

Some Reflections on the Origin, Challenges and Contributions of
Marine Science Degree Programs at Savannah State University

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I don't have a copy of the Job Announcement from the Chronicle of Higher Education but it came at the right time in the fall of 1979 for me as I was completing my dissertation and had scheduled the defense in the Department of Ecology and Evolutionary Biology at the University of Arizona in Tucson. I applied and was invited for an interview at Savannah State College in December 1979. In June 1979 the Board of Regents of the University System of Georgia had approved Bachelor of Science degree programs in Marine Biology and Environmental Studies. The former was both controversial and unique in the System but came about by the strong insistence of Acting President Dr. Clyde W. Hall and Chair of Department of Biology and Life Sciences (later Dean of the College of Sciences and Technology) Dr. Margaret C. Robinson (Hall 1991). Indeed their personal commitments to the program more than balanced the challenge of recruiting minority white students to an HBCU in order to prevent elimination of the program for failing to enroll students and meet the obligations of College's part of *A Plan for Further Desegregation of the University System of Georgia* that was submitted to the Office of Civil Rights and approved in 1974 (Hall 1991).

I felt uniquely equipped – academically, morally and spiritually - if I may use those terms, to use my experience and instincts to make a go of this new degree program. The plan was strongly opposed by many at the College and in the community. It was even legally challenged. As soon as I arrived, besides being mistaken for a student, I was surprised at how willing faculty and staff were to share observations like 'You're wasting your time here. That program will never succeed. White folks won't come. Blacks aren't aquatic.' I thanked them for being so kind as to share their interesting opinions with me but we had work to do and I had the support of a weaponized educator/administrator/supervisor/mentor, colleagues like Dr. Charles Elmore and an early mentor in the late 1950s who taught me to swim and regaled us with SCUBA diving stories of exotic marine life who happened to be Black, the Director of Aquatics at the Hartford, Connecticut YMCA and founder of the oldest SCUBA diving club in New England – Mr. Lee Prettyman Jr. Having had a glimpse of what he had to endure and seeing the incendiary events unfold in the early years of the civil rights movement in Hartford, CT, I was motivated to be part of his legacy.

During its first 35 years the B.S. degree program (initially, Marine Biology - now Marine Sciences) enrolled and graduated both African American and white students in nearly equal numbers. By the time I retired in 2011 there had been 194 graduates (92 African American, 94 white (non-Hispanic), and 8 other [Black international, Hispanic, Pacific Island, Asian, and multi-ethnic]) of Marine Sciences degree programs (159 B.S. degrees and 35 M.S. degrees).

From 2002-2012, SSU graduated 9 of the reported 19 (47%) African-American Master's degree recipients in the Ocean Sciences and 43 of the 48 (89%) reported African-American Bachelor's degree recipients in the Ocean Sciences (NSF, 2014).

Nineteen percent of SSU Marine Science undergraduates have gone on to master's programs; thirty percent of the master's degree graduates enter doctoral programs; thirty-three percent of all the master's degrees in marine/ocean sciences earned by African-Americans in the U.S. between 2004 and 2007 came from SSU. Of all Marine Science B.S. and M.S. recipients at SSU, approximately 80% have earned jobs working within the discipline in state and federal labs and agencies (DNR, USACE, NOAA), aquariums, K-12 science teaching or were admitted to graduate programs.

By the time the Marine Biology Building and dock were dedicated in 1989, I had learned a lot about why underrepresented minorities (URMs; African Americans, Hispanic Americans, and American Indians/Alaska Natives) do not participate in higher education in the same proportion as non-Hispanic whites. URMs represent a much lower share of the degrees earned in the geosciences, which includes ocean sciences, than all other science fields (National Science Board 2006). Historically Black Colleges and Universities (HBCUs) are substantially more effective in science education. HBCUs enroll only 13% of African American college students, yet they award 40% of the science degrees earned by African Americans (President's Board of Advisors on HBCUs 1999, NCES, and my testimony before the U.S. Commission on Ocean Policy USCOP 2004). Factors responsible for this high success rate include supportive environments with small class sizes, high faculty-to-student ratio, and diverse faculty and student bodies compared to more traditional majority institutions (Culotta 1992, Gilligan 1996).

There is a growing body of recent data, papers, strategies, and commentaries addressing demographic shifts in the U.S. population and the need for strategies to ensure a diverse and innovative future STEM workforce in the USA (The National Academies 2011; PCAST 2012). The recent report by the President's Council of Advisors on Science and Technology forecasts a shortage of one million STEM graduates in the workforce in the next decade (PCAST 2012). Women and minorities only make up 45% of the STEM majors, but comprise 75% of college students (PCAST 2012). The wide-ranging threats to the global ocean require broadly represented and diverse stakeholders to contribute to finding solutions. The literature also provides examples of what works to increase participation by underrepresented groups in marine sciences (Bingham et al. 2003; Cuker 2001, 2005; Gilligan 1994, 1996; Gilligan et al. 2007; IOOS-COOS Report; Klug et al. 2002; National Science Board 2006; ORAP Education Report 2002; Pew 2003; SAML Report; USCOP 2004; National Marine Sanctuary Foundation, 2006; Tsui 2007; Graham et al. 2013). One of the key findings of this literature is that there are 10 main factors that lead to increasing diversity and success of minority students in the STEM fields (Tsui 2007; early intervention, tutoring, strong mentoring, academic advising, research experience, career counseling and awareness, campus learning centers, financial support, and workshops and seminars, curriculum and instructional reform).

I was the co-author of proposals for research and training programs that brought nearly \$9 million in external funding for research and training programs to the University. A large portion of the budgets of those programs were undergraduate research assistantships and graduate research fellowships. I consider my greatest contribution to be innovation and transformation associated with the National Science Foundation's Research Experiences for Undergraduates (REU) Site Program.

In the Early 1990s REU opportunities were typically available to upper division (rising juniors and seniors) only and sought students with strong science coursework, backgrounds and skills presumably in order to minimize training time and quickly integrate them into research labs and embryonic graduate students. A new model developed jointly by Dr. Sue Cook, Director of Education at the Harbor Branch Oceanographic Institution in Fort Pierce, Florida and I in 1994 was called the Bridge to Research in Marine Sciences (NSF OCE-9402526 and OCE-9619799, PI: M. Gilligan) and improved by the more recent SSU Bridge to Research REU Programs (NSF OCE-0851929, PI: M. Gilligan and NSF-OCE-1156525, PI: T. Cox).

The overarching mission of the Bridge Program is to increase retention of under-represented groups in marine sciences by recruiting, training, and inspiring early undergraduates through an authentic research experience. Specifically, our objectives are to increase students': 1) ability to conceptualize scientific research; 2) communication skills; 3) career-related skills; and 4) career aspirations. The innovative elements are targeting URMs who have not had exposure to research (primarily at freshman and sophomore levels), broad exposure to ocean science research and research environments, and multi-week skills development prior to mentor matching.

After a decade of teaching marine courses and trying to build enrollment in the new B.S. degree in Marine Biology at SSU I saw clearly that course, lab and field studies at the freshmen and sophomore level as well as having a critical mass of students including a core of high-achieving leaders were the key to retention and success of URMs in marine sciences. The PCAST (2012) report highlights the importance of targeting early undergraduates to increase retention. Thus, the original Bridge program was visionary and a prototype for the new focus on early undergraduates. The Bridge program is designed to attract students at earlier stages of professional development (particularly targeting underclassmen), who have had little or no prior research experience. This selection process is effective in screening qualified individuals from underrepresented groups at a 'critical time' in their academic careers, when they are choosing a major and need exposure to non-traditional professional/academic areas of interest (Graham et al. 2013). Our program aims to give students a research experience as well as increase those students' confidence, one of the two most important factors recently identified as leading to retention (Graham et al. 2013). Two additional benefits of the 'early' strategy are that the experience could contribute to solidifying choice of a STEM discipline and make students more competitive to be accepted to traditional REU programs which accept mainly upperclassmen or rising seniors. Thus a guiding principle emerges: 'critical time' screening results in 'critical mass' participation by underrepresented groups. There is extra cost in doing so in terms of time spent bringing participants 'up to speed' to participate effectively in research environments. We provide this extra support through short courses, workshops, assignments in the first weeks of the program and careful mentoring processes thereafter.

Mentoring of students is always a key ingredient to successful internships, whether measured by retention or post-internship evaluation. Internship stipends are fundamentally important in initially attracting applicants, but success is largely predicated upon the quality of the mentoring received by the students. Faculty mentors at Savannah State University have abundant experience working with and mentoring minority undergraduates and faculty mentors at the partner institutions also have substantial experience mentoring minorities and authored a paper on best practices in this area (Verity et al., 2002). New faculty mentors from partnering institutions not experienced with students from a variety of backgrounds receive advice through direct peer discussions prior to accepting the role of mentorship and during the mentoring period.

In recent end-of-program surveys, 79% of the REU participants changed or reinforced their plans to continue with graduate degree programs in the STEM fields. In addition, SmartSense conducted a follow-up survey of all previous participants (2009-2013). Forty of the 59 past participants responded. Twenty-one are still completing their undergraduate degrees; 17 (81%) of those are STEM undergraduates, and 4 did not report their majors. Of the 19 that have graduated, six are in graduate school or have graduated with an MS degree; four are working in non-academic STEM jobs; one is applying to PhD programs; and one is pursuing graduate school. Combined, that equals a 75% retention rate (31/40) in the STEM field.

The previous 6 years of the program have demonstrated our broader impacts with high racial and geographic diversity in our participants. In the time that the SSU Bridge to Research REU Program has operated, 75% of the REU participants have been retained in the STEM field. Because our program uniquely focuses on freshmen and sophomores, we only have limited data on students actually continuing on to graduate school, but of the 40 total respondents to a recent survey (of the 59 previous participants), 31 participants (78%) have attended, currently attend, or plan to attend graduate school.



SSU Bridge to Research REU Program Summer 2014 participants, some of the mentors and the author.

While the data support that the program is making a substantial contribution to retention of under-represented populations in the STEM field, numbers do not fully capture the true success of a program. Rather, the path of one student can be illustrative of the success of our program. Kiara Gomez was a participant in the Bridge program in Summer 2011. She wrote the following in her application essay, which asks applicants to describe a hardship they have had to overcome:



Kiara Gomez

Four years ago, I thought college was impossible for me and that my dreams of becoming a scientist would end after my high school graduation. I was working two jobs to pay the rent and some bills while juggling extracurricular activities. My mother did not want me to go to college on a loan and my father was never present I (sic) my life to give me advice. I promised her I would work hard to get a scholarship, but she did not believe me because she thought I was incapable because of my speech problem.

...Aside from having an economic hardship, I have had to deal with a speech impediment in which has set me back in school several times and it was the reason why it was hard for my mother to believe in my dream. In middle school, I was always placed in lower leveled classes because my speech impediment was seen as a reason to be in special education.

She went on to describe how she overcame these hardships and entered Smith College. She participated in the Bridge program after her freshman year. After the Bridge program, she completed two more internships – one in education, one in geological research. She graduated in June 2014 and immediately travelled to Greece to study oceanography on a Fulbright fellowship. She wrote this in an e-mail:

I just wanted to inform you that I have been selected for a 2014-2015 Research Fulbright U.S. Student Award to Greece (in the field of oceanography). This would have not been at all possible if it were not for my exposure to marine science during my REU, and I thank you again for allowing me to participate!... the skills that I acquired from the REU program were applicable (researching literature, asking and asking the right questions, preparing a powerpoint, writing a paper, etc) and I felt more prepared than others in my department in terms of presenting and navigating my schools library website for references and primary literature. Kiara Gomez, June 2014

In summary, the program takes risks on students who have had many obstacles in their lives, but the rewards can be huge, for the students and for the geosciences.

Finally, while chair of the education and diversity committees of the Southern and National Associations of Marine Laboratories, my advocacy and sharing of best practices of education and diversity, especially through linkages among marine laboratories, oceanographic institutions and minority-serving institutions, has been regarded by some important/effective peer mentoring. Upon retirement at SSU in 2011 I was nominated and approved as an emeritus member of the National Association of Marine Laboratories.

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