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Introduction

By Ellen S. Kappel

WHY ANOTHER “WOMEN IN OCEANOGRAPHY”?

A decade ago—March 2005—The Oceanography Society published a special issue of this magazine on “Women in Oceanography.” The issue’s goal was to explore why men continued to vastly outnumber women at the higher levels of the field, even as the number of female graduate students grew steadily. We captured our story through statistical measures, longer narratives, articles describing some innovative US programs that were conceived to promote women and retain them in science, technology, engineering and mathematics (STEM) fields, and one-page autobiographical sketches written by women oceanographers (<http://tos.org/oceanography/archive/18-1.html>). In stitching together this latest compendium, “Women in Oceanography: A Decade Later,” the steering committee (Box 1) used the same tools to illuminate both the progress that has been made in addressing career barriers since the last volume was published and areas where further attention might still be needed.

Some of the women who were invited to contribute to this supplement wanted to know why we needed to perform this exercise again, implying that gender equity is an outdated issue. Look around—professional women are more visible at every level. Women oceanographers have won major awards. They are directors of large oceanographic institutions and head major US federal government agencies. But despite these well-deserved achievements, the numbers make clear that the oceanographic community should not be complacent and must continually expose inequities and consciously promote our female colleagues because gender bias still exists, even in our highly educated circles.

The seed for this second “Women in Oceanography” volume was planted a few years ago during informal discussions with a small group of women oceanographers. They advised that the timing had to be right. The consensus was that 10 years after last volume was published made the most sense. A decade was a reasonable period of time over which to evaluate any progress made in retaining women in the field, and some of the programs described 10 years ago would

have matured to a point where evaluation was possible. The next step was to elevate our group into a more formal steering committee and include some early career women oceanographers and others who were interested in the topic.

Like the first “Women in Oceanography” volume, this compendium consists of a few articles that review the issues and evaluate the numbers, two articles that review US programs intended to help promote women and retain them in oceanography, and more than 200 autobiographical sketches that provide a more personal view of the joys and struggles of being a woman oceanographer. **ORCUTT AND CETINIĆ** provide an overview of STEM issues related to gender and the unique challenges that women oceanographers face in pursuing a successful career. They probe a bit more deeply into the number of junior, mid-career, and senior faculty at 26 institutions in the United States with oceanography programs, review the number of women chief scientists on some US and non-US research vessels, and offer some recommendations for overcoming the challenges. **O’CONNELL** compares the numbers of PhD graduates in the geosciences and those in the specific oceanography discipline at US universities to the percentage of women who serve on oceanographic institution faculties, have been co-chief scientists on scientific ocean drilling ships, or have been named fellows of geoscience

BOX 1. STEERING COMMITTEE

CHAIR: Ellen Kappel, Geosciences Professional Services Inc.

Robin Bell, Lamont-Doherty Earth Observatory of Columbia University

Kristen Buck, University of South Florida

Sarah Clem, Duke University

Peggy Delaney, University of California, Santa Cruz

Sonya Legg, Princeton University

Susan Lozier, Duke University

Amelia Shevenell, University of South Florida

LuAnne Thompson, University of Washington

societies in the past decade. **KAPPEL AND THOMPSON** look more specifically at how many women have been invited speakers at small conferences, first authors of *Oceanography* articles, and American Geophysical Union Ocean Science Fellows. **HOLMES** discusses some of the barriers to retaining women in STEM fields exposed by the US National Science Foundation's ADVANCE program and offers solutions that focus on transforming the institutions, not fixing the women. **CLEM ET AL.** review the success of the Mentoring Physical Oceanography Women to Increase Retention (MPOWIR) program in retaining women in that specific field and how the program continues to evolve and improve after each evaluation.

While these articles focus on US numbers and issues, the autobiographical sketches contributed by women from

around the globe provide a broader view of women in oceanography. These essays trace the career trajectories of women who shared their stories a decade ago and the twists and turns navigated by a new crop of scientists. Several early career scientists emphasize how much the 2005 special issue inspired them when they were graduate students (Box 2). More senior women provide advice on how to navigate career obstacles (Box 3). These autobiographies also provide readers with a wonderful sense of what oceanographers do. The authors describe their science simply, thoughtfully, and passionately. Many cite the enduring friendships and gratifying international collaborations that result from going to sea. The stories bring out the excitement of being on a research vessel to deploy instruments and gather data and the privilege of visiting Antarctica or other exotic places. The stories also demonstrate how committed these women scientists and engineers are to adding critical knowledge about our planet on topics as varied as climate change, ocean health, and natural hazards.

The autobiographical sketches disclose some positive signs for women oceanographers. Many early career women say that they haven't felt any gender bias—though some acknowledge that it is still out there and stay attuned to the signals. These young scientists recognize the efforts of earlier women oceanographers who worked hard to remove barriers to advancement in the field and to going to sea. More-senior women tell of how there are noticeably more women at scientific conferences—heavens, a line at the women's bathroom—and how women are much more visible on ships in the various roles of scientist, technical support staff, and crew. They see more women on their hallways and at faculty meetings, which makes it easier to openly discuss gender-related issues. Deans and department chairs no longer need to be informed of their institutions' stop-the-tenure-clock policies for parents of young children. Some universities now work very positively with dual-career couples who apply for faculty positions.

And yet, the number of women rising through the tenure track appears to be stagnant—and not close to what might be expected given the number of PhDs earned by women a decade or two ago. Similarly, the number of women being elected society fellows, holding chief scientist positions, or being invited to speak at small conferences lags. Several women note in their autobiographies the exceptionally poor turnout of women versus men recently applying for faculty positions at their institutions. If some women

BOX 2. THE 2005 “WOMEN IN OCEANOGRAPHY” SPECIAL ISSUE INSPIRED A NEW GENERATION

One gratifying aspect of putting together this compendium was reading notes from early career scientists saying how the 2005 “Women in Oceanography” volume was an inspiration. If there was any question at all as to whether publishing another compendium was needed, some of these emails dispelled any doubts. Some examples:

“Thanks...for the 2005 issue which was an inspiration while I was in grad school.”

“I am excited to contribute—I was a graduate student when the first article came out and I felt really inspired by the women's autobiographies, all of which I eagerly read!”

“As a graduate student who was inspired by the 2005 volume, it'd be my honor if my article will make a contribution to the upcoming volume.”

“As an aside, thank you very much for making another issue of this topic. Coming out the year before I started graduate school, the first issue gave me important insight into the complex pathways women took in oceanography and served as a fount of advice as I made my own choices. I am looking forward, in particular, to seeing how the lives of all of these women have changed in the past 10 years.”

“I have a copy of the 2005 edition and it was certainly an inspiration to me when I was looking for my job at that time.”

remove themselves from seeking academic jobs early in their careers, and others take jobs but later “leak from the pipeline,” then parity at the full professor level is a long way from being attained.

MANY OF THE SAME ISSUES REMAIN

This “Women in Oceanography: A Decade Later” compendium demonstrates that some issues that plagued women a decade ago persist. Nearly every autobiography describes the work-life balance as the biggest challenge. For a female scientist, having a partner who supports her career and does an equal amount of childcare and housework is the biggest factor in being able to remain competitive, including going to sea for weeks at a time, attending meetings in far-flung places, or staying in the lab for extended hours. Women speak of their well-traveled children who learned early on how to wheel a suitcase or who come to the lab with them on weekends. The flexibility to write papers and proposals at home is cited as another positive family-friendly factor in remaining in academia. This kind of flexibility is valuable for not only staying home with a sick child, but also for caring for aging parents. Needless to say, such flexibility benefits men as well as women.

Doing fieldwork, especially going to sea for weeks or months at a time, will always be a consideration for women (and men) who choose to be observationalists. Some women took a hiatus from going to sea for several years when their children were young. Others temporarily changed their scientific focus to nearshore problems that didn’t require being away for long periods on ships. A few others moved into more computational areas, using publicly available oceanographic data (e.g., from satellites or drifters) so that they didn’t have to go to sea. Another solution that worked for some was to send their graduate students to sea to collect data, at least for a while. Technology has also made it easier to stay on shore and still participate in a cruise. To pursue the science they love and a career that they believe in, women find many creative solutions to maintaining active scientific programs.

The “two-body problem” of partners seeking academic positions at the same institution doesn’t seem to loom as large as it did a decade ago, at least in the United States. One autobiographical sketch from a US scientist stated: “We have been positively overwhelmed by the numerous resources available to us to solve our ‘two-body problem.’” Another discusses how her family’s two-body problem was solved

BOX 3. SOME ADVICE

Women whose autobiographical sketches were published a decade ago were asked to include advice for early career scientists in their updated profiles for in this compendium. By far the most cited advice is to find mentors (women and men) both inside and outside their own institutions—and lean on and gain strength from them. Having a variety of mentors during the early career stages can be essential to success. Having peers helps, too. Several women talked about being part of a group of female colleagues who meet at specified intervals and how these women have been very valuable sounding boards at all stages of their careers.

Our contributors were not shy about offering advice. A few samples:

- Remain focused and keep your priorities clear; be persistent.
- Work on problems that keenly interest you, work with colleagues with whom you feel free to say something stupid or share a laugh, gather mentors, become a mentor yourself, build community.
- Take advantage of all opportunities to expand your horizons and collaborate with colleagues from diverse fields.
- Take something positive from every professional experience—you don’t know what skills will come in handy down the road.
- Take care of female colleagues and find opportunities to enrich our community of women scientists. Reach out to a female colleague and start a new collaboration, co-chair a committee, co-advise a student, or co-teach a course.

at a supportive US institution in a manner that would have been impossible, or at least much more difficult to solve, at home in Europe. Not all the stories are as rosy. Some couples commute long distances or live apart for years in different states or countries to seize the best career opportunities, or one partner compromises his or her career so that the couple can live together. Moreover, sometimes building a career in scientific research prevents women from even reaching the stage of confronting the two-body problem. Early career scientists often move from country to country for postdocs and for jobs until landing something more permanent. While living in another culture can be enriching and the science experience broadening, being a nomad can make it difficult to build long-term relationships, and being far from family and friends can be stressful and lonely.

Many of the autobiographical sketches brought up the issue of funding, which affects women and men alike, both within and outside of the United States. Spending long hours writing proposal after proposal is stressful, and having to propose new and clever ideas when the data gathered from ongoing projects have not been fully analyzed is frustrating. The contraction in science funding creates other anxieties, such as whether sufficient funding will be available to retain graduate students, postdocs, and technical staff and conduct all planned activities. Obligations such as conducting “broader impact” activities and sharing and reporting data eat into productivity. Some women cited the difficulty of remaining optimistic and motivated when constantly struggling to maintain funding. While there is no magic solution to this perennial problem, some of the autobiographies offer suggestions on how to increase funding prospects, such as broadening research in new directions, seeking new collaborations, and applying for funding from a larger variety of sources (from federal agencies to local foundations).

Despite the variety of the impediments encountered along the path to a successful career, the overwhelming majority of the authors of the autobiographies say they love their science and are very happy with their careers. The joy of scientific discovery and the sense of adventure far outweigh the pebbles, boulders, and occasional mountains that they encountered along their journey. Some challenges turned out to be opportunities.

SOME FINAL THOUGHTS

This compendium demonstrates that two complementary paths should be taken to increase retention of women in oceanography. Over the longer term, mentoring and creating supportive work environments are essential. With a concerted effort through organized programs such as MPOWIR and through informal mentoring efforts that become widespread, the number of women who choose academic jobs as a career—and remain to become full professors or senior scientists—should increase, though perhaps slowly. Similarly, family-friendly practices at institutions need to become commonplace as well. More immediately, the oceanographic community consciously needs to promote deserving female colleagues, nominate women for awards, and invite women to speak at a conferences or department seminars

and first-author articles in journals. All of these practices will quickly increase the visibility of outstanding women scientists within and outside of their institutions, whether academic, government, nongovernmental, or industry, and will create positive feedback loops. With women more visible at high-level positions on shore and at sea, gender bias will likely decline as well. If we work together as a community to retain more women in the ranks of professional oceanography, perhaps one last “Women in Oceanography” volume a decade from now can be devoted to highlighting how parity for women has been achieved.

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