

## **NOSB 2020 Student Instructional Choices and Preparation Report September 2020**

The Consortium for Ocean Leadership (COL) annually implements the National Ocean Sciences Bowl (NOSB) as a regional and national competition-based program for secondary students in the United States. A tracking survey has been implemented to follow students after high school graduation, through college, graduate school, and into the workplace beginning in 1999 and continuing annually since that year. Drs. Tina Bishop and Howard Walters, of the College of Exploration and Ashland University respectively, have developed the surveys associated with this longitudinal tracking study, as well as numerous other instruments and data collection procedures. In prior years, in addition to the student tracking surveys, an additional research project was undertaken focused on one or more of the other constituency or stakeholder groups attached to the program, including scientists and graduate students, judges and volunteers, teachers and parents. For this year, COL personnel directed that the study be focused on instructional strategies and team preparation for both students and coaches, as a follow-up to a similar study which was implemented in 2014-15. Two separate surveys were administered, one for students and one for coaches. (The coach survey data are presented in a separate report).

For purposes of this current report, the data and summaries following are based on a follow-up survey to students who attended the national competition in 2016 through 2020, which was disseminated in late May, 2020, by the NOSB program office to its most current database of past participants from the national competition. A total of 85 individuals provided responses to the twenty-eight items on the survey, as summarized below. The entire raw data set is provided as an appendix to the report to COL. (Note: the attached PDF file of raw data contains 86 student responses. This additional student responded after the summary report was written.)

Items one through four were demographic to obtain descriptions of the respondents. There was a mix of grade levels reported by the respondents, with the majority in grades eleven or twelve or in college as freshmen and sophomores. There was one 9<sup>th</sup> grader and ten graduated or were out of school. Twenty regional bowls were represented in the surveys, which can be identified in the attached data report.

Of the 85 respondents, the top three mentioned fields for anticipated college study areas were biological science, engineering, and pre-medicine. Each of these was mentioned by 16%-17% of the respondents. Seven respondents listed ocean science, with the rest distributed over a variety of areas of anticipated study. When asked how they were selected to be on their NOSB team, more than 25% indicated that they were a member of an ocean-related club (n=25) and another 25% (n=24) said that they volunteered. Next mentioned were teacher-selected (n=13) and school-based competition (n=10).

Item five asked respondents to indicate the number of years they had participated in the NOSB competition (Table 1 below). The distribution of responses was nearly constant, with a slight decline in a full four-year participation, which seems logical.

*Table 1. Years of participation in the NOSB*

Years	Number of Respondents
1	18
2	32
3	22
4	12

In item six, twenty respondents indicated their team placed 1<sup>st</sup>; sixteen indicated 2<sup>nd</sup>; fifteen indicated 3<sup>rd</sup> and sixteen indicated they placed between 4<sup>th</sup> and 8<sup>th</sup>. Seven indicated that they placed outside the top 8.

Item seven focused on the use of preparatory activities for the teams. Practice quizzing was by far the most mentioned method of preparation with over 40% of the respondents individually listing this method. Reading science textbooks was next most mentioned method. Ten students specifically said that they took ocean-related classes at school. Four individuals listed all of these methods while twenty respondents described a variety of combinations of methods.

The teacher provided resources (item eight) mentioned most by the respondents were mock competitions, sample questions, and team challenge questions. Ten respondents listed all of these activities with others selecting various combinations of activities. Two people said none, with one person saying that because it was a student- led club, the students provided the resources themselves.

Item nine requested information about time use each week to prepare for the competition, and specifically time spent alone. The greatest number of students said they spent between one and five hours preparing on their own for competition, with the remaining distribution of responses included on Table 2.

*Table 2. Time spent alone preparing for the competition.*

Number of Hours	Number of Respondents
1-5 hours	59
6-10	18
11-15	4
16-20	1
More than 20	3

A similar pattern was seen in time preparing with the team (item ten) with fifty-three (out of eighty-five) respondents indicating 1-5 hours spent preparing with the team. Twenty-three said that they spent 6-10 hours preparing with the team, with a small number spending a greater number of hours.

When queried about weekly time spent with the coach (item eleven) preparing for the competition, 59 out 84 respondents (70%) said 1-5 hours. Eighteen respondents said 6-10 hours. Only two respondents said more than 20 hours a week. [Note: in select cases, a single respondent opted to refrain from answering a question, as in this case.]

In item twelve, nearly 70% of the respondents said the preferred way to prepare for the competition was with their team and their teacher. Twenty-six percent said with their team (no coach), and only 5% said alone. Items thirteen and fourteen related to courses of instruction in secondary or post-secondary education related to ocean sciences. In item thirteen, when asked if they had taken an ocean-related class at their high school, 45% of respondents indicated Yes and 55%, No. And finally, in item fourteen, when asked about having taken a *college* level ocean science class, (of seventy-six responding to this question), sixty-three (83%) indicated No, and thirteen (17%) indicated Yes. This seems to have been misread by the respondents, leading to a misleading representation, because the question asked, “*if in college*” and there were not sixty-three respondents already in college. Any future survey implementation which uses this item should address an item revision.

Items fifteen and sixteen asked respondents about their participation in other academic competitions and science related enrichment activities. Sixty-two percent of the respondents said they had participated in other academic competitions, while 38% had not. Several students mentioned national level and local or regional level competitions were mentioned. The most mentioned competition was National Science Bowl, followed by the Science Olympiad. Other competitions mentioned most frequently included Quiz Bowl, Envirothon, and mathematics competitions.

To item sixteen, respondents described science related enrichment activities including field trips (most frequent mention), followed by visits to a university campus or laboratory, meetings with college students, and lab experiments. Ten respondents said there were no additional enrichment activities.

Items seventeen and eighteen solicited descriptions of other ocean-related activities in which the students had been involved, and (in eighteen) any community service or conservation projects that had been a focus of their team activity. The most listed out of school ocean-related activity was a *science-related hobby* (not detailed), with over one-third of the respondents listing this. The next most frequently mentioned activities were aquatic vacation activities and career exploration. Community service or conservation projects, parent support, ocean bowl club, and aquarium visits all received some acknowledgement but in smaller numbers. One person highlighted “curiosity about the natural world.” In responses to item eighteen, five of the respondents indicated that their team is comprised of weekly volunteers at the Oregon Coast Aquarium and as such a primary focus is community service. Additionally, forty-two out of the fifty-eight responses to this question said they had *not* participated in conservation projects.

Other conservation projects mentioned included:

- Environmental Conservation Club
- Beach cleanups, beach sweeps; litter pick up
- Painting a mural for an elementary school
- School cleanups
- Water conservation project
- Collecting and hatching horseshoe crabs

Items nineteen, twenty and twenty-one solicited feedback on resourcing that was available to the teams for preparation for their NOSB competition. In nineteen, the respondents indicated that the top resources used during preparation were sample questions from the NOSB (over 95%) and textbooks (over 95%). The next four highest category of resources were websites, resources from the NOSB website, teacher-provided resource materials (including teacher created questions) and YouTube or other videos. Magazines and television were the least used. In item twenty, the respondents indicated nearly 60% saying “yes,” that their teacher maintained or created a focus on engineering, technology, and math, with 40% saying this did not happen. And finally, in item twenty-one, sixty students responded that web sites were helpful, with respondents most frequently mentioning NOAA’s website as a resource (twenty-seven out of sixty respondents to this question mentioned NOAA). Other websites mentioned included WHOI, WoRMS, NASA, USGS, NSDF, US Fish and Wildlife and the Monterey Bay Aquarium. The NOSB web site was also listed. Interestingly, more than one-third said there was no web site that was especially helpful, and twenty-five survey respondents declined to answer this question.

In response to item twenty-two, more than a dozen respondents indicated that the NOSB has helped them find a career or be better prepared for a career. They noted that there were opportunities to meet scientists through the NOSB. An additional group indicated that the NOSB helped interest them in the field and showed them about ocean science careers specifically, and perceived that it also helped them appreciate the diversity of fields that relate to ocean sciences.

Several respondents said that the NOSB helped with science classes in general, while a half a dozen stated that the NOSB helped them specifically with ocean science classes.

The NOSB increased interest in science and awareness of the environment, providing insight into nature and the way the world works. Perspectives of how the ocean interconnects with our lives and a broader world picture were mentioned. Knowledge was increased and helpful marine content enriched their learning, coupled with a desire to learn more.

Further skills that were articulated included:

- Teamwork. Many respondents listed the benefit of learning how to work with others in a team
- Ability to process large volumes of information
- Work and study skills; time management
- Thinking on one’s feet
- Independence of thinking
- Self-directed learning
- Staying calm under stress
- Aid in resume building and college entry

Having fun and making good friends were also mentioned as social development benefits of the NOSB.

Item twenty-three asked respondents what specific information they received during preparation or competition related to universities which were associated with ocean science. Of the sixty-

eight individuals who responded to this question, thirty-three said they had not been informed through NOSB about college or universities that do ocean science research. There were thirty-five responses that indicated the affirmative. Stony Brook University was particularly highlighted. There were three listings for Rutgers University and four for the University of San Diego. Also mentioned were the University of Connecticut, Savannah State University, the University of Hawaii Manoa, Columbia University, the Massachusetts Institute of Technology, Oregon State University, and Scripps. A number of respondents mentioned career information sessions at the National Finals competition and at the Southern Stingray Bowl, while another respondent mentioned informative experiences with Woods Hole Oceanographic Institute and with Sandy Hook Laboratory, where they interacted with graduate students.

Students (or past participants) were asked to identify other sources of preparation support (item twenty-four). A number of interesting insights emerged in the responses. The responses to this question fell into three main categories: activities or resources; organizations; or people.

*Activities or Resources* included:

- Google, Internet
- College textbooks
- Internships
- “My own research”
- Presenting at science conferences
- Reading a lot, including scientific papers, journals, books, ocean technology - even children’s books
- Team notes, passed down over the years (mentioned twice)
- Nature documentaries
- Scioly’s Dynamic Planet event
- Tidepools
- Quizlet.com

*Organizations* included:

- Oregon Coast Aquarium
- Schools
- Little Caesar’s Pizza

*People* included:

- Ocean science club coordinators
- Coral club teacher
- Other teachers in the high school
- Parents, other family members, and friends
- College students
- Alumni
- The coach

- Team members
- Other people in ocean science careers (Alaska)

Respondents were queried specifically about the most effective preparation methods (item twenty-five). An overwhelming number of responses to this question mentioned practice questions or mock questions and the implementation of practice (mock) competitions. This was identical to the responses of the ninety-five respondents in the 2016-2017 surveys for this item. Practice games with the team were perceived as particularly effective. Experience with quizzing and with using the buzzer system were deemed especially useful (another identical response to the 2017 survey). Five students found writing their own questions and then quizzing teammates to be effective. Studying with the team and teamwork were helpful to many respondents too. One person mentioned specializing, that is, having different team members specialize in different topics. A dozen or so respondents listed reading materials and reading textbooks as effective methods. Two people mentioned taking ocean science courses (a smaller number than the 2017 survey).

Other preparation techniques mentioned included:

- Watching videos
- Coach's explanations of wrong answers
- Memorizing definitions
- Glossaries
- Making one's own notes

One student emphasized that "we need more sample questions."

Item twenty-six asked about an emphasis on preparation and the focus on strategies or content or both. Most respondents said they focused on both. That said, nearly a dozen said they focused mainly on content. Strategy was discussed by a number of respondents, with specific techniques listed, while a smaller number said that strategies were the main focus. A couple respondents indicated that they focused on content for the most part until close to competition time, when they then looked at the strategic side of the competition.

Item twenty-seven solicited responses about individual motivation to participate in the NOSB and academic competitions. Seventy-three respondents answered this question. The motivations expressed for participating in the NOSB or academic competitions fell into three main themes: Learning and Interest in Content; Teamwork, Collegiality, and Community; and Competition and Winning.

The most frequently mentioned theme was a strong interest in the content, whether the sciences in general or ocean sciences. "Love of learning...love of science," and "love of the ocean" were all mentioned. Many students listed content interest as a motivator including a general pursuit of knowledge and an emphasis on learning as a motivating force.

A second primary theme mentioned by many respondents was the community emphasis and being part of a team. Teamwork, friendship, meeting like-minded people with common interests,

motivated by, and engaging with favorite teachers, collaboration, and collegiality were high on the list of motivators. Closely related to this was the positive atmosphere of the program as well as fun being mentioned frequently as a motivator.

A third main theme was the enjoyment of competition and the excitement of winning. These were mentioned by twenty-four respondents. Several mentioned testing their own knowledge, the “feeling of victory” and enjoyment of the buzzer and speed of response as motivation. Select quotes that highlighted these motivators include:

- “I love learning new things and knowing more than other people.”
- “A passion for knowledge.”
- “Being able to compete in something you are passionate about.”
- “Support from my teachers and having someone believe in my abilities.”

The final item (twenty-eight) solicited feedback about the relationship of NOSB preparation activities and how this impacted study skills for other courses. Some respondents said that the NOSB did not really help them for other classes with a few saying that studying for the NOSB is different from studying for other high school classes. That said, fifty-five of the respondents said that NOSB helped them in other classes and they highlighted various ways that this occurred. They described how material from the NOSB came up in other subjects. They mentioned specific courses in which NOSB preparation was helpful, including chemistry, physics, environmental science, biology, oceanography, and STEM fields in general.

An important theme was the helpfulness of NOSB study methods to development of transferrable study skills and strategies for learning. The respondents lauded NOSB’s help in developing new ways to study and strategies for more effective study. These included:

- Quizzing and self-quizzing, and writing sample questions
- Strengthening of work ethic
- Time management
- Improving reading skills with textbooks
- Increased capacity to focus
- Communication skills
- Increased awareness of resources
- Better test taker
- Working under time constraints
- Better memory skills
- Better note taking skills
- Application to other subjects

The following select quotations illustrate the help that the NOSB has provided to the students for other academic purposes:

*“Honestly (NOSB) has changed the way I study science and view the natural world around me.”*

*“...Definitely pushed me to be more passionate about conservation and environmental activism.”*

*“It gave me a more complete understanding of the applications of what I was learning in math and science.”*

*“I learned how interconnected everything is across all the studies.”*

*“It taught me that the best way to study is to find ways to make new information interesting to me.”*

*“It helped me learn how to divide a monumental task (learning about the ocean) into smaller subtasks.”*

*“My ocean bowl experience has taught me the value of being a lifelong learner.”*

## **Conclusions:**

The survey responses were rich, with return rates consistent with earlier survey implementations for the NOSB past participants and students. Clearly, these individuals’ perceptions of the benefits and challenges of the competition are consistent with the perceptions offered by past participants dating back over twenty-years at this point in time. Program participants, past and current, consider the competition an important part of their academic experience in high school, and one which yields important impacts in later post-secondary education experiences.

Based on current response data, the evaluation team recommends three specific points of focus and potential action be considered by the NOSB leadership within COL. First, respondents identified resource materials and web sites associated with NOAA education and outreach efforts as being important to their growing understanding of ocean sciences and their preparation for the NOSB competition. This observation within the survey data should be conveyed to NOAA education leadership based on past and current relationships between individual NOAA science and education staff and the NOSB, and NOAA as a past and current funding agency of the program.

Second, over the years that the NOSB has been implemented, it has assumed a stability within its respective regions and school sites. The NOSB leadership should collect further data regarding this stable and recurring community of participants in the NOSB. How have the regional coordination, school leadership, locations, partners and sponsors varied over the years of the NOSB? What are the variables which causes this change over time? How have specific high schools persisted in the NOSB over the years of implementation, and what are the variables which influence this persistence? The need to develop stable models for STEM education has never been more important than it is currently in the country, and the NOSB has a history of implementation at this point in its longevity to speak into this need.

And finally, certainly the complexity of marine and ocean science has continued to evolve over the 20+ years of the NOSB. As the resources for preparation follow and are highly dependent



upon internet mediated content information, it seems clear that there are increasing complexities in the view of marine and ocean sciences presented through the competition. The questions asked, the projects included, the geographic and cultural markers of the competition itself, its community, and its broader stakeholder group are and have evolved in tandem with the academic discipline itself. To that end, it has been nearly 16 years since a comprehensive, 360-degree descriptive systemic study of the NOSB was undertaken by external evaluators. It may be that some type of similar, wide-scale research study may be warranted again.