

## MENTORING PHYSICAL OCEANOGRAPHY WOMEN TO INCREASE RETENTION

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### ABSTRACT

The proportion of women receiving their PhD in physical oceanography has approached 35–40% at most major oceanographic institutions; however, the number of women with principal investigator status remains fairly low. A 2005 survey of 16 universities/institutions, as well as two government laboratories, found that women comprise 19% of the physical oceanographers in associate-level positions—a position assumed to be held by those who attained their PhDs between 1991 and 1999. Enrollment data from Joint Oceanographic Institutions (JOIs), averaged from 1988 to 2001, show that women constituted nearly 35% of oceanography graduate students. These statistics imply that the retention rate for women was half that for men over this time period. This chapter describes the Mentoring Physical Oceanography Women to Increase Retention (MPOWIR) program, which focuses on the role of mentoring in the early career stages of a young scientist. The primary objectives of MPOWIR are to (1) provide continuity of mentoring from a young woman's graduate career, through her postdoctoral years to the early years of her permanent job; (2) establish a collective rather than an individual responsibility within the physical oceanography community for the mentoring of junior women; (3) provide a variety of mentoring resources and mentors for a range of issues; (4) cast a wide net to avoid exclusiveness; and (5) open this program to all those who self-identify as a physical oceanographer. The impact of MPOWIR so far has been very positive toward improving retention of women.

## 12.1 Background

Efforts over the past several decades toward increasing the number of women entering science and engineering have largely been successful, with undergraduate and graduate school enrollments averaging between 30% and 50% women [Nelson, 2002]. PhD attainments show similar progress. However, the percentage of women occupying tenure-track positions has not risen commensurably. Across the board, women in science and engineering fill, on average, only 15%–25% of academic positions [Nelson, 2002]. Because the number of women in graduate school has been sufficiently large for at least a decade, it is difficult to ascribe the lower percentage of women in entry-level faculty positions to a small pool of potential candidates. Thus, while recruitment efforts should be lauded, we need to also turn our attention to retention if we are to capitalize on the investment that funding agencies and universities have made on the education of women students, and, importantly, if we are to create a scientific workforce whose diversity more closely matches that of the student population and, in a broader sense, that of the U.S. population as a whole.

Ocean sciences provide no exception to these trends. The proportion of women receiving their PhD in physical oceanography has approached 35%–40% at most major oceanographic institutions; however, the number of women with principal investigator status remains fairly low. A 2005 survey of 16 universities/institutions, as well as two government laboratories, found that women make up 19% of the physical oceanographers in associate-level positions, a position assumed to be held by those who attained their PhDs between 1991 and 1999. Enrollment data from Joint Oceanographic Institutions averaged from 1988 to 2001 shows that women constituted ~35% of oceanography graduate students. These statistics imply that the retention rate for women was half that for men over this time period, though historical data, disaggregated by discipline and gender, is needed to compute more accurate retention rates.

The Nelson [2002] diversity study, as well as concerns within the community, prompted members within the physical oceanographic community to examine whether mentoring efforts could aid the retention of junior women in the field. Although institutions are increasingly focusing on the role of mentoring in the early career stages of a young scientist, it is generally recognized that a discipline-based community can also foster success during a scientist's early career. Members of the community can advise a junior scientist on a host of issues, ranging from funding sources to collaborative work to research programs. With this in mind, a group of female physical oceanographers obtained funding from the Office of Naval Research (ONR) and NSF in the spring and summer of 2004 for the purpose of investigating the retention issue of women in the field of physical oceanography and how mentoring might aid such retention. This initial group originated the concept for MPOWIR (Mentoring Physical Oceanography Women to Increase Retention) and formed the first MPOWIR steering committee.

## 12.2. Formulation of MPOWIR

The MPOWIR steering committee recognized that the physical oceanography community could not simply adopt a program that has been developed from another discipline. A career in oceanography is unique in that it often requires sea time, there are few industry jobs, the number of geographical locations where oceanography jobs are available is limited, there are a relatively large proportion of research positions versus academic positions, and the field is relatively small compared with computing sciences, mathematics, physics, and so on. Thus, the aim was to design a program unique to, and designed by, the physical oceanography community. To achieve this goal, the steering committee sought input from a broad segment of the community by hosting a workshop. The committee wanted representation from the spectrum of workplaces for physical oceanographers, as well as from different career stages. Finally, but most importantly, the steering community decided to invite men to participate in this workshop. Men have been providing the bulk of mentoring in the field for many years, and the committee believed it was important to gain from their experience in this endeavor. Such inclusion is also a statement that the committee believes the lack of retention for women in the field is not a “women’s issue” but is instead a community issue.

Many factors contribute to the lack of retention of women scientists: competition between family building and career building, competition between career goals of spouse/partner, lack of female role models, lack of adequate mentoring, and others. While some of these problems are best met with institutional changes, the latter problem in particular is one the physical oceanographic community has decided to address. Toward this end, an NSF- and ONR-funded workshop was conducted at the Airlie Center in Warrenton, Virginia, on October 9–12, 2005. Twenty-nine physical oceanographers, men as well as women, assembled for the purpose of designing a mentoring program for junior women in the field of physical oceanography in order to help remove barriers, real or perceived, in their career development.

During this first official effort, participants followed an agenda established to (1) gather input from the participants that would aid a collective identification of the particular needs for mentoring within the physical oceanographic community, (2) design a mentoring program that would meet those needs, (3) set up an implementation strategy for the program, and (4) establish metrics for measuring the success of the program. MPOWIR workshop participants identified gaps and needs for mentoring that are not currently filled by local institutional mentoring or by the peer mentoring afforded by PODS (Physical Oceanography Dissertation Symposia: <http://www.pods-symposium.org/>).

The initial focus at the workshop was on identifying the obstacles that junior women face in their career development and deciding which of those obstacles could be met by a community-based effort rather than by institutional

efforts. A community-wide survey conducted prior to the workshop provided important input for the mentoring program design. From the survey and workshop discussions, it was concluded that transitions from PhD to postdoc and then from postdoc to entry-level positions were the most vulnerable times for a junior woman in the field. Identified obstacles included exclusion from large programs, lack of collaboration and collaborators, lack of senior women role models, and lack of advice on career development and on balancing work and family. Importantly, the survey results showed that only 30% of the respondents formed a significant mentoring relationship during their postdoctoral years.

To make mentoring accessible to junior women in a wide variety of positions and at different types of workplaces (e.g., research institutions, government labs, universities, industry), workshop participants decided on a multiprong approach with several elements, including a workshop dedicated to mentoring, mentoring groups that meet monthly, and workshops and socials at national meetings. All program elements are described in detail below. Further information on the Airlie workshop can be found in the workshop report [Lozier *et al.*, 2005] and in the meeting report published in *EOS* [Lozier, 2006].

Participants at the MPOWIR workshop designed a community mentoring program that would provide continuity from the PhD attainment through the early years of a young woman's scientific career. Importantly, the workshop participants decided to focus on the collective community responsibility for mentoring rather than on mentoring that matched a single junior scientist with a single senior scientist. The working hypothesis is that a network of mentors would better fulfill the various needs of a junior scientist. Following the workshop, funding from NSF, DOE (Department of Energy), NASA, and ONR was secured for the implementation of MPOWIR program activities in the spring of 2007.

### 12.2.1. Goals of MPOWIR

The primary objectives of MPOWIR are to (1) provide continuity of mentoring from a young woman's graduate career, through her postdoctoral years to the early years of her permanent job, (2) establish a collective rather than an individual responsibility within the physical oceanography community for the mentoring of junior women, (3) provide a variety of mentoring resources and mentors for a range of issues, (4) cast a wide net to avoid exclusiveness, and (5) open this program to all those who self-identify as a physical oceanographer. Each of these goals is intended to make mentoring opportunities universally available and of higher quality by expanding the reach of mentoring opportunities beyond individual home institutions. For the purposes of this initiative, retention is defined as continued employment within the field of physical oceanography. Since the program is focused on retaining junior women through the transition from graduate school to a postdoctoral position, and then from a

postdoctoral position into a permanent appointment, retention is gauged by the percentage of women who remain in the field several years into their first permanent position.

### 12.2.2. Program Elements

**12.2.2.1. Pattullo Conference.** The centerpiece of the MPOWIR program is the Pattullo Conference, named for June Pattullo, the first woman in the United States to receive a PhD in physical oceanography from Scripps Institution of Oceanography in 1957. The first Pattullo Conference was held May 18–21, 2008, in Charleston, South Carolina. Since 2008 there have been Pattullo Conferences in 2010, 2011, and an upcoming conference is planned for 2013. The main goals of the Pattullo Conference are as follows:

- To provide junior women with career advice and feedback on their research
- To build community networks with peers and senior scientists
- To build confidence and skills for promoting one's research
- To raise awareness of issues confronting junior women among the senior scientist community

A variety of session formats are utilized to meet the conference goals. Participants give short research talks on which they receive feedback from other junior and senior scientists. This, in combination with professional development sessions (i.e., negotiations and proposal writing) strengthens participants' confidence and skillsets. Participants actively build networks through meeting in small groups and participating in one-on-one mentoring. Informal interactions at meals and during free time provide additional opportunities for organic conversation and mentoring.

Overall, the Pattullo Conference has reached 75 junior women and 41 senior scientists representing 52 institutions. Based on feedback gathered from the participants, the Pattullo Conference is a valuable experience for everyone involved and has been an extremely successful event. In follow-up surveys administered after each conference, nearly every participant said they would “definitely recommend this conference to another junior scientist” (see Table 12.1). Most importantly, the conference goals were accomplished. In evaluations and in conversation, many junior women spoke of increased confidence and were impressed by the networking opportunities with not only senior scientists but also their peers. One junior participant commented, “I am leaving with more confidence in myself and a much better idea of where I want to go in my career and why I want to do it.” Another participant remarked, “This was a very helpful experience for me as a junior scientist and has definitely increased the likelihood that I will stay in the field.” Many participants state the immediate, tangible benefits of the conference as well: “It provides an opportunity for you to build up your research network, to learn how to apply for funding, and how to manage your time among research and life, etc.”

**Table 12.1** Post-Pattullo Survey (2008, 2010, and 2011) of junior and senior scientists.

	Average Junior Scientist Response	Average Senior Scientist Response
Please rate on a scale of 1–5 (poor–excellent)		
Networking opportunities	4.78	
Professional development opportunities	4.62	
Feedback on research	3.72	
Please rate on a scale of 1–5 (strongly disagree–strongly agree)		
My skills and expertise were used to their fullest		4.22
My time was well spent at this conference		4.78
I had enough information/background about the conference to participate fully		4.54
I would attend another Pattullo Conference		4.78
Please rate on a scale of 1–5 (not valuable–extremely valuable)		
Value to current position	4.62	
Value to future position	4.6	
Overall value	4.69	
Perceived value of conference to a junior scientist		4.76
Perceived value of conference to another senior scientist		4.3
Please rate on a scale of 1–5 (definitely not–definitely)		
Would you recommend this conference to another junior scientist?	4.95	4.97
Would you recommend this conference to another senior scientist?	4.61	4.73

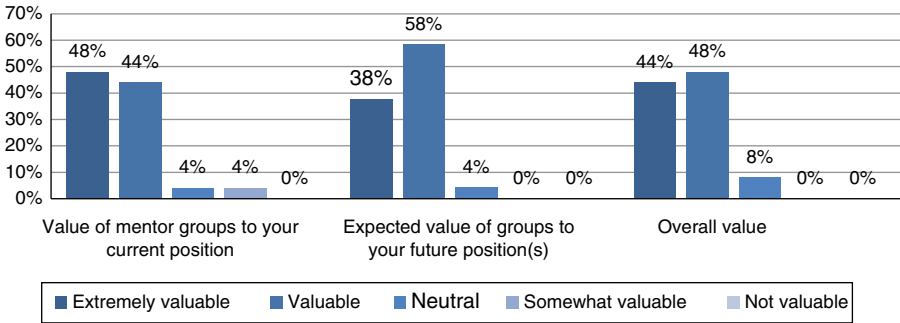
**12.2.2.2. Mentor groups.** To keep the momentum generated by the first Pattullo Conference in 2008, mentoring groups were established the following fall. The mentoring groups are intended to support both peer and traditional mentoring on a smaller, more intimate basis. Each group meets monthly via conference call for approximately 60 minutes. The objectives are to help junior women make connections and gain community support, to offer junior scientists advice and strategies for professional success, and to help them learn from the experiences of both senior scientists and peers.

New mentor groups are formed approximately once a year. MPOWIR announces the opportunity to join a mentor group through e-mail lists and promotion on the MPOWIR Web site. New members are drawn from junior participants from Pattullo Conferences as well as women who have learned about MPOWIR through our Web presence, attendance at town hall sessions, and through colleagues and collaborators. As part of the registration process, background information on research interests, educational level, and affiliations is collected. Groups are matched to maximize similarities in career stage and to minimize overlap with individuals at their home institution. Groups consist of six to nine junior women and two senior facilitators. As of the summer of 2013, six mentoring groups were operational. Groups meet for two years, at which point members have the option to join another mentor group or form a peer group. Peer groups continue with the same format for calls but without the leadership of senior scientists. MPOWIR facilitates peer group meetings for as long as they wish to continue.

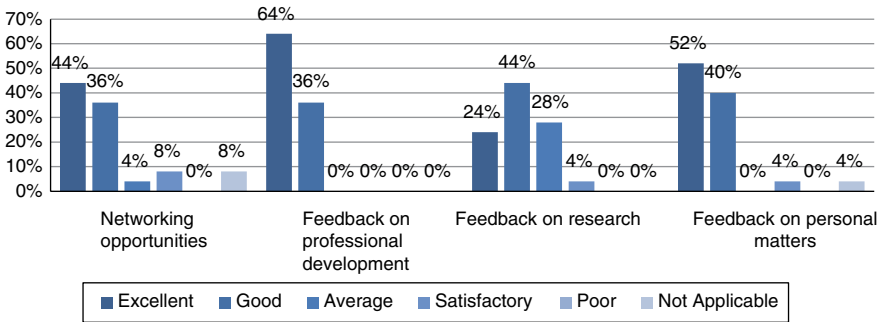
To ensure that the groups offer an immediate tangible benefit to attendees, the junior women are asked to formulate specific goals that they wish to work toward during the coming year. Prior to the first meeting of the mentoring group, each member and mentor leader received a notebook containing the biography and goals for each participant. These goals, along with other topical issues, are discussed during the mentoring group calls. Based on the 2011 survey, 100% of mentor group participants reported that they made progress on their stated scientific, professional, and personal goals. After each call, relevant articles, Web links, and information are often shared with the broader community through the MPOWIR blog.

To evaluate the effectiveness of the mentor groups, MPOWIR conducts an annual survey. Participants are asked what they value about their mentor group, the effect of being in a mentor group in their current position (Figure 12.1), and questions about the logistics and setup of the groups. Based on the survey conducted in 2012, participants all rated mentor group participation as a valuable experience, with particular emphasis on feedback about professional development and on personal matters (Figure 12.2).

**12.2.2.3. Web site.** The MPOWIR website ([www.mpowir.org](http://www.mpowir.org)) is the central place for information on all MPOWIR activities and is intended to provide mentoring opportunities to all physical oceanographers regardless of gender or home



**Figure 12.1** Results of MPOWIR’s 2012 survey to evaluate the effectiveness of mentor groups. For color detail, please see color plate section.



**Figure 12.2** Results of MPOWIR’s 2012 survey showing value of mentor groups to feedback on professional development and personal matters. For color detail, please see color plate section.

institution. As was clear from the geographical distribution of the Pattullo Conference and Mentor Group participants, many junior women are isolated in departments that are not traditionally considered to be “oceanographic.” While this provides an opportunity for fruitful interdisciplinary research, it can also be isolating and create difficulties for their involvement in larger research programs. The Web resources are intended to bridge the geographical divides, to provide information and resources, and to encourage peer and traditional mentoring opportunities. Over the past two years (2010–2012) the Web site has averaged 1,025 visits per month. The resources currently provided on the MPOWIR Web site include the following:

- Profiles of female physical oceanographers, included to illustrate different career paths and provide a context for women in the physical oceanographic community
- Information, registration, and photos from the Pattullo conferences



- Resources associated with tracking, mentoring, and encouraging the participation of women in science
- A blog, which is proving to be an effective venue for the exchange of information and ideas and where job opportunities and articles relevant to women in science are shared

**12.2.2.4. Town hall meetings and socials.** MPOWIR town hall meetings and socials are intended to facilitate networking between physical oceanographers, to provide early career advice and career development information to junior scientists, and to enhance the sense of community. The town hall events are open to all attendees at the ocean sciences meetings, and as such, serve to broadcast the MPOWIR effort and to engage a wider audience. To date MPOWIR has sponsored five events at national meetings:

- *Town hall meeting at Ocean Sciences in 2006:* At Ocean Sciences 2006 in Honolulu, Hawaii, MPOWIR held a town hall meeting to introduce MPOWIR to the oceanographic community. Over 150 people, men and women, attended this informational meeting. At the meeting, a panel of Airlie workshop participants presented the goals and planned activities of the MPOWIR program.
- *AGU Fall Meeting reception in 2007:* At the AGU Fall Meeting in San Francisco in 2007, MPOWIR hosted a social for the purpose of providing networking opportunities for junior researchers in the field.
- *Town hall meeting at Ocean Sciences in 2008:* MPOWIR sponsored a social at the 2008 Ocean Sciences Meeting in Orlando, Florida, on dual-career couples. Dr. Elizabeth Creamer, a professor and researcher of issues related to faculty careers at Virginia Tech, spoke about her research to approximately 75 people. The background and career-stage of the audience was varied, and while many of the audience members were physical oceanographers, scientists from all of ocean science were in attendance. Dr. Creamer presented statistics on the number of dual-career couples in the sciences and summarized recent research about the impact of children and an academic spouse on faculty research productivity.
- *Town hall meeting at Ocean Sciences in 2010:* MPOWIR sponsored a town hall meeting at the 2010 Ocean Sciences Meeting in Portland, Oregon. The meeting, which was titled “Where Do All the Oceanographers Go? Career Paths in Oceanography,” featured a panel discussion exploring career paths taken by oceanographers over the years. It focused on current opportunities for graduates with PhDs in oceanography. There was standing room only at this event.
- *Town hall meeting at Ocean Sciences in 2012:* MPOWIR hosted two town hall events at the Ocean Sciences Meeting in Salt Lake City, Utah, in collaboration with AWIS (Association for Women in Science). Both events

drew on the recent implementation of NSF's Career-Life Balance Initiative. The first event was a panel discussion featuring Joan Herbers (AWIS), Eric Itsweire (NSF), and Debra Bronk (Virginia Institute of Marine Science). Each focused on a different facet of balancing work and life. The second event was an informal discussion about work-life balance.

**12.2.2.5. NOAA internship.** Since 2009 MPOWIR has collaborated with NOAA to provide internship opportunities for graduate students. The goal of the NOAA/MPOWIR internship program is to familiarize junior women in the field of physical oceanography with the research conducted at the NOAA labs and to afford NOAA scientists the opportunity to work with a graduate student on a project of joint interest. Each year, two junior scientists are chosen for an internship at AOML, GFDL, or PMEL (Atlantic Oceanographic and Meteorological Laboratory, Geophysical Fluid Dynamics Laboratory, Pacific Marine Environmental Laboratory). Students are integrated into an ongoing program of mutual interest for a period of 8 to 10 weeks and are mentored by a NOAA researcher. Prior to the start of the internship, the students communicate with their supervisor about their goals and ideas for their project with the aim of a coauthored publication. This opportunity is open to any female scientist who is currently enrolled in a graduate program.

Participants see the internship as an opportunity to meet and work with experts in their field. Interns often comment on the lasting effects of the internship on their career, stating, "The effects of the MPOWIR internship will undoubtedly continue to influence my future work."

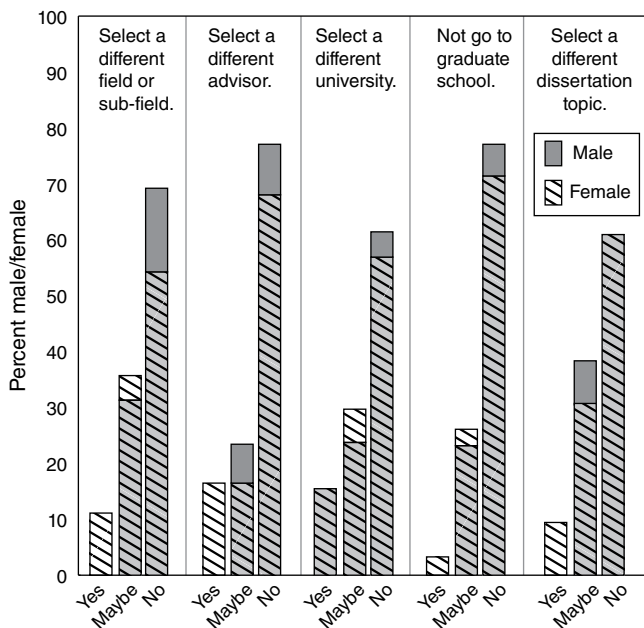
**12.2.2.6. NASA Speaker Series.** The goal of the NASA MPOWIR Speaker Series is to familiarize junior women in the field of physical oceanography with the research conducted at the NASA labs and to inform NASA scientists of the research conducted by junior scientists in the community. Each year, two scientists are chosen to give a seminar at either Jet Propulsion Laboratory or Goddard.

Since 2009 eight junior scientists have participated in the NASA Speaker Series. A past participant summarized the speaker series saying, "NASA MPOWIR Speaker Series was beneficial for allowing me the opportunity to learn about Goddard community and to present my research to them. I left my visit feeling both inspired by the conversations that I had and grateful for the gained insights for how I might better contribute to discussions in similar experiences that I may encounter in the future."

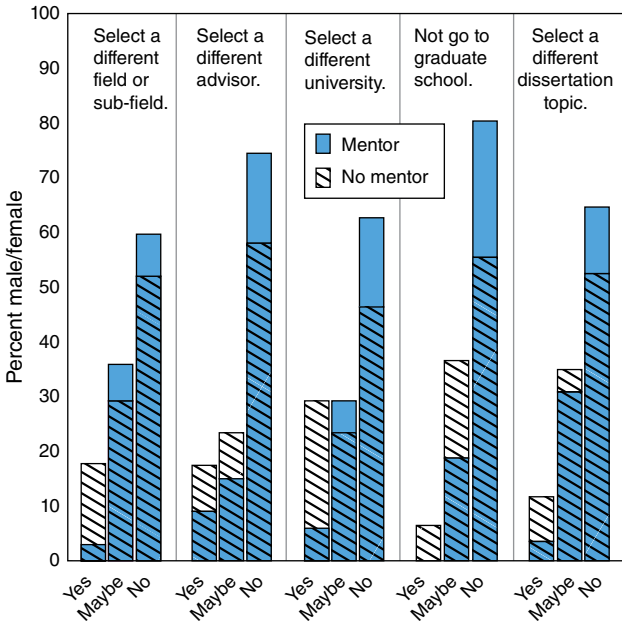
**12.2.2.7. Statistics and surveys.** Beginning in 2005, MPOWIR has gathered gender and discipline-specific information on enrollment and PhD attainment

since 2001 from 25 degree-granting oceanography programs. The gender-specific data gives a concrete measure of graduation rates and retention in the field. As with data collected by NSF and by other researchers, our data shows that nearly 40% of all PhD graduates in physical oceanography are female, and the percentage of women in the field drops sharply as they progress in their careers.

MPOWIR also conducts a comprehensive survey of all graduate students, male and female, enrolled in physical oceanography graduate programs across the country. This survey asks students to reflect on their graduate experience and their attitudes about the field of physical oceanography. While the survey is anonymous, the majority of respondents provided contact information, which will allow us to track their progress and changing attitudes through their early career. Results of two questions from the 2008 canvas illustrate the type of information that we are gathering. As seen in Figure 12.3, men and women responded differently when asked about their advisor relationship and overall graduate student experience, with more women than men, proportionately, reporting negative opinions. While approximately the same proportion of women and men have mentors, women are more likely to have a mentor who is not their academic advisor. Whether



**Figure 12.3** Women are more likely to report that they would change decisions related to their graduate studies.



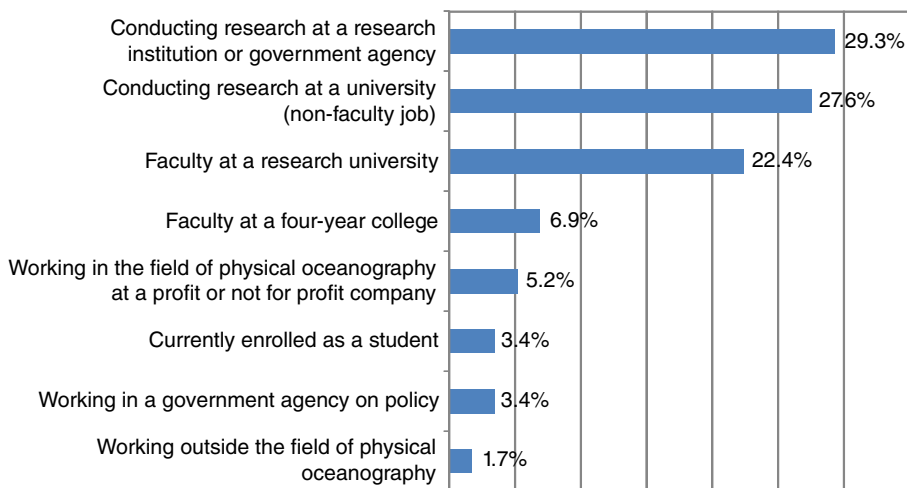
**Figure 12.4** Nearly 40% of both male and female respondents do not have a mentor. Whether or not a student has a mentor significantly affects their attitude toward graduate school. For color detail, please see color plate section.

or not a student has a mentor also affects his or her response. Figure 12.4 suggests that those without mentors have a more difficult graduate school experience and are much more likely to report that they would change decisions related to graduate school.

Once we have repeated this survey for sufficient years to track any evolving attitudes about the field of physical oceanography, we plan to publish the full survey results. These results, and results from future surveys, will help guide our mentoring efforts.

### 12.3. Assessment of MPOWIR

To date, the impact of this proposed work has been measured qualitatively, namely through the participant surveys discussed above. However, since the overall goal of the program is to increase retention, the metric of success is clearly a quantification of retention improvement. At the start of this program, in 2007, a survey was taken of all universities across the country with oceanographic departments. An assessment was made of the gender breakdown at the

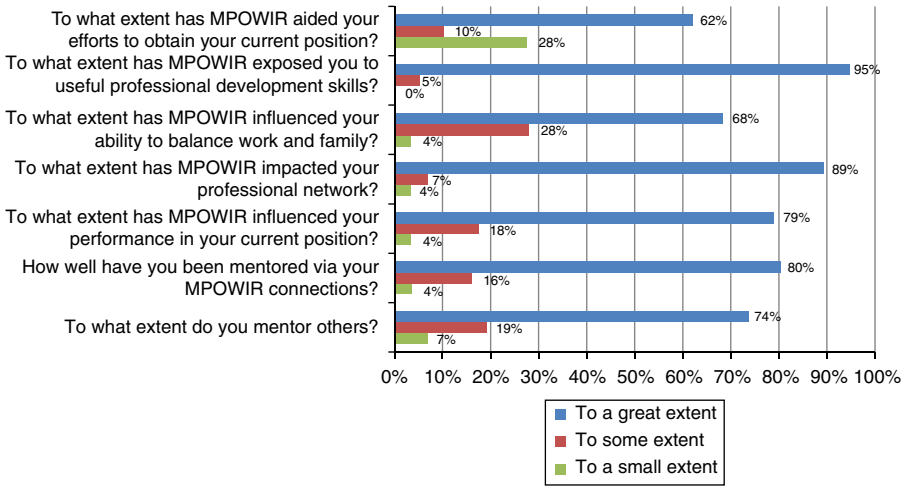


**Figure 12.5** Part I of MPOWIR participant survey. Junior women were asked to indicate their current position.

assistant, associate, and senior scientist position levels. We plan to conduct a similar survey at the 7-year mark of MPOWIR activities, the spring of 2015 (the first Pattullo Conference and the formation of the first mentoring groups were in 2008), to assess the degree to which women have moved into the ranks of assistant scientist/professor ranks. We plan to use the field of chemical oceanography as a control, since it has not had a mentoring program during these past years.

However, this spring, at the 5-year mark of MPOWIR activities, a survey was sent to all junior women who had participated in *Pattullo* [2008 or 2010], and/or in mentor groups starting in 2008, 2009, and 2010, in an effort to assess the impact of MPOWIR on their retention in the field. All of these women joined MPOWIR somewhere between 3 and 5 years ago. Of the 65 participants contacted, 61 responded, resulting in an 89.7% response rate. Of the 61 respondents, only one woman is currently working outside the field of oceanography in an unrelated field (Figure 12.5). Two are currently enrolled as students. All of the others are effectively in the field, with a remarkable 79% conducting research at a university or research institution.

Since the pipeline has historically been “leakiest” at the post-PhD transition, we believe that such retention shows remarkable progress. As for what might explain this retention, Figure 12.6 shows that the participants ranked MPOWIR as having the greatest impact on professional development skills and professional networking opportunities.



**Figure 12.6** Part II of MPOWIR participant survey. Junior women were asked to indicate the overall impact of MPOWIR on their careers. For color detail, please see color plate section.

In conclusion, MPOWIR has seen many anecdotal, yet very positive, responses to programs and offerings, and a recent survey of past participants shows remarkable retention. In the near future, we plan to monitor retention by assessing the percentage of early-career women holding positions in physical oceanography at universities and institutes around the country.

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