

Reaching Out to Underserved Communities

Corey Garza

Division of Science and Environmental Policy

California State University, Monterey Bay

100 Campus Center

Seaside, CA, 93955, U.S.A.

cogarza@csumb.edu

The observation that there is a lack of diversity in the sciences is not new. The most recent NSF survey [1] reveals that in the Biological and Physical Sciences, underserved students make up 19 and 12 percent of the total graduate student population in U.S. academic institutions. Such numbers should alarm the broader scientific community given the large pool of untapped scientific talent and the ever increasing need to develop the U.S. scientific workforce. We can look at the Ocean Sciences as a particular case study into some of the potential causes of the lack of diversity in the sciences and methods for increasing participation by underrepresented students in the field. Among the sciences, the Ocean Sciences have some of the lowest numbers of underserved student participation with only 8.8 percent of all Ocean Science graduate students identifying as belonging to a group historically underserved in the sciences [1]. Given the rapid shifts

in the demographics of coastal states, it's imperative to identify potential barriers to and, new recruitment strategies for engaging historically underrepresented students in the Ocean Sciences. It will be this new generation of students who will be tasked with managing coastal resources and combating the effects of climate change and will be asked to bring new perspectives for dealing with the emerging needs of 21st century Ocean Science.

Why do so few students enter the Ocean Sciences relative to other disciplines? The causes are much more complex than the availability of opportunities. STEM specific programs such as the Louis Stokes Alliance for Minority Participation (LSAMP) and McNair programs have been in existence for many years while Ocean Science specific programs such as the Hollings Scholarship, a NOAA program that promotes the participation of students in fisheries related research, and the NSF Ocean Science

Research Experiences for Undergraduates (REU) Program have, for many years, promoted the participation of underrepresented students in the Ocean Sciences. To begin to address the issue of student participation in the Ocean Sciences one needs to understand the cultural landscape that different student groups experience during their personal, academic and professional development. Drawing predominantly on the experiences of Latino and Hispanic students, the examples of cultural drivers provided here are often shared among students who come from groups historically underrepresented in the Ocean Sciences.

For students who come from underserved groups, there can often be family pressure to enter careers where career prospects are more obvious, stable or more easily understood by larger segments of a family [2]. This derives in part from historical cultural expectations of younger generations taking over the role of the family breadwinner [3], a tradition that may not be as heavily integrated into historic Western culture. In Latino cultures, there can also be strongly ingrained gender roles, males as breadwinners, women as homemakers [4], that can further impede the advancement of potential young scientists into graduate careers and subsequent senior positions in the sciences. A historical emphasis on students staying within close proximity of their

families, even after graduation, can also limit potential graduate school opportunities for an aspiring Ocean Scientist. Strategies for engaging students in light of these cultural influences need to be adopted by those wishing to engage underserved students in the Ocean Sciences.

In part how the Ocean Sciences are depicted to students also plays a role in the lack of diversity that we see in Ocean Science related fields. Relative to other fields, the Ocean Sciences have struggled with messaging as well as, strategies for engaging students early in their academic career. For instance, one simply need look at depictions of medical scientists in television and film with many being depicted as having highly successful careers or careers that have the potential to benefit large segments of society. Such depictions of Ocean Scientists in the media are few and far between with the most common being that of the explorer venturing out to sea with their fate and purpose largely undefined. If you were to ask a group of Ocean Scientists what an Ocean Scientist does, you are likely to get a multitude of answers ranging from Oceanography to Engineering to Biology. Thus, as a field, we lack the clear messaging about our discipline that other fields successfully employ to engage with underserved students.

Coupled with the lack of a clear message is the absence of early intervention programs such as those offered by the National Institutes of Health (NIH). Step onto a college campus and you are likely to find NIH programs such as the Minority Biomedical Research Support (MBRS) or Maximizing Access to Research Careers (MARC) actively recruiting first and second year students into early career research programs in the Biomedical Sciences. Many of the approaches and messages employed by these programs resonate strongly with the cultural pressures that underserved students may experience as part of their academic and personal growth trajectory. No similar early intervention programs exist at a national level for the Ocean Sciences.

Though programs such as MARC and MBRS can play a key role in entraining students in the sciences, they can also have the effect of providing early career students with a very limited range of academic and career opportunities in the sciences. Recent print and radio stories [5] have highlighted the struggles that students in Biological related (e.g. Biomedical) fields have encountered in securing faculty or other senior research positions after obtaining a graduate degree. The primary problem is presented as one of not enough job opportunities for students in the Biomedical Sciences, in particular for students who come from underserved communities. However, this

issue may be better framed as the production of too many students with graduate degrees in a narrow range of fields, fields that have been historically overemphasized to underserved student populations. Recent NSF statistics [1] highlight that there are 18,000 plus students currently enrolled in graduate fields in the Biological Sciences. The issue comes down to a simple one of supply and demand, there are too many students being produced for far too few faculty or higher end research positions in a very narrow range of fields.

Conversely, NSF statistics [1] report approximately 2,556 students enrolled in Ocean Science graduate programs. This information coupled with hiring bottlenecks in other fields suggests that there is an opportunity for the Ocean Science community to rethink how we engage underserved communities and begin to increase the number of students entering the Ocean Sciences. Improved messaging that resonates with diverse populations and highlights career opportunities (e.g. Ocean Engineering) available in the field provides one method for beginning to engage underserved students. Highlighting skill development (e.g. Computer Programming) and the variety of Ocean Science disciplines those skills can be applied within will help in not just attracting students but, in refuting misperceptions about the types of skills used and

career opportunities available in Ocean Science research. For instance, although I am a marine ecologist who specializes in studying benthic communities with Geographic Information Science, it is not uncommon for other scientists from underserved populations to ask me how my dolphin or fish research is coming along. This type of misperception that senior scientists from underserved groups in other fields may have about the Ocean Sciences can in turn be filtered down to students early in their academic career. Finally, the development of recruitment strategies that engage students early in their academic career may provide a way for the Ocean Sciences to start to attract students to the field who may one day comprise the broader Ocean Science workforce.

Refining the messaging aimed at students will go a long ways towards engaging and bringing students into the Ocean Sciences. One effort that my colleagues and I are engaged in is the Ocean Opportunities program (www.oceanopportunities.org). This is a program run by myself and Jim Yoder of Woods Hole Oceanographic Institution (WHOI) that was born out of a concern over the lack of underrepresented students entering Ocean Science graduate programs across the U.S. A meeting of representatives from R1 and Minority Serving Institutions was convened at

WHOI in the summer of 2012 to discuss some of the causes of low enrollment by underserved student groups in Ocean Science graduate programs and strategies for improving recruitment and participation in graduate school. One of the top issues highlighted was the lack of clear messaging employed by the Ocean Science community when engaging with prospective students. The messaging issues focused on (1) the use of language and career examples that would resonate with students and parents from diverse cultural backgrounds, (2) imagery that conveys Ocean Science is more than being out on a boat and involves diverse groups of people and (3) clear information on the course pathways that students need to take to pursue a specific career pathway in the Ocean Sciences. Currently, Ocean Opportunities maintains a webpage that clearly defines career and course pathways in Marine Biology, Oceanography, Marine Geology, and Ocean Engineering. Coupled with the site are information brochures for students and an education booth that travels to major scientific conferences such as Association for the Sciences of Limnology and Oceanography (ASLO) and the annual meeting of the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS).

With funding provided through the Deerbrook Charitable Trust, Ocean Opportunities also sponsors

graduate school immersion trips for groups of underserved students to R1 oceanographic institutions that include Woods Hole Oceanographic Institution, Scripps Institution of Oceanography and the University of South Florida. The trips draw students from Minority Serving Institutions in the Southwest, Northeast and Southeast and provide students with the experience of learning about life as a graduate student at a major research institution, as well as the variety of academic and career pathways that a student can undertake during and after graduate school. The program draws from students early in their academic career in order to provide them with robust examples of the types of pathways available to them once they enter their upper division academic career and any subsequent career pathway in the Ocean Sciences. To date many of the students who have participated in the program are still on academic pathways in the Ocean Sciences and have participated in Ocean Science related conferences.

Another approach to engaging underserved students early in their academic careers will require the Ocean Science community to begin recruiting students outside of venues historically attended by the majority of Ocean Scientists (e.g. ASLO). The annual SACNAS meeting represents one such opportunity for the broader Ocean Science community. In collaboration with colleagues from the

National Oceanic and Atmospheric Administration (NOAA) and the Consortium for Ocean Sciences Education Excellence (COSEE) I have organized professional and scientific research symposia in the Ocean Sciences at the annual SACNAS meeting. The symposia provide a platform to introduce underrepresented students to the career pathways that are found within the broader field of Ocean Sciences. The programs provide students with examples of successful minority role models who have navigated the academic and career pathways in Ocean Sciences and, how fields such as robotics and computer programming are used in Ocean Science research. The sessions have become quite successful, going from an average attendance of 20 students per session to an average of 100 students per session at recent conferences.

In the twelve years that the programs have been in existence, there has been a marked increase in student participation in Ocean Science programming at SACNAS. In addition to the increased attendance at the Ocean Science symposia a formal poster session and graduate student oral presentation session have now been established at SACNAS in order to meet the increased demand by students for Ocean Science programming at the annual conference. The programming efforts at SACNAS are beginning to see professional successes with an increasing number

of student participants entering REUs, graduate programs and professional careers. Three of the earliest participants have moved onto higher level positions within the Oceans Sciences with one taking a faculty position at the University of Rhode Island, another taking directorship of the Summer Training Academy for Research in the Sciences (STARS) program at UC San Diego and finally, one having recently received an NSF Pre-doctoral Award from the Division of Ocean Sciences. The success of the programming has not only been driven by the coordination among Ocean Scientists at the meeting but, also by the capacity of the meeting to provide a supportive mentoring environment for aspiring young minority Ocean Scientists.

In addition to rethinking how the Ocean Science community reaches out to underrepresented communities, we must also rethink how we recruit and engage underrepresented students to summer research programs. The most notable of these programs is represented by the NSF Ocean Science REU program which has been successful in attracting students to its programs but often sees few underrepresented students participating in the network of Ocean Science REU programs. This may potentially stem in part from many REUs having a single discipline focus (e.g. Marine Biology) which may limit the students attracted to an individual

program, messaging that may not resonate with underserved student populations and a limited number of mentors to support student participation. For those underserved students who may participate in an REU, the lack of staff and post-REU support programs to help students continue their intellectual and professional development may affect student retention in the Ocean Sciences even after a successful REU experience. The new Ocean Science REU program at California State University (CSU), is one example of a site that was developed in part to address some of these particular issues. The REU is unique in that it is set up as a distributed model REU with CSU Monterey Bay (CSUMB) serving as the host campus within a partnership that consists of Elkhorn Slough National Estuarine Research Reserve, Hopkins Marine Station of Stanford University, Monterey Bay Aquarium Research Institute, Moss Landing Marine Labs and the Naval Postgraduate School. This distributed model not only provides a large number of potential mentors for the program, 40-50 in any one summer, but because of the variety of institutions involved in the partnership, it can offer students research opportunities across fields such as Marine Biology, Marine Geology, Oceanography and Ocean Engineering. Thus, the CSUMB REU is able to engage a broader swath of students than many REUs are able to do.

Having the capacity to offer fields that are not historically associated with Ocean Science, such as engineering, within our REU provides a mechanism through which to attract a diverse group of students. The variety of disciplines also provides a mechanism through which to introduce students, via summer research, to how skills such as robotics, computer programming, mathematics and microbiology can be applied to ocean based studies. These alternative uses of skill sets that may have been applied in biomedical or other non-Ocean Science related fields can serve as a strong method for attracting and retaining students from other fields into the Ocean Sciences. In fact, within the first two years of our REU program the majority of our participants have come from students historically underrepresented in the sciences and students who come from Community Colleges with a particular heavy representation of students in engineering, mathematical modeling and microbiological related research. This model of distributing the research opportunities available through an REU by leveraging the research expertise of regional partners, provides an alternative approach for the Ocean Science REU community to engage and retain diverse cohorts of students within the Ocean Sciences.

In addition to offering summer research programming, the CSUMB REU program also

supports the student participants during the Fall semester. For many students, the semester after participating in an REU can be a critical one as they may lose the intellectual momentum that they may have gained during the summer. To help students remain engaged with their research, an REU staffer, supported by the university, provides each student with access to Fall webinars on pursuing a second summer intern experience and, for those applying to graduate school, assistance in preparing graduate school applications. Our program also helps the students remain engaged with their summer mentors by having the mentors and REU staff actively involved in the production of student posters and talks for the Fall conference season. Overall, the activity has been highly successful with 8 of our 11 students presenting posters and talks at national conferences, all 3 eligible for graduate school having submitted competitive applications, and four other students having secured additional research opportunities at their home campuses. Although the Fall support does entail additional work for an individual REU program, it can have a long lasting effect in helping retain students in Ocean Science academic pathways.

While the approaches described here may not work for all programs and individual institutions they do represent alternative approaches that the broader

Ocean Science community can utilize as part of rethinking how we as a community engage underrepresented student populations. More broadly they define new engagement strategies and programmatic approaches for recruiting, engaging and retaining the diverse assemblage of students and perspectives that will be required to address the emerging needs of 21st century Ocean Science.

REFERENCES

- [1] National Science Foundation 2012, National Center for Science and Engineering Statistics. 2012. Women, Minorities, and Persons with Disabilities in Science and Engineering. Available at <http://www.nsf.gov/statistics/wmpd/>. Table. 3.1
- [2] Hrabowski F.A. 2011. Boosting minorities in science. *Science* 333(6014):125.
- [3] Hernandez, J. C., & Lopez, M. A. 2004. Leaking pipeline: Issues impacting Latino/a college student retention. *Journal of College Student Retention*, 6(1): 37-60.
- [4] Hernandez, J.C. (2000). Understanding the retention of Latino college students. *Journal of College Student Development*. 41: 575-586.
- [5] Harris, R. 2014. Too few university jobs for America's young scientists. National Public Radio. <http://www.npr.org/blogs/health/2014/09/16/343539024/too-few-university-jobs-for-americas-young-scientists>. Date of Access: 03-31-15.