Ocean Science Educators Retreat 2014

Enhancing Diversity in the Ocean Sciences: A Landscape of Opportunities

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Diversity in the Ocean Sciences

• Current NSF statistics: Of the current NSF Ocean Science graduate student population, 8.8% come from groups historically underrepresented in the sciences (NSF 2012).

• For comparison the Physical Sciences (12%) and Biological Sciences (19%) have higher percentages of underrepresented groups.

• The comparison becomes worse when looking at whole number figures, 2,556 total graduate students in Ocean Science compared to 18,000+ in the Biological Sciences.
Why the difference?

• Lack of personal connection to the ocean.

• Unclear understanding by students of what a career in the Ocean Sciences entails (“Jacques Cousteau Syndrome”).

• Ineffective messaging relative to the Biological Sciences, particularly at the early undergraduate stage (e.g. career options, service to communities).

• Historic overemphasis of certain fields (e.g. biomedical) relative to other scientific disciplines.
Too Few University Jobs For America's Young Scientists

September 15, 2014, 2:30 AM ET

Listen to the Story

Imagine a job where about half of all the work is being done by people who are in training. That’s, in fact, what happens in the world of biological and medical research.

Victoria Ruiz (left), a postdoctoral fellow in Immunology, works with Drianna Delgado, a high school student that she mentors, at the Elazer Lab, inside NYU’s Langone Medical Center in New York, NY.
Article Highlights

• Uses biomedical related fields as only example of lack of funding and career related opportunities.

• Does not give as much weight to non-academic careers.

• Provides an example of how a disproportionate number of students are entering a narrow range of fields.

• Using hiring and funding bottlenecks in one field, provides a broad brush overview of opportunities in all fields to students considering a career in the sciences.
Too many science PhDs? Not if unis train them for careers outside academia

Only 3.5% of UK science PhDs stay in university research. It's time universities recognised that, and trained them accordingly.

Only 3.5% of science PhD graduates end up pursuing long-term careers in university research. Photograph: Linda Nyland for the Guardian

I once spent three years inserting extremely slender glass electrodes into rat neurones. I was trying, mostly in vain, to understand how neurones' properties change when they are stimulated. A phenomenon that might...
Opportunities for the Ocean Sciences

- The overabundance of students in specific fields and hiring/funding bottlenecks in those fields represents an opportunity to re-think how we engage and attract students to the Ocean Sciences.

- Messaging that resonates with diverse populations and highlights how Ocean Science careers can serve their communities.

- Emphasize skill development and their application across a diverse array of fields.

- Develop programs and recruitment strategies that engage students early in their academic careers (e.g. NIH-MARC, NIH-MBRS).
SACNAS (Formerly Society for the Advancement of Chicanos and Native Americans in Science)

- The largest society in the U.S. focused on advancing the participation of minority students in the sciences.
SACNAS Background

- Founded in 1973 by 8 graduate students, (7 Biomed, 1 Math), 7 Hispanic/Chicano, 1 Native American.

- Primarily Funded by NIH and NSF.

- Main activity is their annual conference which attracts approximately 5000 attendees.

- Majority of attendees are students in biomedical related fields.
Ocean Science at SACNAS

- Prior to 2004, a minimal Ocean Science presence at SACNAS.

- In 2004, first formal Ocean Science session was held at SACNAS meeting in Austin, Texas.

- Organizers: Dr. Corey Garza, Dr. Sarah Mesnick (NOAA), Dr. Lisa Torres (CSULA).

- Approximately 30 attendees and 4 student posters.
Lessons Learned

• Advertising—Because of the heavy biomed presence at SACNAS, other disciplines can get overlooked without advertisements.

• Student Understanding—Students had a very different outlook on the field. Most saw it as a soft/niche science. The use of molecular, mathematical and computer approaches in Ocean Science was surprising to students in attendance.

• Coordination—Realized after the conference that they were a few other Ocean Science individuals at the meeting. We needed to do a better job of coordinating with them.
SACNAS 2006

• Many of our lessons learned were implemented for the 2006 SACNAS meeting in Tampa, Florida.

• We initiated a large advertising campaign both before and during the conference. Solicited student presentations through our ads.

• Coordinated with Drs. Claudia Benitez-Nelson and Ray Torres (USC) to co-advertise our sessions.

• Our session integrated a student panel focusing on their pathways and the skill sets they used in their academic work. Ashanti Johnson was the main speaker.
Session Results

- 400 attendees at the session.
- 25 poster submissions
- Learned there was a larger pot of funds being donated by NOAA that was being placed into a general award fund.
- Gained a valuable ally within SACNAS.
Remaining Barriers

- The large number of student attendees was surprising to SACNAS leadership. Society did not anticipate this type of student interest in Ocean Science.

- This grabbed the attention of other senior scientists within SACNAS who were still not clear what a career in Ocean Science entailed.

- We still needed to educate the faculty level scientists within SACNAS.

- Stable funding was still an issue.
A key ally: Dr. Diana Marinez

• Former professor of Biochemistry and Chair of College of Natural Sciences at Michigan State University.

• Former Dean of College of Science and Technology at Texas A&M, Corpus Christi.

• Founding member of SACNAS.

• A key ally after 2006 meeting.
Why the alliance?

• An undergraduate in her program at Texas A&M won one of the first student poster awards in Ocean Science.

• Texas A&M, CC is an HSI with large programs in Fisheries and Wildlife as well as Marine Biology.

• Recognizing she needed to present her students with examples of minorities working in Ocean Science, she invited me out to her campus for a 3 day outreach event.

• Was able to explain to her the Ocean Science presence we were trying to establish at the yearly conference.

• In turn she offered key advice on how to navigate the SACNAS hierarchy and advocated to their program committee to set aside a slot for an Ocean Science session.
SACNAS 2008

• The SACNAS 2008 session in Salt Lake City, Utah provided another key moment in the development of an Ocean Science presence at SACNAS.

• COSEE became involved in the SACNAS Ocean Science programs.

• Was approached by Gail Scowcroft of COSEE about having them involved in the yearly programming (“The coffee line meeting”).

• The involvement of COSEE would lead to the development of professional development sessions, provide speaker funding and help build a network of Ocean Scientists at SACNAS.
SACNAS 2008-current

- Yearly scientific and professional development sessions.
- Regular undergraduate poster session.
- Graduate student talks.
- Conversations with Scientists.
- Student presentation award funding from NOAA Fisheries and Maryland Sea Grant (Dr. Fredrika Moser).
- Ocean Science row in main exhibit hall.
SACNAS Activities

Ocean Science Row

Student Posters

Ocean Science Talks

Presentation Judges
Student Successes

Dr. Serena Moseman-Valtierra
SACNAS Student Participant
Assistant Professor, URI

Dr. Elisa Maldonado
SACNAS Student Participant
Director, UCSD-SIO STARS

Dr. Michael Navarro
SACNAS Student Participant
NSF Postdoctoral Fellow
Remaining Challenges

- Stable funding for Ocean Science programs.
- Stable frequency in graduate student sessions.
- Fluctuating institutional memory within SACNAS administration.
- Lack of Ocean Science representation on SACNAS Board of Directors.
- Ongoing need to educate existing and emerging faculty level scientists within SACNAS about the Ocean Sciences.
Long term outcomes of SACNAS programs

- Increased student attendance at SACNAS Ocean Science sessions (average 100 attendees/year/session).
- Increased number of student poster presentations (60-80/year).
- Improved student understanding of Ocean Science academic and career pathways.
- Coordinated network of Ocean Scientists available to students at SACNAS conference.
- New linkages between agency program directors (e.g. NSF REU) and Ocean Science participants at SACNAS providing new opportunities for increasing diversity in the Ocean Sciences.
Monterey Bay Regional Ocean Science REU

- A new program within the REU network that arose out of connections developed at SACNAS.

- Focused on recruiting students from underrepresented groups in Ocean Science using lessons learned from SACNAS.

- Additional emphasis on recruiting community college students.

- Uses a distributed model to increase research options for students.

- First CSU Ocean Science REU
California State University System (CSU)

- The nation’s largest four-year public university system.

- Educates 437,000 students on 23 campuses, 87% of whom are undergraduates, with over 76,000 bachelor’s degrees conferred annually.

- Draws students from the top third of the state’s high school graduates, placing it between the more selective University of California system and the open-access California Community Colleges.

- In Fall 2012, 37% of CSU students were of Hispanic/Latino, African American, or American Indian decent. The CSU awards more than half of all undergraduate degrees granted to students from these groups in California.
CSUMB History & Stats

• Founded in 1994.

• Hispanic-Serving Institution.

• 34% from historically underrepresented groups, 47% first-generation college students, and 30% low-income.

• Predominantly undergraduate (6,200 UG and 300 graduate students).

• More than half of our students live on campus, and 83% are under the age of 25.

• Home to CSU COAST (Council on Ocean Affairs Science and Technology).
Monterey Bay Regional Ocean Science REU

- Distributed REU Model
- California State University, Monterey Bay
- Elkhorn Slough National Estuarine Research Reserve
- Hopkins Marine Station of Stanford University
- Monterey Bay Aquarium Research Institute
- Moss Landing Marine Labs
- Naval Postgraduate School
- 40-50 potential mentors.
Monterey Bay Regional Ocean Science REU

- 10 week program in Ocean Science
- Rising Sophomores and Juniors
- Emphasis on the participation of students from underrepresented groups and institutions where research opportunities are limited (Community Colleges, HBCUs, HSIs and Tribal Colleges/Universities).
- A diversity of people in a diversity of disciplines.
A graduate school specializing in training U.S. Naval and civilian personnel in the use of advanced oceanographic modeling and engineering techniques, the Naval Postgraduate School will serve as one of our host institutions for the 2014 Monterey Bay Regional Ocean Science REU. Follow the link below for additional information on the school and the research opportunities that they offer:

http://www.nps.edu/
Monterey Bay Regional Ocean Science REU

- In addition to diverse research experiences, additional program elements are included.
- Pre-REU mentor training workshop.
- A mentor commitment form outlining expectations for mentors in the program.
- Pre-REU Skype meetings between mentors and mentees to discuss summer research project.
- Graduate school preparation workshop.
- Marine research techniques workshops (GIS, boating, scientific communication).
- REU seminar series
- State funded REU program and curriculum coordinator (Dr. Bridgette Clarkston).
Student Data

- 11 students in the program
- 1 Native American (Costanoan Rumsen), 2 African American, 2 Hispanic/Chicano, 1 Pacific Islander, 5 Caucasian.
- 9 students from research limited institutions (2 Community College students).
- 2 Engineering, 3 Oceanography, 1 Geology, 5 Marine Biology/Ecology
REU Student Profile: Anika Knight

• Pre-vet student at Medaille College in Buffalo, NY.
• Early on in her academic career was presented with professional degree pathways (e.g. pre-med, pre-vet) as her primary options in the sciences.
• As a junior had begun having doubts about her major.
• Applied to the REU because she originally had an interest in Ocean Science.
REU Student Profile: Anika Knight

• Worked with Drs. Giulio DeLeo and Sanna Sokolow (disease ecologists) of Hopkins Marine Station.
• Investigated spatial variation in the outbreak of Schistosomiasis in Coastal Africa.
• Integrated GIS training with her existing background in the veterinary sciences.
• Presenting her work at 2014 meeting of Western Society of Naturalists.
• Currently working on graduate school applications to Stanford and UC Davis with a focus on marine disease ecology.
Post-REU

• A series of webinars focused on applying to graduate school, pursuing the next research internship and preparing for conferences are being offered.

• Students are now part of an REU LinkedIn page that provides them with job, internship and graduate school opportunities.
Post-REU

- Bi-weekly emails to REU students from REU program coordinator (upcoming conferences, fellowship deadlines, etc.).

- Outreach coordinator is being hired in conjunction with our Undergraduate Research Opportunities Center (UROC). Spanish speaker with experience in using social media.

- Re-design of current REU site to include Spanish language version.
Post-REU

• Student presentations at conferences: 4 SACNAS, 5 Western Society of Naturalists, 1 AGU, 1 ASLO, 1 EPOC.

• 5 students are actively working on graduate school applications.

• 1 community college student in Computer Engineering at CSUMB, another is in Environmental Engineering at UGA.

• 2 papers are currently in preparation for publication.
Lessons Learned

• The number of research pathways offered through the distributed model enhanced the diversity of student applicants to the programs (disciplines and ethnicity).

• Pre-REU mentor training and clearly outlining mentor responsibilities and support structures provided a richer experience for students and mentors.

• Students engaged much more actively with social media than email or static webpages.

• Post-REU programming keeps students engaged in their disciplines and helps guide them towards the next steps in their career.

• Staffing REUs is critical in facilitating many key educational activities.
Remaining Challenges

• Unclear student understanding of what an REU is, the Ocean Sciences and how to apply to an REU (national level issue).

• Recruiting at Community Colleges presents a challenge. Need to learn academic culture and how students perceive their place in science.

• Working with mentors at predominantly graduate institutions during the application process to help them understand the skills students are coming in with.
Additional Examples

- CSUMB UROC (Undergraduate Research Opportunities Center)
- CSU COAST (Council on Ocean Affairs Science and Technology)
- Ocean Opportunities
Undergraduate Research Opportunities Center (UROC) Mission

• Mission is to build students’ educational ownership, intellectual vibrancy, and scholarly identity.

• Achieved through mentored undergraduate research; rigorous, authentic, and calibrated scholarly activities; and the development of intellectual, personal, and social capital.

• Students predominantly drawn from Freshman and Sophomore levels.
UROC History & Stats

• Launched in January 2009.
• Home of CSUMB’s McNair Scholars program, Louis Stokes Alliance for Minority Participation (LSAMP) program, HSI STEM & Articulation, and other grant-funded undergraduate research initiatives.
• UROC has placed 420 students across 18 majors in funded undergraduate research experiences.
• 37 UROC’ers are in Master’s degree programs and 25 are in Ph.D. degree programs.
• 13 UROC’ers received fellowships from the National Science Foundation’s Graduate Research Fellowship Program.
UROC Demographics (2013-14)

• In 2013-14, UROC supported 190 students in undergraduate research. Of those students:
  • 38% were underrepresented in higher education.
  • 39% were low income.
  • 48% were first generation.
Key UROC Services for Students

- Four-semester Undergraduate Research Seminar series.
- Workshops, lectures, and panels.
- Identification, planning, guidance, and preparation for UR experiences.
- Paid undergraduate research experiences.
- Preparation and travel support for professional conferences and graduate school visits.
- Cohort development and leadership opportunities.
Key UROC Services for Faculty

- Support of research-based curriculum development through faculty buyout time and research equipment.
- Support of faculty research through undergraduate student time and mentoring support (financial and training).
- Collaboration on proposals and matching funds.
- Advanced mentor training for scholarly student achievement.
- Recognition through internal and external communications.

These services help maintain close connections to faculty and re-enforce faculty buy-in.
A sustained and visible role on campus – along with a clearly articulated vision – cultivates campus support.

Key UROC Services for Campus

- Cultivation of an undergraduate research (UR) supportive campus culture.
- Recognition of faculty contributions to UR.
- Support of graduate student and faculty mentoring through training workshops and recognition.
- Assessment of UR impact and alumni tracking.
- Marketing and outreach support.
- Increased visibility to funders, agencies, and policy-makers.
- Build and maintain relationships with regional research agencies and institutions.
CSU COAST (Council on Ocean Affairs Science and Technology)

- Founded in 2009

- A CSU affinity group. Ocean Science resources of all 23 campuses consolidated under COAST.

- Provides CSU wide student travel and research support in the Ocean Sciences.

- New intern program focused on engaging Freshman and Sophomores interested in Ocean Science.
Training a new generation of scientists

- CSU COAST Geospatial Research Education and Technology Network (GREAT) http://www.calstate.edu/coast/GREAT/

- Provides training in and access to marine geospatial technologies for CSU faculty and students.
Ocean Opportunities

- A community effort coordinated through WHOI to improve recruitment and outreach strategies to engage student populations underrepresented in the sciences.

- Founded in 2012 with funding from the Deerbrook Charitable Trust.

- A webpage that provides clear messaging about Ocean Science pathways is available to students.

- An information booth travels to conferences such as SACNAS, AGU and ASLO.

- Groups of students are provided with graduate school immersion experiences at Scripps, WHOI and University of South Florida. Students experience life as a graduate student, get information on application strategies and are presented with the research opportunities available at each host campus.
Ocean Sciences: Dive in!

Ocean of Opportunities is a partnership between science, math, and engineering faculty at minority-serving institutions and graduate program administrators to recruit students for ocean science and engineering graduate programs. The partnership is dedicated to promoting the development and training of a diverse and thriving ocean sciences workforce.

Ocean scientists are working to:
Geology & Geophysics

Ocean geologists (geological oceanographers) study seafloor features and the rocks and sediments that comprise these features. In the 1960s, ocean geologists led a revolution in Earth science when they developed the theory of plate tectonics and associated continental drift using evidence provided by seafloor measurements. By combining their knowledge of marine chemistry and physical oceanography, marine geologists help piece together information about how the Earth formed and how the movement of plates and continents results in events such as volcanoes and earthquakes. By examining the distribution of microfossils (such as fossil foraminifera) in cores collected from the seafloor, paleoclimatologists seek to understand past changes in the Earth’s climate and the causes for those changes. Coastal geologists study coastal processes, effects of sea level change on coastal environments, the fate of sediments entering the ocean from rivers, and the impacts of ground water entering the coastal ocean.

Preparing in High School For majoring in Geology in college
1. Take as many science courses as you can in high school, including biology, chemistry and physics.
2. Take as many math courses as you can, including Algebra I and II, trigonometry, and calculus.
3. Take computer classes. Computing skills including word processing and data analysis programs are very important.
4. Take English, literature and speech classes. Although it might not seem intuitive, communication skills are extremely important for success in a science career.

Sample course requirements to earn a bachelor’s degree in Geology:
- New Mexico Institute of Mining and Technology – Earth Science (pdf)
- Humboldt State University (pdf)
- St. Lawrence University
- Princeton University
Graduate School Visits
Summary

• Increasing diversity in the Ocean Sciences will require our community to engage in innovative outreach approaches.

• Messaging that resonates with the cultural values of diverse student communities (e.g. service to community).

• Stronger engagement with first and second year undergraduates.

• New recruitment strategies that include establishing a presence at community colleges.
Summary

• Emphasizing the development of technical skills and their application across a broader array of career pathways.

• Coordinating outreach efforts across the broader Ocean Science community.

• Developing faculty buy in to engage in research with first and second year students and bring research into the classroom.
Questions?
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