Advisory Panel (late October); and
- Revise NOSB[®] surveys for regional and final competitions.

Nov. (Month 7):

- Deadline for student registration forms from schools competing in the regionals (late November);
- Hold meeting of Technical Advisory Panel (TAP) to review and edit new questions (mid-November);
- Revise questions based on TAP reviews; and
- Team coaches meet with regional hosts (optional, but recommended).

Dec. (Month 8):

- Regional coordinators provide CORE staff with number of teams registered, coaches' contact information, and number of lockout systems needed;
- Train all volunteers at regional sites with training provided by hosting institutions except where the site has a new coordinator (in that case, CORE staff will provide the initial training); and
- Prepare question packets for regional competitions (early December).

Jan. (Month 9):

- Begin recruiting for volunteers/staff for national finals; and
- Mail surveys to regional sites.

Feb. (Month 10):

- Conduct regional bowls;
- Submit to CORE all forms for teams' travel to the final competition ten (10) days following regional competition; and
- Regional coordinator sends a summary of media coverage and sponsorship to CORE no later than February 28th.

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March (Month 11):

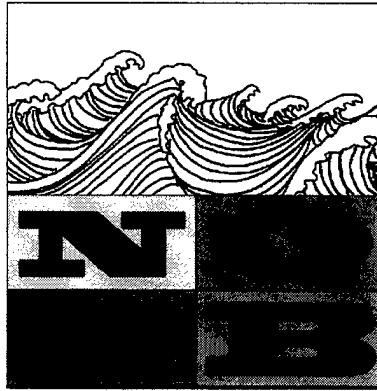
- Finalize the program, prizes and awards for the final competition;
- Begin planning educational experiences (trips) for top four teams;
- Train volunteers for final competition;
- Prepare public relations materials and plan for news coverage of the final competition;
- Review and final preparation of questions;
- Hold meeting of Technical Advisory Panel to review and complete Team Challenge Questions for the final competition; and
- Promote of NOSB[®] at the National Science Teachers Association's annual conference.

April (Month 12):

- Complete team travel arrangements;
- Hold National final competition.

May (Month 13):

- Analyze survey data on regional and final competitions;
- Review the program; and
- Begin cycle for next year of program.



National Ocean Sciences Bowl 2000 Evaluation Report

September 25, 2000

Consortium for Oceanographic Research & Education



THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Institute of

Marine Sciences

J.L. SCOTT MARINE EDUCATION CENTER
AND AQUARIUM

September 7, 2000

Ms. Sarah Schoedinger
Assistant Director of Education
Consortium for Oceanographic Research & Education
1755 Massachusetts Ave., NW, Suite 800
Washington, DC 20036-2102

Dear Ms. ~~Schoedinger~~^{Schoed}:

Please accept this letter as notice of completion of the contract for the evaluation of the National Ocean Sciences Bowl (NOSB), 1999-2000, undertaken by The University of Southern Mississippi's Institute of Marine Sciences for the Consortium for Oceanographic Research & Education (CORE). This project proved to be both challenging and professionally—and personally—rewarding to us in contributing to the goals of CORE with the NOSB and in enhancing our research goals to implement evaluation methodologies and projects for science education to contribute to developments in this critical field of study.

By way of this letter, please note this evaluation was implemented with the full cooperation of you and your staff, as well as the regional NOSB coordinators and coaches, and a select group of representatives from sponsoring agencies with which we communicated. Further, it is our perspective that at no time did anyone from CORE or its related institutions or agencies attempt to influence the direction, scope, or findings from this evaluation study. All analyses, findings, and graphs were independently prepared and submitted electronically to you directly. And finally, original copies of the results and subsequent interpretations, analyses and graphic representations, as well as the original copies of all participant surveys will be maintained in the archives of the Institute for external review should this be requested, and to preserve the integrity of final reports disseminated from your office. Additionally, please note the Project Director of the evaluation (Walters) had no observational or personal awareness of the NOSB prior to undertaking the evaluation, nor any personal or professional relationship or association with any CORE staff member, and thus can be viewed as an objective source for the evaluation.

Beyond the report information already transmitted to you, please know there are several observations which we wish to make in regard to past and future implementation of the NOSB.

1. **It is evident** from interviews with numerous teachers across this country who participate as coaches for the NOSB teams, that CORE and the NOSB are widely viewed as maintaining the highest levels of program excellence and ethical standards in implementing this educational program—and the evaluation researchers commend CORE for its efforts in earning this professional reputation, as this contributes positively to the improvement of science education in this country;
2. **It is evident** based upon site visits at seven of the twenty regional programs and a thorough observational treatment of the national site, and from the pre- and posttesting and school visits, that the NOSB is a substantive and educationally

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effective program which can and does serve as a model for other similar, competition-based programs in this country. Specifically, the thorough and multimedia-intensive communications strategies undertaken to provide concise and succinct direction to participating students, teachers, and regional coordinators provides a case study for national programming. Second, the pervasive scope of the program evaluation to provide both formative and summative data for monitoring effectiveness and for planning future programs has been widely viewed—but rarely undertaken—as the “best practice” for educational evaluation. And third, the willingness to include stakeholders from students, to teachers, to coordinators, to sponsors, and to funding agents in planning activities models a very effective and well-founded strategy for program design.

3. **It is evident** from teacher/coach surveys and interviews and comparisons of the teacher/coach rosters with participant rosters from a select group of teacher education courses and workshops implemented nationally, i.e. Operation Pathfinder and COAST—Consortium of Oceanographic Activities for Students and Teachers, that the approximately 260 teachers who participate in NOSB are a new pool of teachers who are involved directly with ocean sciences education, but who would greatly benefit from workshops to augment their own content knowledge for the ocean sciences for infusion in their classrooms. The NOSB evaluation results indicate that there is transference of ocean science content to these teachers' classrooms and to students who do not participate in NOSB. Thus, NOSB appears to be a vehicle through which an additional national pool of teachers could be reached for a much broader infusion of ocean science content instruction, should a funding mechanism be identified. Specifically and in this vein, NOSB possesses high credibility with these teachers, a regional network of sites and coordinators with a working relationship and a communications and recruitment structure in place, and a well-defined curricular focus and evaluation plan.

We thank you for facilitating our involvement with this program. Further, we would enjoy discussing with you a continued involvement in on-going evaluation of the NOSB or other CORE programming efforts. As throughout this past year, should you have questions or comments, do not hesitate in phoning either of us at 228-374-5550.

Sincerely,



Sharon H. Walker, Ph.D.
Associate Dean for Education and Outreach, and
Administrator



Howard D. Walters
Assistant Administrator, and
Coordinator of Educational Programs

J.L. Scott Marine Education Center and Aquarium
The University of Southern Mississippi's
Institute of Marine Sciences

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NOSB/2000 Evaluation Report Executive Summary

A comprehensive evaluation of the National Ocean Sciences Bowl was undertaken during 2000 to measure the impact the Bowl is having on the high school teachers and students who participate. CORE subcontracted with Dr. Sharon Walker and Mr. Howard Walters of the University of Southern Mississippi to design and conduct an independent evaluation of the program. There were several parts to this evaluation including:

- I. Pre-test/post-test of the students knowledge about ocean sciences
- II. Survey of general science literacy of the NOSB participants
- III. Collection of demographic data
- IV. Attitudinal surveys of the students and coaches
- V. Interviews at five regionals and the final competition

Key Findings:

- The ratio of male to female students in the population of NOSB/2000 participants was 1 to 1.
- 81% of students were Caucasian, 9% were Asian American, 6% were Hispanic American, 2% African American, 1% Native American, and 1% "other".
- Although most students who participated during 2000 had never taken a marine science course, they demonstrated a significant increase in ocean science knowledge between the regional and final competitions as measured by a pre- and a post-test. NOSB participants also had the highest mean scores on a science literacy survey that was given to a subset of the regional participants. The NOSB scores on the literacy survey were compared to those of one group of undergraduates who had taken a 100-level oceanography course and nine other high school marine science classes in Florida.
- 52% of the students and 93% of the coaches said that participation in the NOSB increased the students' interest in science.
- 45% of these students stated that their preparation for the NOSB helped them in other non-marine science courses.
- 90% of the students said that participation in the NOSB increased their interest in a marine science-related career; 49% of the coaches said participation increased their students' awareness of marine science-related careers.
- 84% of the coaches responded that as a result of their participation in the NOSB, they had infused more ocean sciences content into their classroom teaching.

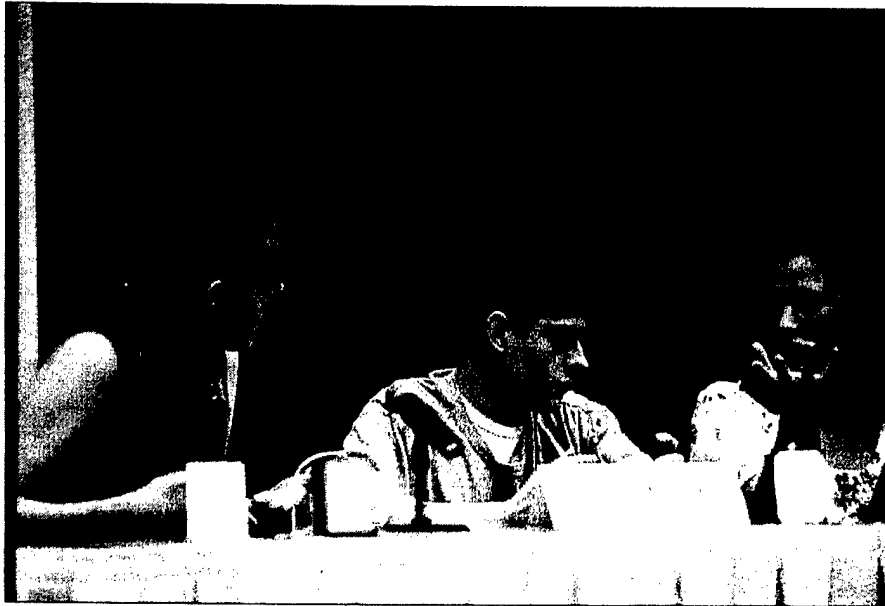
- Almost a third of the coaches said that participation in the NOSB at their school extended beyond the students on the team that was competing. However, when asked whether or not the NOSB resulted in increased emphasis on marine science for *all* students (not just NOSB participants or students in their classroom), 46% of the coaches responded "yes".
- Coaches' top three reasons for participating in the NOSB were:
 - 1) To challenge top students
 - 2) To emphasize marine science
 - 3) To stress academic achievement
- Coaches indicated that directions for participation in the NOSB were clear and delivered in a timely manner. The regional coordinator is an important source of information about the Bowl. Lack of time and the expense of traveling to the regional competition were the most frequently cited obstacles to participation.
- Future participation of a high percentage of NOSB/2000 competitors and coaches is assured.

Conclusions:

These data provide evidence that the National Ocean Sciences Bowl is deemed by students and teachers to be a well-organized, challenging, but enjoyable event that is making a positive impact on them. The impacts can be seen most dramatically in terms of an increased awareness of ocean science-related careers by students and an increased incorporation of marine science-related topics into the participating coaches' classroom teaching. This last point is particularly remarkable because not all NOSB coaches are science teachers. To a lesser extent, the National Ocean Sciences Bowl is reinforcing students' interest in science and in some cases is helping the students prepare for non-marine science classes. In addition to establishing the effects participation in NOSB has had on students and teachers during 2000, these data provide useful benchmarks for evaluations in future years and lead naturally into a longitudinal study of NOSB students and coaches, whereby the program's impact on these individuals long after their participation has ended will be assessed.

Introduction

The Consortium for Oceanographic Research and Education (CORE) has implemented the National Ocean Sciences Bowl (NOSB) for three consecutive years. In 1998, sixteen regions from the United States sent a regional winning team of four students and one alternate to participate in the national competition in Washington D.C. In 1999 this number increased to eighteen regional teams participating in the nationals. Participation data for the second year indicate a total of 240 teams of students, with 90 students participating in the national competition. In 2000, the number of regional programs increased to 20. Survey reports completed by coaches from these regions indicated a total of 966 students participated in these regions, with approximately 100 students continuing to the national competition[†]. The NOSB program has been conducted as a partnership between CORE and the National Marine Educators Association with funding provided by the Office of Naval Research, Oceanographer of the Navy, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, National Science Foundation, U.S. Geologic Survey, as well as other public and private sources. The approximate budget in FY 2000 was \$742,000.



Evaluation of the program for years one and two utilized participation data limited to numbers of students, regions, and coaches. Further, attitudinal surveys for both students and coaches were designed and implemented to measure perceptions of the program as it has been conducted. Typical items from the survey include

reason for involvement, desire to repeat the program, source of communication about the program, perception of program quality, accommodations, information displays, and ratings of various programmatic elements.

[†] These counts are a conservative reflection of participation because some coaches reported team alternate members and some coaches did not report these "additional" students. Furthermore, while every attempt was made to reach all participants, some coaches and students chose not answer the surveys. Estimates, based on the teams' registration information, indicate that approximately 1,300 students and 260 coaches participated during 2000.

For the year 2000 competition, funding agencies communicated a need to develop a more comprehensive and robust evaluation of the educational accomplishments and benefits of the NOSB. In that vein, educational researchers at The University of Southern Mississippi's (a CORE member institution) Institute of Marine Sciences/J.L. Scott Marine Education Center and Aquarium (a regional NOSB participant) implemented three avenues of data collection to develop a base upon which to evaluate the NOSB, i.e. content testing and analysis, attitudinal surveys of coaches and students, and structured interviews.

A criterion test of approximately 50 multiple-choice questions on oceanic topics was developed from select items in the national test pool for the NOSB and from questions developed by the evaluation team. This test was reviewed by CORE personnel and by the evaluation team and refined accordingly. This instrument was duplicated by the program evaluator, and mailed directly to NOSB coaches at school locations across the



country. To facilitate the timetable of the evaluation project, tests for the first regional competitions were delivered via FedEx. An administration protocol was constructed, and this test was then administered to all student participants prior to the regional competitions by

the students' coaches at the school site. Two high schools in Mississippi and one high school in Michigan were visited to observe the pre-test during its administration, and it was observed that test administration was within the parameters of the protocol at these three sites.

Student responses to test items were recorded on Scantron sheets to facilitate grading. These forms were returned to the regional directors as part of the registration process at each regional location. Further, each regional director was mailed student and coach surveys to be completed on-site at the regional competition. These surveys and the Scantron forms were mailed by the regional directors to the project evaluator for analysis.

At the national competition in April, 2000, in Washington D.C., but before the competition began, all national level participants were given the post-test by the

project evaluator for use in a pre-/post-test analysis. These instruments were scored and statistical analyses conducted to monitor increases in content knowledge from the regional to the national level as a result of the teams' preparation. The post-tests of 61 finalists were matched to the pre-tests for these same students which they had taken approximately two months earlier prior to their regional competitions. A

paired sample t-test was calculated for a one-tailed test at the .025 level. The one-tailed test was utilized as the researcher had reason to presume the scores would increase as a result of



instruction, even though the .025 alpha level is a more stringent parameter. The results of the content testing were statistically significant ($t=3.12$; $df=60$ ($n-1$); $\alpha=.025$). The analysis was calculated on SPSS, version 9. The test was run on SYSTAT to cross-check the results; the same numbers derived from this software package as well. This finding suggests that the content knowledge for the finalists was increased significantly for ocean science content areas measured by the instrument between the initial test—prior to the regional competition—and the final competition in April, 2000.

In addition to the pre-/post-tests, 40 NOSB regional teams were randomly chosen (2 per site) to take a one-time test of their general science literacy. This provided a potential test pool of 160 to 200 students. Tests were administered at the same time as the NOSB pre-tests. The science literacy test contained 80 multiple-choice questions that were aligned with National Science Education Standards, the AAAS Benchmarks and Sunshine State Standards. The literacy test had been developed as part of a doctoral research project in science education and was also administered to other high school classes in the state of Florida that were not involved in the NOSB as well as to one class of undergraduates at Florida State University. The results showed that 119 NOSB/2000 student participants had the highest mean percentage of correct answers of all groups tested (65%). The FSU undergraduates scored 41% and the non-NOSB high schools in the study had a mean of 43% correct.

Additionally, the attitudinal survey for students and coaches utilized in the NOSB evaluation for years 1 and 2 was reformatted using an overall Likert-scale format conducive to more efficient analysis, but including the some of the same questions to facilitate multi-year comparisons. As discussed above, these surveys were distributed to regional directors by the project evaluator for completion at the regional sites. Further, these student and coach surveys contained open-ended questions to facilitate more descriptive communication between coaches, students, and program directors.



It was believed that the statistical analysis of the content/cognitive test instrument, and the self-reported information from the student and coach surveys was limited in its descriptive utility without cross-validation, i.e. specific reasons why program components were

liked or disliked are difficult to recognize from Likert-scale demarcations. For this purpose, a series of informal and formal interviews were conducted at select regional sites by the program evaluator and a doctoral student employed to facilitate this project. A series of interview questions for students and coaches was developed and refined. Transcriptions for 22 interviews conducted at 5 regional sites around the country have been submitted separately. The text from these interviews substantially supports the comments from the coach surveys, thereby suggesting that the percentage responses delineated in this report are accurate depictions of the coaches' attitudes and perceptions.

Finally, post-program follow-up surveys will be mailed to student participants at 12 and 18 months after the national program. Survey questions will ascertain level of continuing participation and interest in oceanic and other scientific fields of inquiry. Researchers will work with NOSB personnel to identify coaches and students from previous competitions to query in regard to the longer-term impact of NOSB as an educational program.

Demographic Data

Data on student participants' gender and ethnicity and coursework were collected through the surveys distributed to coaches at each regional competition. Responses were voluntary and many coaches obviously chose not to provide us with this information. Nevertheless, we received information on at least 934 students. Student participation by gender was equal (50.5% female, 49.5% male, n=966 students). The competition participants are predominantly Caucasian (Figure 1). Because of the way the data were requested, we are not able to determine number of male and female students within each ethnic group.

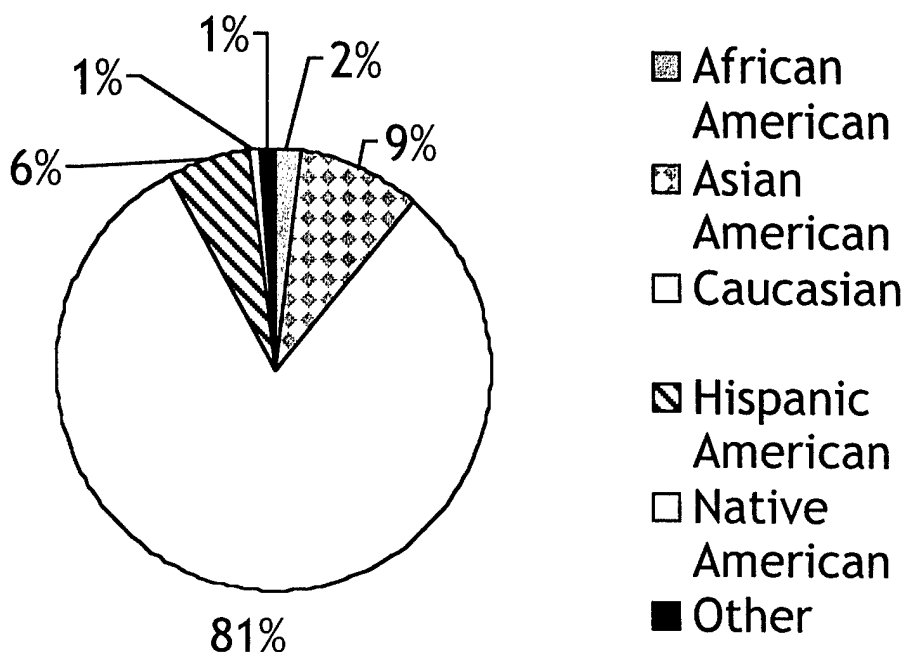


Figure 1. Ethnicity of participating students; n=934 students

Students were asked to identify which science classes they had taken prior to their NOSB/2000 participation. Table 1 indicates the course name and number of students who indicated successful completion of that course. Students were provided with a list of options and were allowed to check all courses that applied. In addition there was space for them to list other courses that were not part of the checklist.

These responses show that very few NOSB student participants have taken a course on ocean sciences. Most of these students are learning about the oceans through their preparations for the National Ocean Sciences Bowl. Comments made coaches and students support this notion (Appendix A, Appendix B).

Course	Number of Students
Biology	860
Chemistry	712
Physical Science	441
Physics	429
Earth Science	417
Environmental Science	182
Anatomy & Physiology	143
Integrated Science	106
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Marine Science	19
Oceanography	12
Marine Biology	8
Zoology	1
Botany	1

Table 1. Academic background of NOSB/2000 student participants. Courses located below the dotted line were added by the respondents.

Attitudinal Survey Results

The following graphs and tables summarize the findings from the surveys distributed to students and coaches at the regional NOSB competitions during February 2000. These surveys were developed not only to collect data on the student demographics but also to ascertain perceptions of the NOSB program's quality, organization, and effectiveness. Where possible, data from previous years are presented for comparison with this year's responses.

Graphs are grouped as follows:

- I. Influence of NOSB on students attitudes about science and careers
- II. Influence of NOSB on teaching about oceans and ocean sciences
- III. NOSB participants' attitudes about marine science and oceans
- IV. Different aspects of NOSB participation including:
 - Reasons for participation
 - Resources for preparation
 - Sources and quality of information
 - Facilities and Location
 - Weekend format of competition
 - Quality of organization
 - Quality of experience
 - Future participation

I. Influence of NOSB on Student Attitudes about Science and Careers

Students and coaches were asked similar questions about the NOSB's impact on their interest in studying science and awareness of marine science-related careers. The coaches were more positive in their responses regarding increases in their students' interest in science (Figure 2) than the students themselves. Although a slight majority (52%) indicated that their preparation for and participation in the NOSB did increase their interest in science, a large portion of the students (46%) indicated they had no opinion about the role the bowl played in this regard (Figure 2). These results are not surprising when one considers that most of the students would not be participating in the NOSB were it not for their interest in science.

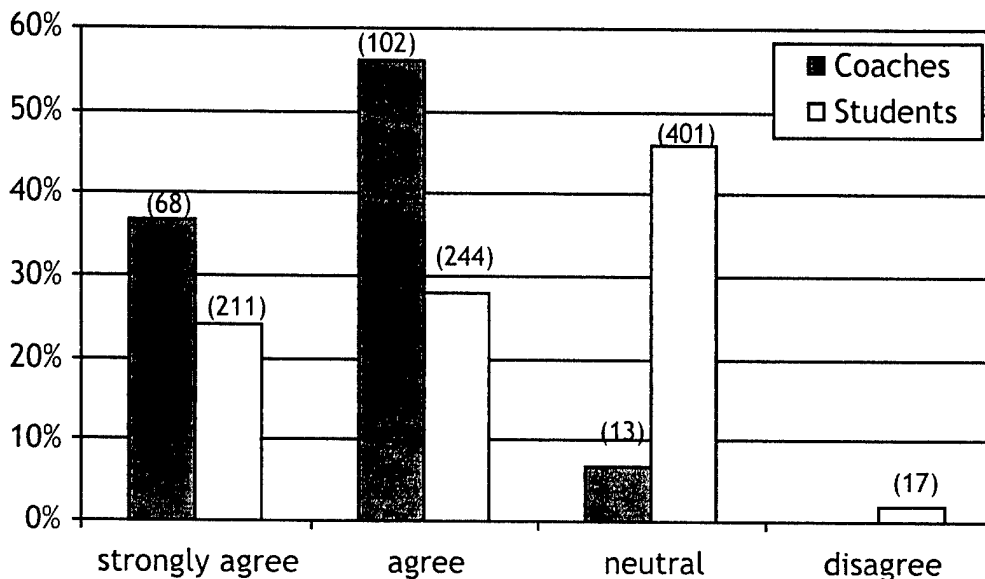


Figure 2. Percentage of responses from students and coaches regarding a statement that participation in the NOSB increased the student's interest in science. Numbers in parentheses above each column indicate the number of individuals who chose that response.

Students were asked to respond to the statement, "After participating in the NOSB, I am more likely to consider a career in marine science." The coaches' statement read: "I believe that participating in the NOSB greatly increased my students' awareness of ocean science careers." The student response was overwhelmingly positive while the coaches took a more neutral stance (Figure 3). Some of this discrepancy could be the result of the different wording of

each statement. For instance, the coaches could have been responding to the modifier "greatly" which the student statement did not contain. Furthermore,

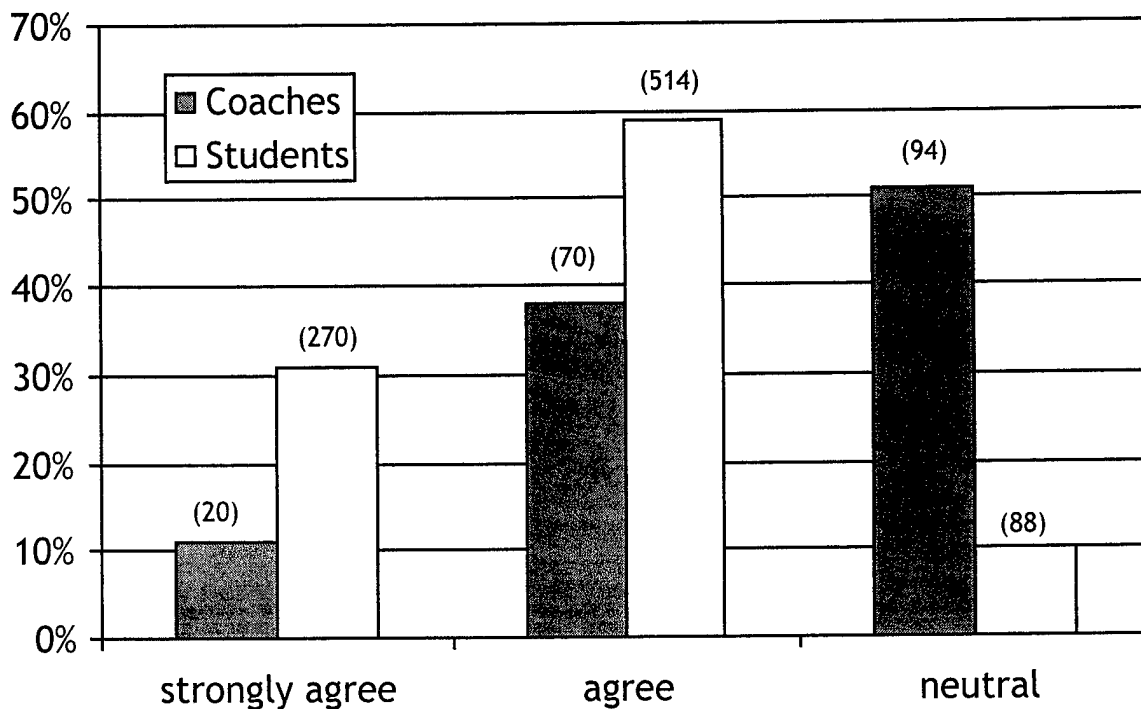


Figure 3. Percentage of responses from students and coaches regarding statement about NOSB participation increasing a student's awareness of/interest in marine science careers. Numbers in parentheses above each column indicate the number of individuals who chose that response.

the students may have been responding to the excitement of the day the competition was held. Nevertheless, comments made by students on the paper surveys and during interviews indicate that through the NOSB, the student's eyes were opened to the possibility of a marine science career.

II. Influence of NOSB on Teaching and Schoolwork

One of the goals of the NOSB program is to make teachers (i.e. the coaches) aware of the excitement and value of teaching about the oceans and particularly ocean sciences. The responses indicate that the NOSB program does make a difference in the classroom as well as out of it. Coaches were asked if their participation in the NOSB resulted in an increased infusion of ocean sciences in their classrooms. A majority (84% of 182) responded that it had (Figure 4). Coaches were also asked whether participation in the NOSB resulted in a greater emphasis on oceans for *all*

students at their school. Forty-six percent of the 177 coaches “yes”. This is an impressive number when one considers that the coaches have less control over what gets taught outside their classes. This figure is corroborated by the responses to another question that asked if NOSB participation involved students other than those on the NOSB team. In response, 31% of 177 coaches said that other students were involved as well. This extension of the NOSB participation beyond the team that actually competes is brought about through oceanography and quiz bowl clubs as well as through some unique arrangements at the host institutions whereby non-competing students are encouraged to submit artwork in a related regional competition or a small lecture series is arranged for up to 20 students from each school that registers a team in that regional NOSB. Finally, the students were asked if their preparation for the NOSB helped them in classes that were not about marine science. A large percentage responded neutrally, but the largest percentage (45%) responded positively (Figure 5).

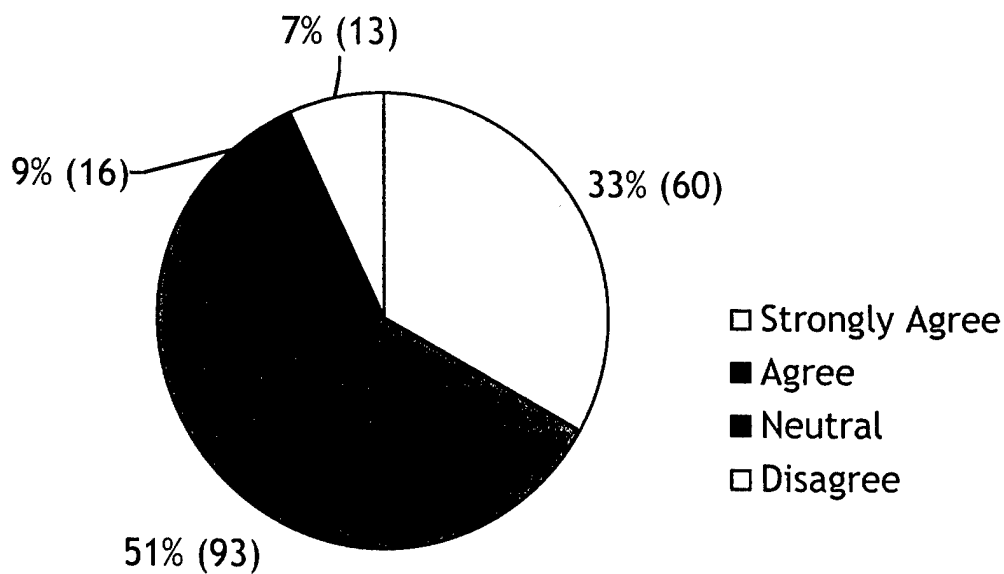


Figure 4. Responses of the NOSB coaches to the statement; “My participation in the NOSB has resulted in an increased infusion of ocean sciences in my classroom.” Numbers in parentheses indicate number of coaches who chose that response.

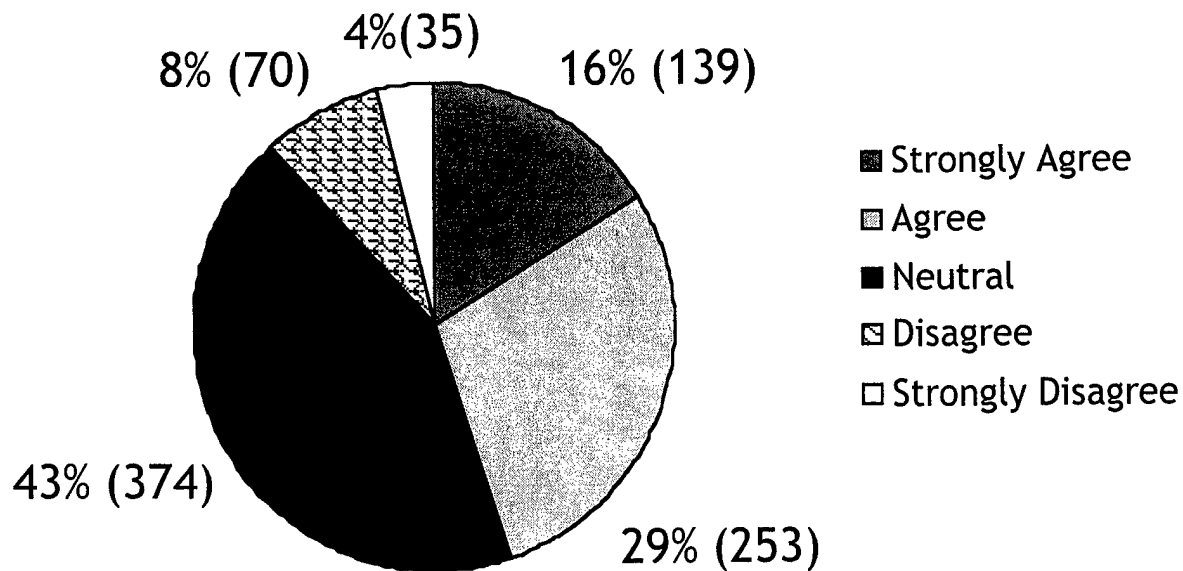


Figure 5. Students' responses to statement: "Preparing for the NOSB helped me in other school classes that are not about marine sciences." Numbers of student responses are shown in parentheses.

III. NOSB participants' attitudes about marine science and the oceans

In effort to understand more about the participating students and their attitudes about the ocean and marine science, the following statements were included in the Likert-scale survey:

- I believe the oceans affect humans who live anywhere on the planet, even in the middle of the continent. (Figure 6)
- I believe everyone should have some general knowledge of marine science (Figure 7).

The results are heartening but not surprising. Because of way the survey was constructed there is no way to determine what influence, if any, the National Ocean Sciences Bowl had on these students' attitudes. It is reasonable to assume that many of the students who chose to participate in the NOSB would agree with these statements since their involvement often indicates an interest in the ocean environment.

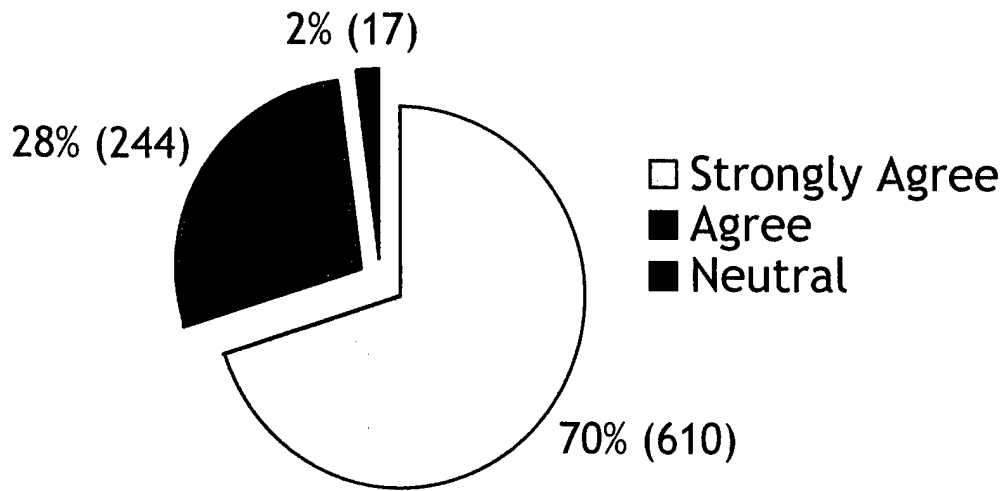


Figure 6. Students' responses to the statement: "I believe the oceans affect humans who live anywhere on the planet, even in the middle of the continent." Numbers of students who responded are listed in parentheses.

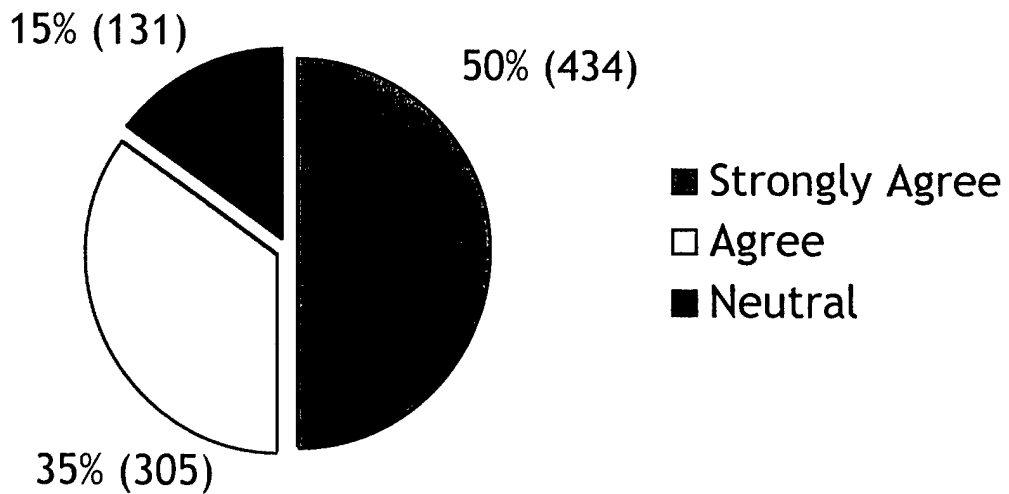


Figure 7. Students' responses to the statement: "I believe everyone should have some general knowledge of marine science." Numbers of students who responded are listed in parentheses.

IV. Aspects of NOSB Participation

Coaches' Rationale for Participation

The NOSB/2000 coaches listed the following reasons why they participated in the competition. These reasons are listed in the order that they were most frequently mentioned.

1. To challenge their top students (n = 138)
2. To emphasize marine science as an academic discipline (n = 129)
3. To stress academic achievement in their classrooms (n = 128)

A similar question was asked on surveys distributed during the 1999 regional tournaments. At that time, challenging top students was most frequently cited, followed by stressing academic achievement and then emphasizing marine science in school. Interviews with coaches confirmed that many NOSB participants already compete in other academic tournaments.

Resources for Preparation

Students and coaches what study aids were employed by them to prepare for the Bowl. Students were asked which reference materials were useful and then what the best sources of these materials were. Coaches were asked what resource materials were most valuable and also which web sites were used.

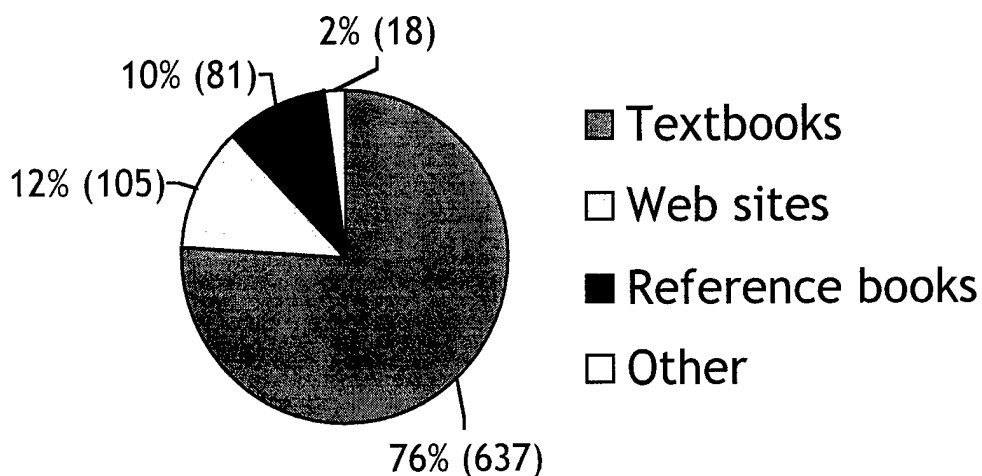


Figure 8. Students were asked which reference materials were most useful in preparing for the NOSB competition. A total of 841 students responded to the question. Numbers in parentheses indicate number of students who chose that response.

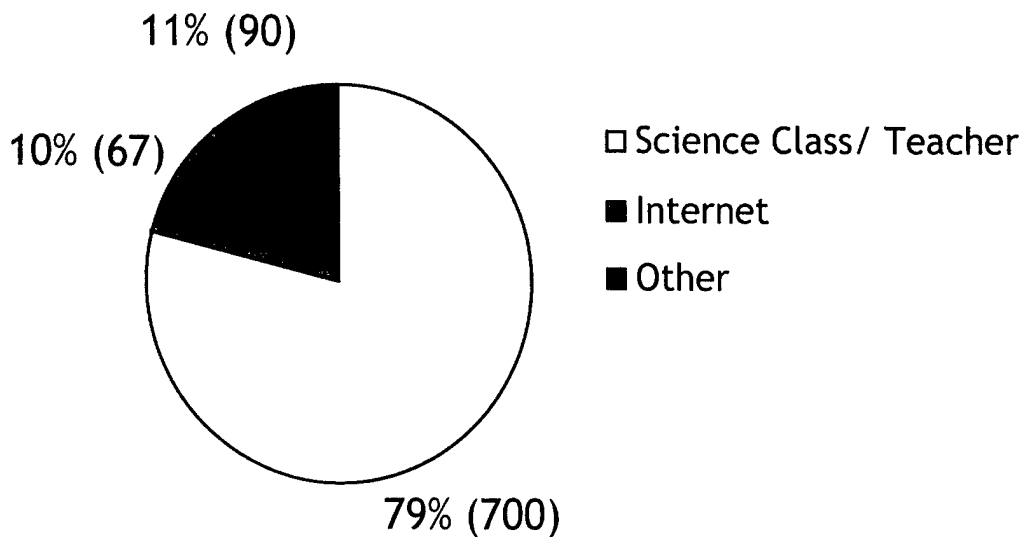


Figure 9. Students were asked what the best source of reference materials was. "Other" includes public libraries and school libraries. Numbers in parentheses indicate the number of students who responded.

Coaches were asked to categorize a select group of resource materials based upon perceived value. The following items are in rank order from having received the highest number of positive comments to the lowest.

1. Textbooks
2. Reference books
3. Websites
4. People (teachers, lectures)

Coaches were also asked to identify which web sites were utilized in preparing students for the NOSB regional competition. The three most frequently mentioned sites were NOAA/Sea Grant, NOSB, and The Bridge.

Since 1999, the percentage of students who listed web sites as the most useful reference materials in their preparations increased from 8 to 12%. Nevertheless, the strong majority of students and coaches rely upon textbooks to learn about the oceans and technology for this competition. In interviews, many coaches indicated that they do not know the content themselves but they provide their students with the books and a list of web sites to prepare.

Sources and Quality of Information about the NOSB

The NOSB/2000 regional coaches were asked about how they first received information about the National Ocean Sciences Bowl and if they received information in a timely manner. They were also asked if directions to the competition were clear and what, if any, barriers existed to their teams' participation.

The director of each regional competition was the primary source of information about the NOSB competition (Figure 10). The regional directors reached coaches via direct mailings, their institution's web sites, and educational conferences and workshops. Most coaches agreed that the information about participating in the NOSB was clear (Figure 12) and arrived in a timely fashion (Figure 11).

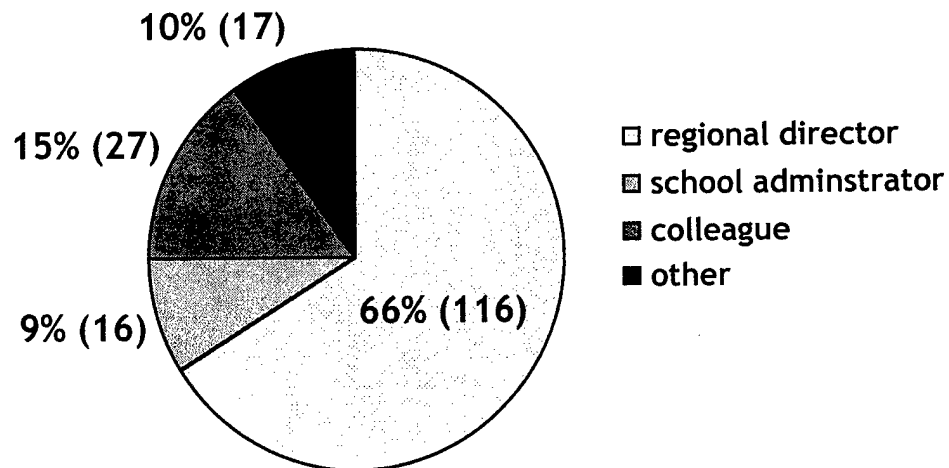


Figure 10. Regional coaches were asked how they *first* received information about the NOSB. Numbers in parentheses indicate the number of coaches who chose that response option.

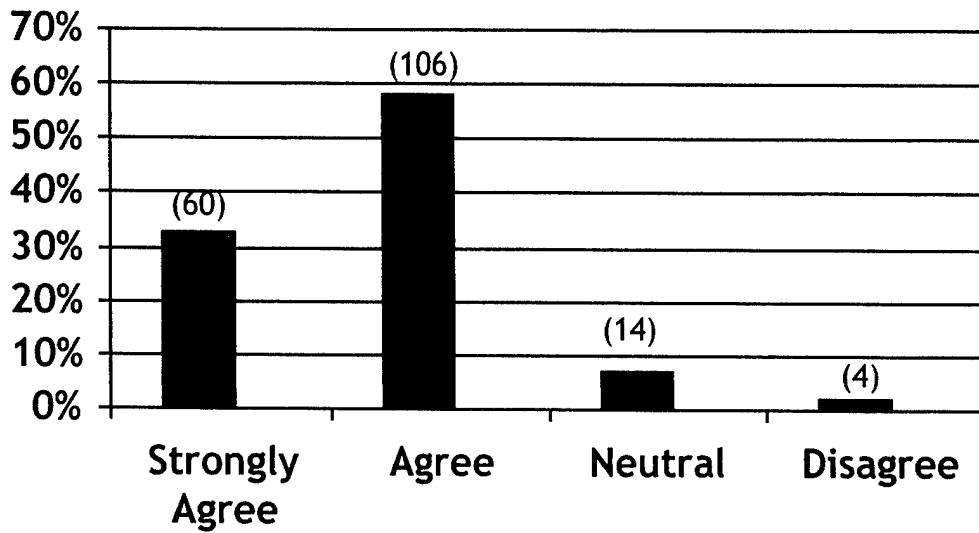


Figure 11. Coaches were asked to respond to the statement, "I received the information about the NOSB in a timely manner." Numbers in parentheses indicate the number of coaches who chose that response.

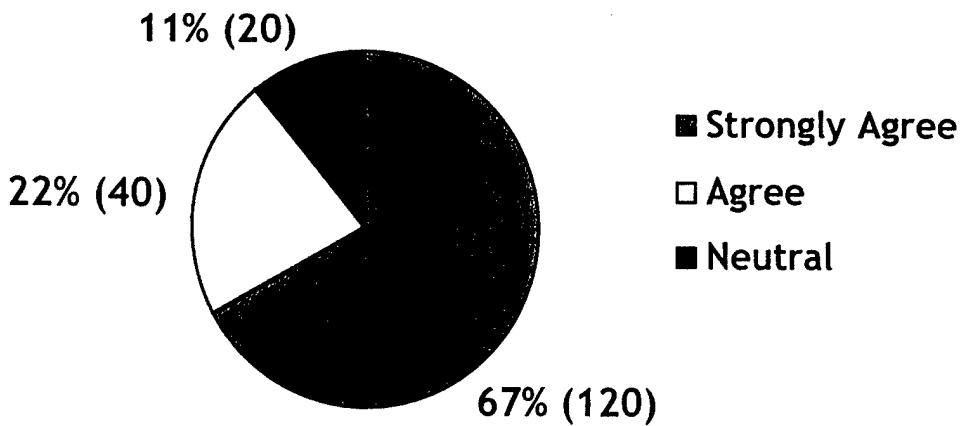


Figure 12. Coaches were asked to respond to the statement, "the directions for participation in the NOSB were clear." Numbers in parentheses indicate the number of coaches who chose that option.

Fortunately, few of the NOSB/2000 coaches said they experienced obstacles to participation in NOSB/2000 (Figure 13). Because these surveys were distributed and collected at the regional meets, those coaches who were interested in participating, but were not able to register a team in a regional competition, were not included.

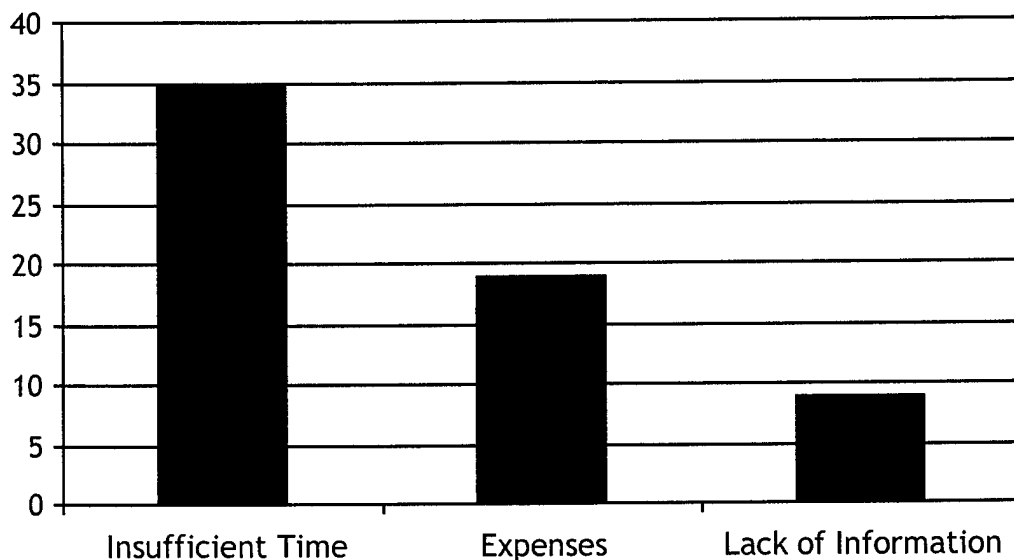


Figure 13. Coaches were able to list more than one type of barrier to participation in NOSB/2000, so total number of responses (y-axis) does not necessarily equal total number of coaches responding. In fact, the latter number is probably lower. Other choices for barriers included, "lack of administrative support to compete," and "other".

Facilities and Location

Coaches at both the regional and national competitions found the facilities where the competitions were held to be suitable. When asked to respond to the statement, "the facility for the [regional/national] competition was suitable," all coaches responded with "agree" or "strongly agree".

Students were asked to respond to a somewhat different statement: "I liked the location for the NOSB in my region." A total of 869 students responded. The majority of the responses were positive (65% strongly agreed, 20% agreed); 6% were neutral and 9% were negative (7% disagree, 2% strongly disagree).

Weekend Format of Competition

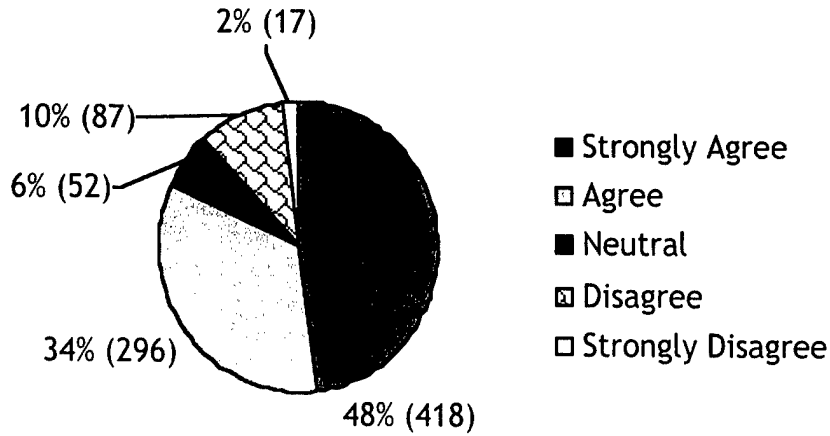


Figure 14. Students were asked to respond to the statement, "the weekend format of for the NOSB worked well for my team." Numbers in parentheses indicate number of students who chose that particular response.

Organizational Quality

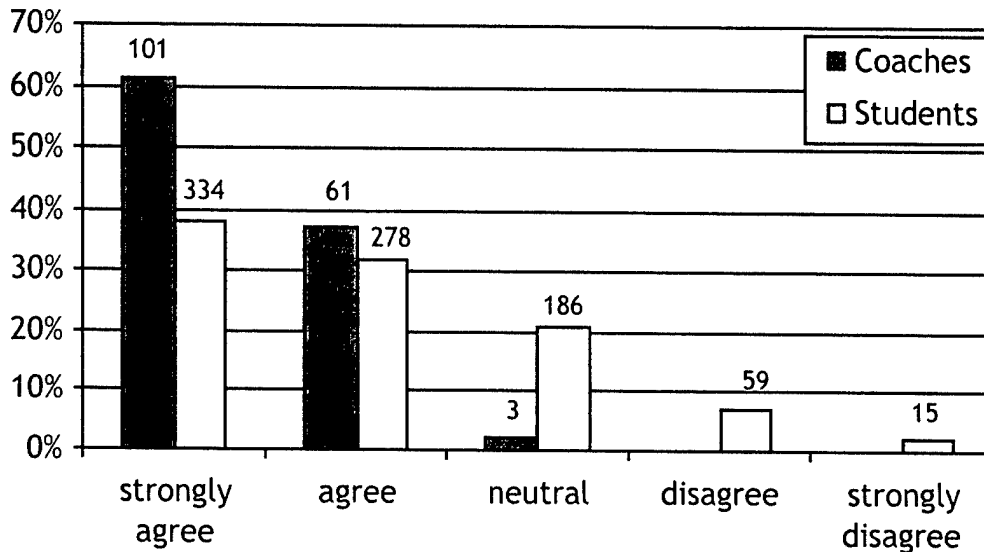


Figure 15. Percentage of students' and coaches' responses regarding the organization of the NOSB. Students were asked to respond to the statement, "the NOSB is organized well" and coaches were asked to respond to, "the overall organization of the NOSB is well done." The number of responses is listed above each column.

Quality of Student Experience

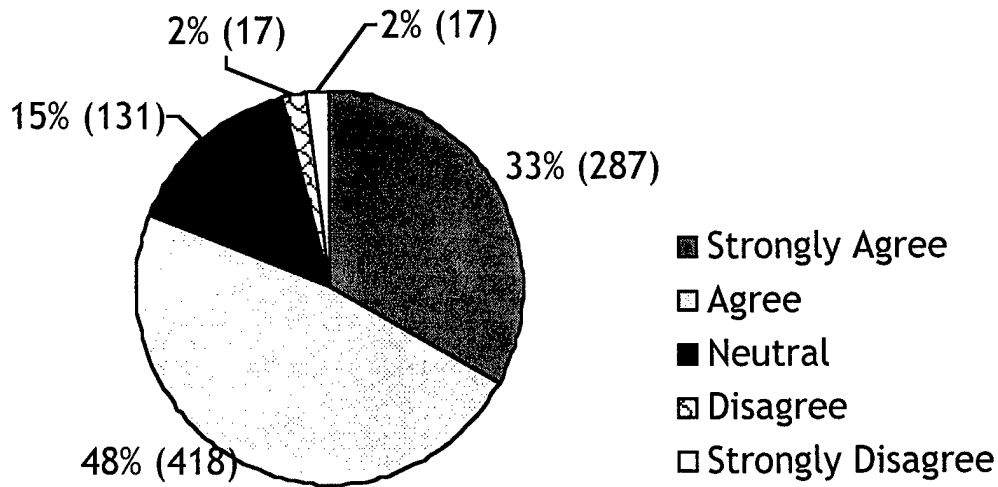


Figure 16. A total of 870 students at the regionals responded to the statement, "The NOSB competition was conducted fairly and well."

The majority of students enjoyed participating in the NOSB competition: 52% strongly agreed, 39% agreed, 8% were neutral and 1% disagreed. A total of 872 students responded. The coaches' responses to the statement, "overall, the majority of my students had a very positive experience with the NOSB" were more emphatic than the students: 67% strongly agreed, 30% agreed and 3% were neutral. A total of 183 coaches responded.

Future Participation

A strong majority of coaches (91%) and students (80%) indicated they plan to participate in future NOSB competitions (Figure 17). These percentages are lower than the 1999 survey responses (92% and 95% respectively), but a much smaller proportion of the participants (91 coaches, 270 students) completed surveys during NOSB/1999. Note the U-shape of the student responses where there are high marks on each end of the scale. This indicates that the data for this question are skewed, which would be expected for two different types of students responding to the survey, namely seniors and non-seniors. Interviews with the coaches support the conclusion that interest in this program remains quite high.

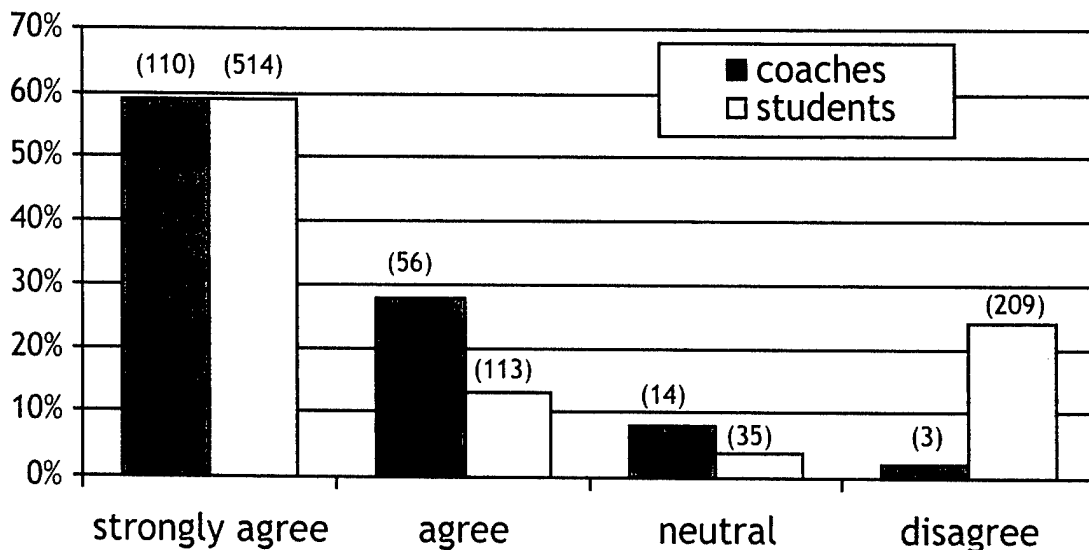


Figure 17. Percentage of responses from coaches and students in answer to a statement that it is likely they will participate in the NOSB next year. Numbers of individual responses are shown in parentheses.

Conclusions

Overall, the written and oral responses provided by the NOSB/2000 students and coaches demonstrate that the NOSB is deemed to be well-organized and is in a format that is generally well liked and easily understood. This event often serves as a way for teachers to challenge their top students and reward students for excelling in science and math. The NOSB is often a mechanism by which students study ocean sciences and its influence extends beyond the immediate participants when NOSB coaches include more ocean sciences in their classroom teaching. The NOSB is a means for the ocean sciences community to make high school students, their teachers and parents aware of careers related to ocean sciences and technology. Dependence of the coaches and students on textbooks as study aids remains high, although use of web-based information is slowly increasing among the students. Barriers to teams' participation include the expenses related to travel and the lack of time to prepare. Given the gains that may be made through this program the onus is on CORE to identify ways to overcome the barriers to participation and extend the potential impact of the National Ocean Sciences Bowl beyond those individuals who participate each year. The data presented herein will provide useful benchmarks for measuring our success in future years, and the impetus to conduct a longer-term evaluation of the program's impact on students and coaches.

Appendix A: Comments¹ from Student Surveys

Question 1: What did you like MOST about the NOSB?

Alaska²

Presentations... Preparations... Quiz Bowl... Round-robin competition... Meeting new people... Friendly atmosphere... Organization of NOSB... Research and compilation of the paper... The hotel... Good sportsmanship... Awesome location... Getting new perspectives on science ...Public speaking and answering questions.

California 1

The competitive nature of it... The staff was very friendly... It was near the beach... Meeting new people... Broadened my knowledge... Food was good the entire thing was great... It was organized well... Great Lakes [questions]... Lunch was good and so was the view... Very well organized... People were great... It's a great activity... Being able to compete against intelligent students from San Diego County... Made to feel very welcome... Location... Academic-bowl style of competition... This survey... The camaraderie you get with your team... Meeting new people... The day-long format... All aspects of sciences were covered - geology., biology, chemistry, physics, etc... I liked the short rounds.

California 2

The moderators... It was organized... Easier than [National] Science Bowl... Getting to rate the moderators and getting the ones we liked for the double elimination round...Competing... The experience of it all... The food... It made me want to learn more about ocean science... Meeting new people... I enjoyed listening to questions when I wasn't competing... The set up... Buzzer set up... relaxed atmosphere... Competing and studying in advance...Great buzzers... The game format and competitive nature... More focused than the regular [DOE] Science Bowl... It's fun... Free stuff... The food and the gifts... The challenges and opportunity to exhibit some of my knowledge of marine biology.

California 3

Being able to compete with other students... I liked the competition... I liked how it was organized... Atmosphere was appealing... The building and the buzzer... The teams... Meeting new people... Great amount of volunteers... It gave me

¹ Comments in Appendix A and Appendix B are grouped by the state in which each regional competition took place. There are three sites in California so those comments were separated by 1, 2 and 3. Comments are shown as they were written except for incorrect spelling. Comments are derived from more than one respondent.

² Alaska's competition follows a modified format. Teams prepare and present a research paper that counts for 50% of the overall score in that regional competition. No other regional event includes this project component.

something new to do [that] was very interesting... All challenges were answered fair and quickly... Learning about the technological aspects of marine science... The buzzers and the people... The suspense was great... Not knowing who would be winner... The food... Jeopardy tournament... The two-day format... Interaction with other people... Testing our knowledge... I liked the campus too... I loved the competitive intensity of the rounds.

Colorado

The prizes that everyone received and the food... Enjoyed the chance to enhance my knowledge and competing skills... Judges were friendly... Good food... Well run... Competitive nature... Just being there... The gift certificates... The gain of knowledge and the friendly competition... Socialization... The people who volunteered... I learned to appreciate the oceans.

Florida

Meeting people from other schools... Location, organization and food... The competition... The round-robin games... Getting away from home for a few days... The concept and meeting new people... Learning new things... All teams being in one place to compete... The fact that one loss doesn't knock you out... Miami was great... The environment and knowledge experience... Organization... Free t-shirts and pressing the buzzer... The wide range of marine topics covered... The prizes... Very exciting... similar to being on "Jeopardy" ... Getting to meet others with similar interests and sharing knowledge about the world's oceans... The experience and the scorekeeper... Getting to stay in a hotel... The exhilaration... The Earth Man Concert... The judges were fair... The fast-paced competitive environment... Working with my team mates... The personalities of everyone... The questions were appropriate for high school students.

Maine

Sportsmanship... Food... Questions... Working together as a team... Collaboration and teamwork... Meeting new people... Seeing our hard work pay off... The intense competition... The opportunity for research... Getting to learn more about the ocean... Winning is a confidence builder... Winning... Round-robin [competition]... Competitive atmosphere... The pressure... The food was good and the judges were fair... Game show format.

Massachusetts

Friendly atmosphere... Good organization... Volunteers... Winning... Learning... Everything... Learning more about oceanography... Educational process and competition... Learned more about marine science... Food and people and goodies... Relaxed and fair competition... Getting the answers right... Buzzers... well structured format... Good location... Very well organized... Competition... the gifts.

Michigan

Competition... The Challenge... Good company... Relaxed fun atmosphere... The scavenger hunt... Good learning experience... Free gifts.

Mississippi

Food was good... Need more variety of drinks... Meeting new teams... Learning about the ocean... The time out of school... It was very well organized... The location and the competition... The prizes... Enjoyed the time spent at the hotel afterwards... Competing with my team... Listening to the questions I missed... Realizing what I need to study more on next year... The organization... Winning... The aquarium provided a serene setting... The food was much better than last year... The buzzers were cool... The way it was conducted... Competing against other states... Bag of goodies... It was very enthusiastic... Fun... Testing my skills... Taking a school trip... Visiting Biloxi, MS... The sportsmanship of some of the teams... The surroundings... Teamwork [was] a lot of fun for all involved... Judges were nice... The absence of a strict dress code... Learning more about the ocean.

New Jersey

Organization and format... Buzzing in... It was fun... Good moderators... Competition was fun... There was one particularly good moderator... Relaxed atmosphere... The variety of questions... Great learning experience... Our teams very humorous outlook... Nice mediators... The buzzers... The setup... I liked the challenge myself.

Oregon

Pizza... It's relaxed and fun... The t-shirts... Learning new things... The w, x, y, z format... Spending time with my teammates... The toss-up format was good... The buzzers and friendly people... Learning new things that aren't covered in science [class]... It's [good] to have competitions other than sporting events... The food... Range of topics... Interacting with people from other schools.

Pennsylvania

Fast action... Prizes... Organization... Fun to get answers right... Food was great... Great facilities... The challenge... Hospitality... The entire event... The luncheon was nice... Buzzers... Freebies.

Rhode Island

The competition... The prizes... Quiz bowl format... It was organized and very professional... The free stuff... The knowledge that I gained... Meeting new people... An excellent way of learning marine science... Entertaining and informative... Love the pressure... Team effort.

South Carolina

Showing off skills... Competition... The subject matter... Fun to be involved... The

range of questions... The traveling... The elimination style... Small viewing audiences... Preparation... Meeting new people... It was organized... T-shirts... Learning new things... The food... The questions... The bonding of team members... Relaxed atmosphere... Buzzers... The fact that we were given the answers to the missed questions... The scoring system... Camaraderie... The entire experience... The set-up... Expanding my knowledge... Winning.

Texas

I really enjoyed the competition and just learning new things... The organization of the NOSB... Getting to know other school teams... Lunch was good... The interaction with other students that had the same interests and goals... Visiting the campus and meeting new people... The number of judges and quest for equality... The experience and intelligence of the judges... Fun... Meeting new people and competing... The format... The competitive aspect... Gave me greater knowledge... Loved campus... Wonderful attitudes and Kindness of staff... We got to meet new people from all over Texas.

Virginia

T-shirts... The food... Location of competition... Learning new things... Meeting new people... Competitive spirit... Well organized... Friendly atmosphere... Loved winning... A chance to test my knowledge... It was a challenge... The museum was very entertaining and educational... The low pressure.

Washington

Judges were very friendly... The other competitors... Feeling smart... It was a good experience... Getting to meet new people... The competition... Judges took the stress off... Variety of subjects and level of involvement... Winning... Attitudes of teams... The prizes... Good clean fun.

Appendix A: Comments from Student Surveys

Question 2: What did you like LEAST about the NOSB?

Alaska

Rules were poorly made and unreasonable... Writing reports... Presentations... Its not fair that Alaska is the only state that has to write a report which takes time away from preparing for quiz bowl... The judging... Oral presentations... It was on the weekend... Not feeling prepared... Too many rounds scheduled too close together made it hard to keep up... Waking up early... Teams didn't mingle enough... Juneau Poseidon (one of the teams).

California 1

We were very unprepared for the materials tested on... The walking and the basement room... The letdown of losing... Too many questions about the Great Lakes... Some moderators couldn't read well... Scary people... The lunch was too long... Slow moderators... The rules... Waste of time between matches... Lack of food... The intensity of matches... Nervousness... Moderators ramble too much.

California 2

Bad food... The moderator said the answers before the team had enough time to answer... Dislike the tables...The questions... They should repeat the questions... the w-x-y-z is very confusing... Losing... The tables gave us splinters... Didn't like the time schedule-- it should have been condensed... Questions were too hard... Started too early in the morning... Interrupt rules... Strict rules... No time to prepare... Singling out the losing team from each bracket... The moderators were playing favorites... Longer breaks needed... Not buzzing in time to give the answer.

California 3

A few judges whose opinions were debatable... Some of the judges did not know the rules very well ...That we didn't win... It rained... it seemed a little rushed and unorganized... Some judges didn't know what was going on... The food... The games should be longer than 16 minutes... Losing... Missing school... Elimination rounds... Questions sometimes contradicted each other...We didn't have any tours or real group functions... An intense game makes me want to scream... More seating at lunch... The long ride and complicated directions... Time-keeping... We couldn't see the time... Distance from home... Short-answer questions required long answers... Waking up too early... Two-day format is too long... Buzzers were annoying... The waiting.

Colorado

The pressure and the emphasis on winning or losing... It was draining to have to get up so early... Intensity... Too many rounds... It stopped being worth it after 7

or 8 rounds... Too early!!... I didn't like competing with teams from our own school... I didn't like that that it was one week after DOE Science Bowl.

Florida

The food... Waking up so early for competitions... Reading rules every time... Too little biology... The band... Not winning and the fact that it had to end... It could have been done in one day... The concert was a little long... Stress... Food was gross... Concert was weird... Impersonal atmosphere... Rules were interpreted differently between judges... Three days is too long... The rules were read way too many times... I didn't feel like we could contest a judges decision... Legalities in the finals... The food was not appropriate since we were entering into a mental competition... Rules change from year to year... Having an alternates causes someone to always have to sit out which meant I didn't get to play in the finals... Rude comments by opposing teams... Cost and quality of accommodations... The incident with MAST was unfair; the judges knew there was a problem and ignored it. They beefed up security from then on, but the offenses were already committed and nothing was done... The dishonesty of some teams and how the officials handled the situation... Also some of the mediators didn't verbally acknowledge the team quick enough.

Maine

First round was a little shaky... Long breaks... Lack of knowledge of rules... Poor sportsmanship on the part of others... Immature winners... The first few rounds were paired up unfairly... Cold weather... Judges needed to know the rules... Too far away from home... Unclear questions... Losing...The rivalry/competition... Longer breaks needed.

Massachusetts

Buzzers... Snotty kids... Lack of snacks... attitudes of other teams... The cameras... The stress... It's on a Saturday... The questions.

Michigan

Losing... Getting up early... A lot of judges accepted answers not listed because they felt it was correct... Bonuses were worth too much... The three-second loss... slow readers.

Mississippi

Food ran out too quickly... Saturday night food... A few of the rooms were crammed... Hotel curfew... Should serve seafood... The moderators... The interruption rule... Lack of seating... Some of the readers obviously had very little knowledge of the subject... Waiting... The question difficulty... Weekend format... Waiting to be recognized... Lack of recognition and prizes for losing teams... The way you couldn't get of out of the loser bracket... Not winning... have more games... Takes too long... How long it lasted... Bigger rooms... Too little advertised... Hard to find study information... No seafood buffet as hoped...

Lack of cheering... The crude remarks written on our van by a team... A little hectic and confusing format... The stress... Losing... Confusion of the rules... Dead time between rounds.

New Jersey

The lack of attendance... I expected more schools... I didn't like waiting to be recognized... It was stressful... w, x, y, z format... Taking the pre-test... Readers were difficult to understand.

Oregon

Had to get up too early... Slow internet connection... Some people need more knowledge of the rules and should be organized ... The tough questions... The w, x, y, z format... The competition is too long... No milk?? Not enough physics questions... Not knowing how much time remained in each round... The stress... Losing... Magnet schools... The moderators weren't well prepared... Felt unprepared for rules and regulations... Technicalities... Waiting to be recognized... The bonus questions were easier than regular questions... Method of scoring was wrong causing some teams to lose by very few points... The short-answer questions.

Pennsylvania

Some questions were so difficult, only graduate students or professors would know... The multiple choice... The state college team... Poor audience seating in morning... Too much down time... Weekend format... Losing... The rule of being acknowledged... We were ill-prepared because we don't have an oceanography class... Moderator's did not read or pronounce well... Competing against older students.

Rhode Island

Our team had to compete three times in a row... Each judge had different rules... Unfair judgement on an interrupt... Too long of a day... Losing too soon and having nothing left to do... Send out surveys beforehand to see what type of food we want... The enforcement of some rules... The wait in between competition... buzzers handles should be sanitized... Overzealous rules judges.

South Carolina

Too much whining by teams... The guy who kept answering within seconds of the question being read... Losing... Scheduling conflicts... Waiting to be acknowledged... Didn't like competing with 3 to 6 teams from the same school... No morning breaks... Questions were read too fast... Strict volunteers... Didn't like being forced to wear the shirts... Driving so far... My team lost in the semi-finals due to screw up by judge... Some teams were very uptight... Some answers to questions were different than the samples provided... Being forced to answer word for word or its considered incorrect... The w, x, y, z format... No air conditioning... The poster.

Texas

The location was too windy... Too many biological questions... Its too easy to be eliminated... Too rushed... The way the judges responded to an interrupt... Waiting to be recognized... Blurts-when answered right... Name team mix-up... The number of rounds... Some moderators did not fully know the rules... Anxiety... The way it was timed... Incompetent judges... It was a lot crammed into a short amount of time... Too early... The buzzers.

Virginia

They didn't have activities for us after the competition...It was stressful... The scoring... inconsistent judging... Long day... Rounds too short... Questions difficult... Don't like the tie-breaker... Too many physics questions... The bye rounds... Thirty-five questions would be better than twenty one... Too specific of answers needed... One moderator was rude... Some teams are too serious... Too much waiting... The w, x, y, z system was confusing ...Too strict rules... The fact that eliminated teams were required to stay... Stuffy judges... We were pressed for time to get from room to room... The pressure... Some schools were arrogant... Inconsistency of interrupts... The noise in the rooms upstairs was disruptive...Too many biological questions... Too early in the morning... Mind-numbing questions.

Washington

Poor sportsmanship... Very poorly worded questions... Fierce arguments... Losing... Number of bonus points... Different rules in different rooms... Questions were too hard... The time limit... Not enough teams... Had to spend too much time studying... We couldn't see the clock... The teams that argued didn't get docked... The seriousness of the games.

Appendix A: Comments from Student Surveys

Question 3: What suggestions would you make to improve NOSB for next year?

Alaska

Have more questions concerning chemistry... Broader range of topics like technology and social sciences... Too much was centered around physical and biological questions... Locations is not very good... Time was badly used... We were exhausted by trying to do it all in one day... Consider having the event on a different date possibly in January or March... Loosen up on the rigid rules concerning "exact" answers to the questions... Have every state do the presentations, not just Alaska... drop the paper writing and presentations altogether... Have more judges for the presentations... Open the gym for breaks... Start the day later... Use more common language and be more flexible with answers... More schools, more people, less presentations... Go over the questions before bringing them to the students... Give prizes for individual categories, presentations, paper and overall prize.

California 1

Have classroom/match rooms closer... Have more reasonable questions that we can answer... Make sure the moderators know how to pronounce key terms... Get better lighting in the rooms... Less stairs... Bonus questions are worth too much... Have a coach's match... More flash cards and practice sessions... Need more teams... Have donuts in the a.m.... Ask more computer science questions... Ban uniforms and eliminate Revelle as a location.

California 2

Get better caterer... Have more variety in the questions... Have a better moderator... More organization... Get more schools to participate... Make it ABCD... Change the tables because they caused splinters... Have better preparation... Start it later... Have less wait for teams... Make the questions harder... Mix variety of subjects during one half... Have less vague questions... Better trained moderators... Organize the tournament structure better... More history questions and less physical questions... Officials were aesthetically pleasing.

California 3

Have more rounds... More interaction with teams before competition... Use all five people on the teams during questions... Breakfast foods for the first day... Better organization... The [moderators] should pronounce words correctly, because it wastes time and messes up the teams concentration [if they don't]... Encourage the teams to talk to each other more, instead of [having] a lecture... Allow the kids to make up questions for the judges... Have it a different time of the year... Have categories easier like freshmen with sophomores and

juniors with seniors rather than all together... Instead of notebooks... We should have big pieces of paper... Have time stop to explain an answer... More centralized location... Naptime... Have all timekeepers wear watches.

Colorado

Make the rules strict... Have the competition a different time of year than science bowl... Have clearer pronunciation... Better enforcement of rules... Clarify the rules for what happens when time runs out... Have more food... Stop the clock while considering an answer... Use only people who speak clearly and quickly for moderation/reading of questions ... It would be beneficial to have a round-robin format in the morning, and have double-elimination finals in the afternoon... A few more chemistry and physics questions... Improve the question format... Have Chinese food.

Florida

More officials to reduce the possibility of cheating... Shortening the reception and be clearer on the agenda and activities... Bigger variety of questions... More variety of food and more available... Find an effective way to reduce cheating in final rounds... A good reward for the last place... Organize the hotel arrangements for us ... In the finals teams should not face the audience... Isolate final round to reduce cheating... More minorities... Have the rules enforced the same room to room... Better pronunciation of questions... Teams should not be eliminated on the basis of win or lose but rather by point accumulation... Have the finals with the audience to the competitors back to avoid any chances of cheating in the audience... No spectators during finals... More organization needed... Maybe a dance to relieve stress... Larger diversity in questions... Dress code more semi-formal instead of shorts and t-shirts.

Maine

More centralized location needed... More time in between matches... Make rules more clear... More training for staff... Have less numbers for us to remember... More biological questions... Only have 1 team per school... Make it later in the year... Suggest specific books to study.

Massachusetts

Need stricter enforcement of rules.

Michigan

Have more consistent rules judges... Rounds seemed too short... Have rules be more consistent... [Have] no deductions for interrupting... Have a larger lounge area, maybe with a couch or something ... Have moderators be more familiar with difficult words... Post more practice questions.

Mississippi

Have more food... Change the scoring system... Make the points divisible... More

biology and chemistry questions... Have seafood... Have scientific advisors... Less waiting... More reference materials... Have more teams... Small plaques for all teams... Publicize essay contest more... Make the day shorter... More geography... Better sound system... Have practice rounds.

New Jersey

Consider questions that were not so vague... Have more diverse questions... More public school participation... Re-enforce the fact that it is all for fun... Make sure judges understand the rules... Less time between games... Don't repeat questions... Clarify the rules... Ask more organism questions.

Oregon

Needs more organization... Have more practice questions... Give notice as to when a round will end... Clean off buzzers between rounds... Start later in the day.

Pennsylvania

Find better moderators... Keep the questions at high-school level which will keep the competition more fast-paced... More preliminary matches and short-answer questions... Involve more students... Have judges that know the rules... Suggest resource materials ahead of time... More info on dress style prior to arriving... Faster switches between competing... Have questions read all the way through before allowing answers.

Rhode Island

Spread out the times of competitions... The bonus points should be worth less points... Have rules posted... Have waiting room in each building so we don't have to be so quiet... Visual aids on screen... Have more [of it] outdoors.

South Carolina

Regional competitions... No more than 3 teams per school... Prepare staff more... Don't have the audience facing the students... Don't have group problem worksheets... Give poster information sooner... Lower the difficulty level of questions.

Texas

Fix the buzzers... Have better food... Spread the time out more... Get new judges... Easier questions... Slightly easier questions... More in depth rules ... Publish time and place earlier... Don't allow last years champs to come to competition... Make it more fun and longer... More time to enjoy the environment... Make the rounds a little longer... Have an equal amount of questions from each field... Give more time for rounds.

Virginia

Have ice-cream at break... Need activities for downtime... The bonus questions

should be worth less... Provide fruit as snacks... use 1, 2, 3, 4 format... All judges should follow the rules exactly... Quicker... More teams or better rooms... Have the game room open later... The scoring system needs to be more organized... Let teams leave when they lose... Evenly distributing categories.

Washington

Have teams understand that its just a game—it's not the end-all be-all of your life's accomplishments... Have less vague questions... Have more dynamic questions... Have more marine biology... Call on contestants quicker... Show the clock.

Appendix B: Comments from Coach Surveys

Question 1: We are interested in extending the impact of the NOSB program to include students and educators in addition to those who were involved in the competition. What suggestion, if any, do you have to help us accomplish this goal?

Alaska

Contact the marine science and/or biology teachers at other schools... Questions should be monitored more closely for accuracy... Attend a science/math educator conference in Anchorage... Contact district administrators for a slot at in-service teachers... Have more money for prizes... Competition... Special thanks... Supply more money so more schools can be contacted about the event... Have more prizes... the National [Office] needs to recognize the Alaskan students effort with their research papers and oral presentations.

California 1

Send out invitations to county school offices and have them distribute them to the high schools in each district... contact administrators with information on training, workshops, and competitions... The outreach programs for internships need to take into consideration the need for living accommodations... go forward with the curriculum distribution idea... pay attention to each state's science standards... Have inter-school practices locally during off season... Encourage other teachers and students to attend in the audience... More good oceans curriculum.

California 2

Allow coaches to pick final teams later... Have small competitions to show new schools the program... Field trips, e.g., whale watching, etc... Community service events... More seminars and lab tours... More in evening rather than after-school advertise... Workshops for elementary/middle school teachers... Internships... Partnerships w/students forming long-term connections... NOSB is unknown to most schools. This would be an excellent way for academic teams to practice and to learn oceanography. Most schools are in an oceanographic vacuum.

California 3

Create a video to share with schools... Send info to oceanography clubs... Practice games to play in classrooms... More school input... Have a District Ocean Science Bowl... Earlier mailings to schools in area (mail directly to science chairpersons or dept. heads) ... T.V. spots for winners... Organize a workshop for teachers to improve marine/ocean science knowledge... Assistance from marine science research institutions to spark interest in students (field trips, speakers, etc.).

Florida

Personal communication with educators to inspire and motivate them to become involved by putting together a team... Ancillary programs less expensive or no cost

to students... Have an e-mail list of marine science educators... Present the program at science teacher's conferences (NMEA... NSTA... State level organizations) ... More support from local school districts... Newsletters... Workshops for teachers (paid, [during] summer)... Make information available to educators especially at Florida Marine Science Educators Association's conference.

Maine

Have a program printing which highlights the regional competition ... Interviews with students and the coaches may generate interest... Encourage more high school students to be volunteers at the host site... Ask participating schools to recruit 1 other school from immediate area... Try to involve more schools in the program, rather than multiple teams from one school ... Positive publicity of participants—use the media to get the word out about NOSB.

Massachusetts

Massachusetts Frameworks... MCAS Testing... Help us to establish a good curriculum in marine/ocean sciences... Need more PR to get communities excited about the program... More Cape Cod and island schools... Let schools know about the educational prizes in advance... Guest speakers from aquarium to establish contacts and heighten awareness... Have a lecture series at the aquarium once per month.

Michigan

You could offer in-class workshops (classroom visits)... Organize on-site visits to scientists' workplaces... Creation of curriculum materials... Develop a middle school competition.

Mississippi

[Have] public broadcast [of competition]... Invite schools for lectures by marine biologists... A week of summer workshops... Promote it with a video showcasing competition, lunch, final rounds, prizes, etc... Include a junior team to watch the event from each school... Perhaps [have] a guest speaker who has a marine science career... Federal aid in the form of courses taught in schools... provide try-out questions to be used at the local school—students could compete for a chance on the team.

New Jersey

Send information to more than one teacher in the school... Less paperwork... Provide the forms instead of making us download... NMEA newsletter, STANYS newsletter—widen your horizons so as not to limit your audience... Have timekeepers.

Oregon

Design a two-week ocean sciences unit that could be included in a standard biology curriculum... Need more sample questions... Field trip opportunities...

Summer science... Advertise it more... Have final match televised... More involvement of marine sciences classes... Offer workshops and conferences.

Pennsylvania

Prepare a study packet for schools with materials in it... Rather than just lists of names... Have mini-seminars with hands-on sessions... Video tapes of "ocean" projects and research... Have more advertisements... Send results of competition to superintendents... Send invitations to all secondary schools in the state.

Rhode Island

Have curriculum packets for NOSB coaches to distribute to other teachers in their science departments... Try to get school administrators to realize the importance of oceanography... Have summer workshops... Staff the exhibit hall.

South Carolina

[Hold] local competitions... Perhaps send a group of oceanography/marine science to field questions and share experiences... Regionals... Have a workshop at NC Science Teacher Conference in November... Inservice awareness and preparation programs... Mailing letters to all science teachers... Have a web site... Have incentives... Utilize Jr. Academy of Sciences... Offer scholarships... Have a poster contest for middle school students to make them aware of NOSB.

Texas

Could you sponsor an Ocean Sciences Summer Camp in which students were selected by applications? Room, tuition, and board would be needed to be [provided] as that would attract a significant number of students... Publicize more broadly—videos are great tools.

Virginia

More questions should involve ocean sciences... Help individual schools set up ocean science curriculum... Curriculum guides to be shared with other teachers... Middle school competitions... Have teams design web sites as a condition of participation... Tape the broadcast and have it on local cable or PBS... Have more regional competitions/multi-level competition... Relate resources to Standards of Learning (Virginia's state education standards)... Hold a pre-competition series of 3 to 4 lectures by active oceanographers beginning several months before the competition... Have students follow a grad student at Virginia Institute of Marine Sciences all day... Expand the number of teams allowed to participate in NOSB... Have more of a workshop atmosphere.

Washington

Test other methods of learning other than listening skills... More local competitions.

Question 2: Is there anything else you would like to say about your participation in the NOSB or the NOSB program?

Alaska

This is a wonderful experience for these students...The students become excited about learning and grow in confidence... Keep up the great work providing this opportunity... The pre-test was a surprise and it was poorly prepared... Thank you... NOSB is the best! ...We enjoyed our stay... Regional directors do so much work, we really appreciate it... Thanks to the Seward Community for their support... Nationals need to require all regional competitions to do research papers or none for Alaska.

California 1

You did a wonderful job, thank you... Thank you for providing this opportunity to the students... Regionals should never be held over 2 days—one day should be more than adequate... Should have clocks so competitors can see how much time they have left... Moderators should read fairly quickly and avoid explaining why the right answer is the right answer...The double elimination was more fair... How about a coaches match—possibly as Saturday night entertainment?... We need to have a participation during the school day... It's fun... Kids love it.

California 2

Great experience... Fantastic view... Fun—organizers were wonderful... Moderators did well... The bowl was put together very well—the competition increases each year; it's getting tougher.

California 3

Well organized—kids enjoyed their time... Would it be possible to have a 1st place plaque for the kids to give to the school? Thank you for your time and efforts to set this up... This is a great opportunity—thanks for the invite...Good experience for my students... Thanks for your hard work. It was great for our students... Nice experience! Thanks, but better food needed.

Florida

Thoroughly enjoyed the experience so thrilled to have been first runner up on first time involved in competition; anytime there is a practice bowl of any kind, please notify all intended participants in NOSB... Great experience for students... We'll be back next year...Well run program providing an excellent experience for teachers as well as students... During final [rounds], have students facing away from audience... Signs directing students to RSMAS sites were very confusing... Some questions were repetitive...It gave me a fresh look at University of Miami—I wouldn't mind sending my son here... More interaction among students would have enriched this experience, such as an activity Saturday afternoon or housing together.

Maine

Readers should be able to pronounce the words... Try to announce what the activities to be offered are, the number of persons permitted for each, and the times... How about a promotional poster for a classroom teacher to put up which students will see when they walk in? It would draw more interest... Volunteers need more training and readers need better pronunciation.

Massachusetts

Film a mock competition... [Hold a] practice session or interview teams in between rounds.

Michigan

Fantastic experience... Excellent job... NOSB shows that learning can be fun... Well organized... Happy to attend... Shorter afternoon breaks to minimize sluggishness after lunch.

Mississippi

My number one complaint is the readers that cannot pronounce the terms correctly. [That] affected our outcome... I am extremely pleased the NOSB is attempting to raise the awareness level of marine concerns among the general public, just hope its not too late... We should have been made aware of the essay questions so we could have been more competitive... My students have learned a lot by attending this event... This event is the highlight of my school year in science... The staff of NOSB have done an outstanding job... Keep coaches to the backs of their team members... Some readers could not read well and had difficulty with terms... A great time was had by all... Judging and rules need to be more consistent. Rules were sometimes enforced strictly, sometimes were lax... Would like to see a copy of the winning essays... Keep up the good work.

New Jersey

We had a great time, thanks... Enjoyed participating... Have competitions more spread out in the building to avoid noise from other classrooms... Would like to see more ordinary public schools participate.

Oregon

We had FUN... Need more sample questions... Had a great time... Thanks for the hotel stipend... Positive experience... Need to remind students not to blurt out answers... Organization is excellent... Can't say enough positive things about NOSB.

Pennsylvania

We needed more study materials and time before-hand... Great experience... [We] look forward to next year... Keep up the excellent work.

Rhode Island

Keep up the good work... Each year we seem to compete against the same teams... Didn't like competing against our own school... It's a great experience... Have questions on overhead as they are read.

South Carolina

Some judges didn't enforce the rules fairly... Some supporters were disruptive and overly excited... Eliminate student surveys... Have practice rounds... Students learned a lot and enjoyed it... Our student's families got involved which made a greater impact on the kids... The moderators need better pronunciation... We lost a round because a student answered "Pacific Ocean" rather than "The Pacific Ocean"—that seemed unfair and prevented us from advancing to the afternoon rounds.

Texas

Well organized and well run; could you please send the address for CORE; we'd love to thank them also... The competitions are well done and my students were motivated by the experiences... In my 34 years of teaching, I have never seen a contest more organized, student friendly, and exciting. My students had fun.

Virginia

Have the divisions based on school size as in athletics, etc. It would make the competition more fair... Coordinate the event better, i.e. no band/concert going on next door next time... Give out certificates of participation... Put empty rooms between the competition rooms... Change the date because the Crab Bowl is on the same date in D.C.

Washington

Judges and volunteers were kind and professional... Keep up the good work... Have a project component like Alaska's [regional competition].