

# MPOWIR

Mentoring  
Physical Oceanography Women  
to Increase Retention



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## Mentoring Physical Oceanography Women to Increase Retention

Report of a workshop held October 9-12, 2005  
at the Airlie Center, Warrenton, Virginia

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# Executive Summary

The *Nelson Diversity Study*<sup>1</sup> published in 2002 revealed that despite several decades of increasing enrollments for women in undergraduate and graduate science and engineering programs, women remain underrepresented in science and engineering positions nationwide. The disparity between the number of women trained in a field and the number of women occupying positions in that field is a growing concern because it prevents funding agencies and universities from capitalizing on the investment they have made on the education of women and it perpetuates the existing mismatch between the diversity of the scientific workforce and that of the U.S. population as a whole.

This diversity study, as well as concerns within our own community, prompted the initiation of an effort within the physical oceanographic community to examine whether mentoring efforts could aid the retention of junior women in the field. Though 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. Toward this end, a National Science Foundation (NSF) and Office of Naval Research (ONR)-funded workshop entitled, "Mentoring Physical Oceanography Women to Increase Retention (MPOWIR)," 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 in their career development. The overall goal of this

community effort is to develop a program within physical oceanography that, if successful, could be expanded to include women and minorities in all areas of ocean sciences, or geosciences.

The initial focus at the workshop was on identifying the obstacles that junior women face in their career development and deciding upon 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 Ph.D. to post-doc and then from post-doc to entry-level position were the most vulnerable times for a junior woman in the field. Identified obstacles include 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 family and work. Importantly, the survey results showed that only 30% of the respondents formed an important mentoring relationship during their postdoctoral years.

Given the identified obstacles, MPOWIR workshop participants decided to design a community-mentoring program that would provide continuity from the Ph.D. 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

<sup>1</sup> Nelson, D.J. 2002. *The Nelson Diversity Survey*, Norman, OK; <http://cheminfo.chem.ou.edu/faculty/djn/diversity/top50.html>.

fulfill the various needs of a junior scientist. 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 multi-prong approach with three main program elements:

1. *Internet-Based Mentoring*. This element will have four components: (a) a moderated, anonymous community forum that will address issues related to the success of junior women in physical oceanography, but accessible to the entire community, (b) a searchable database for mentors to be used as a resource for junior women, (c) a list server with important information given to interested scientists about mentoring and funding activities, and (d) a resource library on mentoring issues, data and statistics, and links to funding opportunities.
2. *The Pattullo<sup>2</sup> Conference*. The centerpiece of the MPOWIR-proposed program, this conference is intended to provide an opportunity for junior women to inform senior scientists about their current and planned work. The goal is for senior scientists, men and women, to provide feedback, give advice, and make connections for these young women. This conference would be held annually, have the format of a Gordon Research Conference, and be open to all junior women in the field. The conference would also include roundtable discussions on career-development issues and provide a forum for junior scientists to learn about senior scientists' research programs.

3. *AGU Socials on Mentoring*. It is planned that these socials will take place at all Ocean Sciences meetings and at the American Geophysical Union (AGU) fall meetings in alternate years. The goal of the socials is to facilitate connections between junior scientists and more senior scientists in the field. Talks and/or panel discussions on career and mentoring issues are also planned.

To implement these three programs, workshop participants focused considerable energy in establishing oversight responsibility, recruitment strategies, data collection, and metrics for gauging program success and funding needs. Specifically, workshop participants decided to: (1) establish an ongoing committee that would take responsibility for the implementation of the proposed program elements, (2) establish mechanisms to identify mentees and attract mentors, and (3) create a statistical database to quantify success.

A successful MPOWIR community-run program will help create a scientific workforce whose diversity matches that of the student population and, in a broader sense, that of the U.S. population as a whole. Additionally, by creating a scientific community that facilitates the retention of women, we are creating a community that will be more attractive to junior men as well as to minorities.

<sup>2</sup> June Pattullo was the first woman to receive a Ph.D. in physical oceanography from Scripps Institution of Oceanography (in the 1950s) and is believed to be the first to receive such a degree in the United States.

# I. Introduction

Efforts over the past several decades toward increasing the number of women entering science and engineering fields have largely been successful, with undergraduate and graduate school enrollments averaging between 30% and 50% women<sup>1</sup>. Ph.D. attainments show similar progress. However, the percentage of women occupying tenure-track positions has not risen commensurably. Women in science and engineering fill on average only 15–25% of academic positions<sup>1</sup>. Because the number of women in graduate school has been sufficiently large for at least one decade, it is difficult to ascribe the lower percentage of women in faculty positions to a small pool of potential candidates. The disparity between the number of women trained in a field and the number of women occupying positions in that field is attributed by some to subtle biases that keep women out of research or academic positions, while others argue that women are simply staying away from these positions of their own accord. Thus, while recruitment efforts should be lauded, we need to turn our attention to retention if we are to capitalize on the investment the funding agencies and universities have made on the education of women students, and, importantly, if we are to create a scientific workforce whose diversity 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. For example, the number of women receiving their Ph.D. in physical oceanography has approached 40% at most major oceanographic institutions; however, the number of women with principal-investigator (PI) status remains fairly low. Though not a direct accounting of the number of women in the field, it is interesting to note that in the past ten years, only 12% of all proposals submitted to the physical

oceanography program at NSF have had women as the lead PI. This statistic does not account for the women employed by government labs and in the private sector, yet we take it as broadly representative of the retention rate.

Many factors contribute to the lack of retention of women scientists, such as competition between family-building and career-building, competition between career goals of spouse/partner, lack of female role models, and lack of adequate mentoring. While some of these problems are best met with institutional changes, the latter problem in particular is one the physical oceanographic community can address. Toward this end, an NSF- and ONR-funded workshop entitled, “Mentoring Physical Oceanography Women to Increase Retention (MPOWIR),” was conducted at the Airlie Center in Warrenton, Virginia on October 9–12, 2005. Twenty-nine physical oceanographers, men as well as women, assembled to design a mentoring program for junior women in the field of physical oceanography to help remove barriers, real or perceived, in their career development. The overall goal of this community effort is to develop a program within physical oceanography that, if successful, could be expanded to include women in all areas of ocean sciences, or geosciences. Additionally, efforts toward retaining women in the field will also be transferable to the retention of minorities, a goal we heartily endorse.

This report focuses primarily on the content and outcomes of the October 2005 workshop (Sections IV–VII), but also includes pertinent background information on women in science (Section II) and a brief discussion of the initiation and early work of the MPOWIR effort (Section III). The report concludes with a discussion on next steps to take (Section VIII).

## II. Background

Attention to issues regarding women in science certainly predates the MPOWIR effort. Here, we briefly summarize efforts that have helped to set the context for our work. The first item discussed, the 1999 Massachusetts Institute of Technology (MIT) report, is pertinent to our efforts as it addresses the climate for women in science. The second item discussed, the NSF ADVANCE program, provides information on current efforts by a funding agency (NSF) to increase the representation of women in academic science. The third effort discussed, the mentoring program at Woods Hole Oceanographic Institution, gives an example of institutional promotion of mentoring. Each of these three efforts is focused on effecting change within institutions, while the last efforts discussed in this section are efforts initiated within a discipline-based community to effect change within that community.

### A. MIT Report and Update

The landmark 1999 report, *A Study on the Status of Women Faculty in Science at MIT*, broke the taboo on the consideration of gender biases and inequities in the university system and provoked similar analyses across the country at major academic institutions. The report emerged as a result of a few senior faculty women meeting in 1994 for the first time to discuss working conditions across departments at MIT. Within a day, nearly all of the tenured female faculty were engaged in the discussion. Central to the emergence of the study was a supportive dean who evaluated conditions and agreed to form a committee to survey faculty and collect data on space, teaching obligations, internal awards and honors, and the nature of committee obligations. The results were surprising: junior women

felt well supported by their departments, though they struggled with work-family life obligations. Senior women, however, felt “invisible in the department,” and tellingly, reported that they too had once felt supported by their departments. A system of largely unconscious choices kept them from leadership roles.

As a result of this report, a number of changes were made. MIT created a new definition for gender discrimination that recognized unconscious biases, established an ongoing review process, created direct lines of communication for tenured female faculty to the administration, remedied individual inequities, and altered hiring policies. In May 2004, MIT conducted a five-year review. This report found significant improvements in the number of women in administrative positions in particular, from zero to nine. In general, improvements were substantial, with senior women reporting a lesser sense of isolation, and some institutional reforms improving the family-work balance for junior women.

Although the MPOWIR workshop was largely focused on junior women and retention, we recognize that senior women physical oceanographers also experience unconscious gender biases and can be isolated in a male-dominated field. The accumulation of minor incidents driven by these subtle and generally unconscious biases tends to, over time, reduce the sense of being welcome in the field. Thus, retention of women in senior positions is an important metric of success for MPOWIR; establishing networks for senior women is also important to the goals of MPOWIR. These women act as mentors and role models to junior women, and can be important advocates for tackling sensitive issues in the field as a whole.

## B. NSF ADVANCE Program

In 2001, on the heels of the release of the MIT report, NSF initiated a new program called ADVANCE: Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers (for additional information see <http://www.nsf.gov>). The goal of the ADVANCE program is to “increase the representation and advancement of women in academic science and engineering careers, thereby contributing to the development of a more diverse science and engineering workforce.” There are currently three types of ADVANCE awards:

1. *Institutional Transformation Awards* support academic institutional transformation to promote the increased participation and advancement of women scientists and engineers in academe. These awards support innovative and comprehensive programs for institution-wide change.
2. *Leadership Awards* support the efforts of individuals, small groups, or organizations in developing national and/or discipline-specific leadership in enabling the full participation and advancement of women in academic science and engineering careers.
3. *Partnerships for Adaptation, Implementation, and Dissemination Awards* support the analysis, adaptation, dissemination, and use of existing innovative materials and practices that have been demonstrated to be effective in increasing representation and participation of women in academic science and engineering careers.

Several universities with physical oceanography faculty have ADVANCE Institutional Transformation Awards, including the University of Rhode Island (URI), the University of Washington (UW), and Columbia University. At UW, the goals of ADVANCE include increasing the number of women faculty in the science, engineering, and mathematics departments and increasing the advancement and leadership of women faculty in these departments. To achieve these goals, UW ADVANCE has implemented leadership-development training for current chairs, deans, the provost, and president; encouraged cultural change within the departments; examined UW policies for equity and policy transformation; mentored women for leadership; and provided transitional support for women faculty. Launched in June 2004, the mission of the Earth Institute ADVANCE program is “to increase the recruitment, retention, and advancement of women scientists and engineers at Columbia University.” A major focus of this ADVANCE program has been on the hiring of established women and minority leaders, as well as creating an environment that is attractive to both women and minorities. URI received a five-year Institutional Transformation Award from the NSF ADVANCE program in September 2003. Current projects at URI include climate assessment, faculty recruitment, faculty development, work/family policy initiatives, and the development of professional and social support networks.

It is important to note that the ADVANCE programs are focused almost exclusively on women in academia, particularly those in faculty positions. As will be discussed later in this report, this focus diverges from our effort in this regard: we are interested in retaining women in physical

oceanography in nonacademic as well as academic positions. Additionally, we are interested in directing our retention efforts toward women at all stages in their early careers, including the graduate and postdoctoral years.

### C. Mentoring Programs at Woods Hole Oceanographic Institution

A formal, institution-wide mentoring program is available to all staff and students at Woods Hole Oceanographic Institution (WHOI). It is relatively new, having been in existence since 2003. Every year, interested participants apply to be mentors or “mentees” by filling out an application form where they list their goals and objectives for their professional advancement. The Mentoring Committee then pairs participants based on compatible goals. Both mentors and mentees receive some basic training on what mentoring is (and is not), and how to access additional resources. The pairs meet informally for a period of six months on a schedule that suits both parties, although this can continue for as long as the participants agree to meet. The program is intended to help employees with any of the following:

- Understand and navigate the promotion/tenure process at WHOI
- Enhance skills and abilities
- Enhance project management skills (financial management, personnel/resource management, time management)
- Improve research project development and fund-raising skills (proposal preparation, collegial networking, relationship-building with program managers)
- Develop better communications skills (writing, verbal, presentations)

- Develop better job search skills (for positions within and outside WHOI)
- Make sound decisions about continuing education

Participants evaluate this program every year and the feedback is used by the Mentoring Committee to improve the program. Some internal funds are provided by WHOI to support the program.

A second, more informal mentoring effort is in place in several departments at WHOI, including the Department of Physical Oceanography. In this case, scientists beginning a tenure-track position choose, in consultation with the department chair, one or two tenured scientists to be their official mentor(s). Department chairs favor this arrangement, especially in the relatively large PO department (30–35 scientists), because it distributes the responsibility for providing professional guidance and advice to the junior members of the department among a number of the more senior staff. Junior scientists are certainly not precluded from consulting with other members of the staff; this program simply ensures that someone is officially available to provide guidance and advice. Expectations for mentors and mentees are laid out in an internal handbook entitled, “Navigating the Tenure Track: A Handbook for Scientific Staff.”

### D. Community Mentoring Efforts

Several discipline-based scientific communities have established mentoring networks for women during the past several years. Notable among these are the CRA Committee on the Status of Women in Computing Research (CRA-W), whose goal is “to take positive action to increase the

number of women participating in computer science and engineering research and education at all levels.” COACH (Committee on the Advancement of Women Chemists) is committed to “developing and implementing strategies that can have an impact on increasing the number of successful women chemists in academia in this country.” Casting a wider net is the generally well-known MentorNet, an e-mentoring network that “addresses the retention and success of those in engineering, science, and mathematics, particularly but not exclusively women and other underrepresented groups.” Operational since 1997, MentorNet facilitates the establishment of email-based mentoring relationships with mentors from industry and academia. MentorNet is sponsored through partnerships, grants, and donations. Another email-based mentoring program has its roots closer to the field of physical oceanography: ESWN (Earth Science Women’s Network) operates informally as an email list and promotes peer-mentoring among women in the earth sciences.

## III. Physical Oceanographic Context

### A. Initiation of MPOWIR Effort

Though institutions are increasingly focusing on the role of mentoring in the early career stages for a young scientist, it is generally recognized that a discipline-based community can also foster success during a scientist's early career. It is members of the community that can most readily advise a junior scientist on a host of issues, ranging from funding sources, to collaborative work, to research programs. Clearly, this mentoring has been going on for ages, generally in the form of an advisor-advisee relationship or in the form of another relationship that arises naturally between a junior and senior person. While such mentoring supports the careers of all young scientists, male or female, the retention rates suggest that it either occurs less often for women than for men, or it is less effective. With this in mind, a group of female physical oceanographers obtained funding from ONR in spring 2004 for the purpose of investigating the retention issue of women in the field of physical oceanography. A steering committee was formed in April of 2004:

- Amy Bower, Woods Hole Oceanographic Institution
- Victoria Coles, Horn Point Laboratory, University of Maryland
- Rana Fine, University of Miami
- Susan Lozier (chair), Duke University
- Julie McClean, Naval Postgraduate School
- Paola Rizzoli, Massachusetts Institute of Technology
- Lynne Talley, Scripps Institution of Oceanography, UCSD
- Luanne Thompson, University of Washington

The committee met in May 2004 with representatives from ONR and NSF to discuss the retention of women in the field of physical oceanography. From those discussions, the committee decided to focus its efforts on a community-based mentoring program. Though cognizant of other community-based mentoring programs (such as those discussed above), the steering committee recognized that the physical oceanography community cannot 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 forth. Thus, the aim was to design a program unique to and designed by the physical oceanography community. To achieve this goal, the steering committee decided to obtain input from a broad segment of the community by hosting a workshop. In August 2004, a proposal was submitted to NSF for workshop expenses. The proposal was peer reviewed and funds were successfully garnered.

Planning for the workshop began in earnest in fall 2004. The committee selected October 9–12, 2005 as the date and the Airlie Center in Warrenton, Virginia, as the venue. The steering committee decided that participation should be inclusive on a number of fronts. They sought representation from the spectrum of workplaces for physical oceanographers as well as representation of the 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 have their input as well as their buy-in to this endeavor. Such inclusion is also a statement that the committee believes that the lack of retention for women in the field is not a “women’s issue,” but is instead a community issue that affects everyone in the community and should be addressed by everyone in the community. Appendix 1 provides a list of workshop attendees.

## B. MPOWIR Survey

In order to collect some information for the October 2005 workshop, the MPOWIR Steering Committee conducted a survey on mentoring. To advertise the survey, which was available online at [www.mpowir.org](http://www.mpowir.org), notice of its availability was given by steering committee members, who invited all members (male and female) at their home institutions to take the survey and pass it along to their physical oceanographic colleagues at other institutions.

Eighty-seven physical oceanographers took the survey, of which 56% were female and 44% male. Scripps Institution of Oceanography, UW, WHOI, URI, and the University of Miami each had approximately 6–10 respondents, providing the bulk of the responses. However, there was representation from institutions with relatively fewer physical oceanographers (e.g., University of Maine, Florida State University, Lamont-Doherty Earth Observatory, Princeton), though generally only one or two surveys from each of these places were received. Additionally, six respondents worked at government labs. In agreement with the national trends noted above, half of the graduate students at the respondents’ in-

stitutions were women, yet only 20% of the scientists with PI status were women. Women were also disproportionately represented in tenure-track positions: 49% of the male respondents held a tenure-track position, compared to 14% of the female respondents.

The results of the survey show differences between the mentoring experiences of the men and women who took the survey. All of the male respondents had male mentors, while only 12% of the women had female mentors. Twenty-four percent of the women said that the gender of the mentor was important to them, while none of the men did. In response to a query of when a mentor was acquired, a male/female difference was noted: though as likely to have a mentor as a male in graduate school, a female is less likely to acquire a mentor during the postdoctoral years. Additionally, fewer women than men, proportional to the response ratio, reported that they have a mentor in their current position.

Respondents were also asked to select areas for which they were mentored and for which they would like to be mentored. Responses to those queries are shown in Figures 1 and 2. In general, men and women reported that they want similar outcomes from mentoring (Figure 1). There were a few exceptions: Proportionately more women than men want advice on juggling family and career and more women than men want aid with a job hunt. On the other hand, proportionately more men reported that they wanted mentors to invite them to meetings. In describing the mentoring they had received (Figure 2), again there was a general agreement, yet proportionately more women than men received mentoring on the career/family balance,

Figure 1. How Mentors Helped

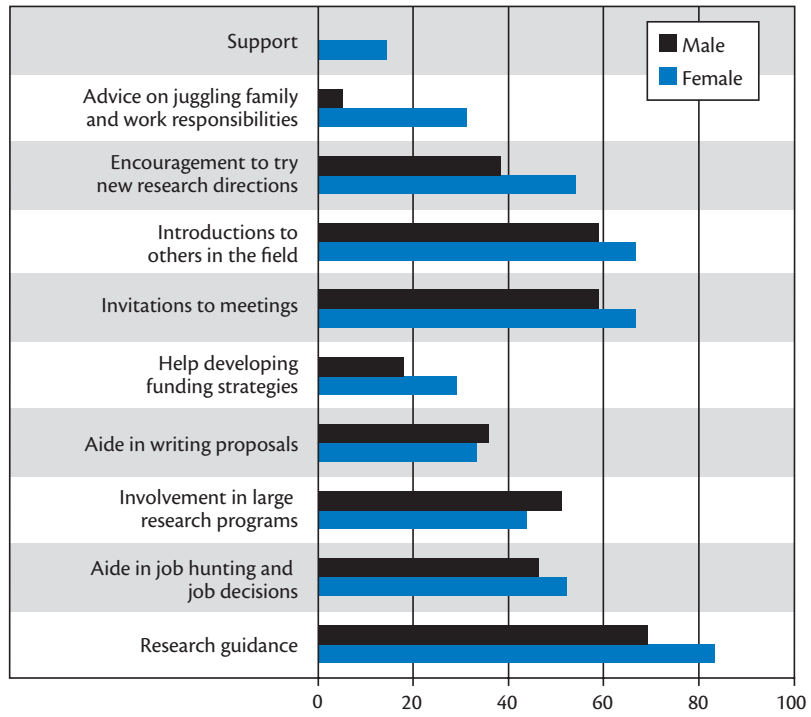
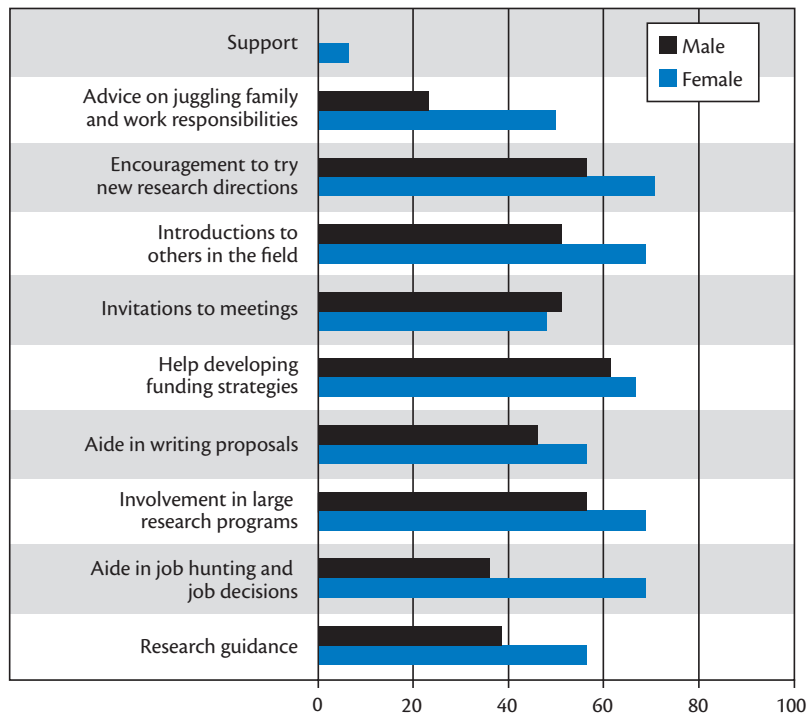


Figure 2. What We Want From Mentors



while proportionately more men had mentors who wrote proposals with them and who invited them into large research programs.

A final part of the survey invited comments on how to design a community mentoring effort. Input included:

- Have mentor database available to junior scientists
- Allow for people to mentor in different areas
- Make sure that mentors are connected to the community
- Set up mentoring relationships early
- Include face-to-face meetings as part of the community mentoring
- Establish a practice of getting junior researchers involved in big research programs

## IV. Structure of the MPOWIR Workshop

With the goal of establishing a community-based mentoring program, participants assembled in October 2005 for a three-day workshop. Prior to arrival, the steering committee supplied participants with background reading material and links to web pages with pertinent information (Appendix 2). The workshop followed an agenda (Appendix 3) that was 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. These workshop components were dealt with via a combination of large and small group discussions. Additionally, as the workshop progressed and participants identified components of the mentoring program, working groups were formed that focused on specific aspects of the program. In the following sections, each of the four components of the workshop listed above is described. Finally, on the last morning of the conference, representatives from funding agencies and professional societies were invited to hear a summary of the workshop outcomes and to provide feedback on the planned mentoring activities. A list of those representatives is given in Appendix 4.

During the MPOWIR workshop, participants identified a number of issues as relevant to women in physical oceanography, but not specifically concerned with mentoring the target population of women in physical oceanography. Some of these issues had a broader focus, such as improving the professional climate for all young researchers in the field. Others dealt

with spreading the message that mentoring is important, or with the collection of information on mentoring “best practices.” Yet others were concerned with the further investigation of the culture of physical oceanography and its impact on young researchers. A short summary of these issues, which at the workshop were placed in a “parking lot,” is given in Appendix 5.

## V. Workshop Input into the Design of a Mentoring Program

### A. Obstacles and Barriers for Women in the Field of Physical Oceanography: Inner and Outer Obstacles

To assess how a mentoring program might help a female physical oceanographer achieve a successful career in research, participants in the MPOWIR workshop identified obstacles or barriers for women in the field of physical oceanography. The obstacles were classified according to their origin; those that originate from common female perceptions, expectations, or fears (whether conscious or not) were characterized as *inner obstacles*, while those originating from external constraints, the present-day academic/research culture, or sexual discrimination were characterized as *outer obstacles*. Upon discussion, participants recognized that many of these may also be obstacles for men in the field.

Many of the inner obstacles common to women may be related to a lack of self-confidence, combined with the need for acceptance. Women fall prey to the so-called “Imposter Syndrome”—the feeling that, “I am not as smart/clever/good as they think I am, and it’s only a matter of time before they find out.” Women often describe their achievements as a result of luck rather than hard work and skill, and while women want and need recognition for their work, they are reticent to self-promote. In instances where recognition has clearly been neglected or overlooked, even deciding to bring attention to the matter may present a significant inner obstacle.

Feelings of isolation or loneliness are common among women, as are feelings of intimidation by and perceived aggression from others in the

field (typically, but not exclusively, men). These negative emotions likely fuel women’s need for acceptance in a predominantly male field, while also creating the perception that in order to be accepted they must “adapt” to be like men. As a result, professional success is often perceived as an “adapt or die” situation, requiring women to employ strategies such as developing an unnaturally “thick skin” or becoming aggressive themselves.

Expectations for and achievement of success are associated with other types of obstacles as well. Although an individual’s personal expectations may be unrealistically high, there is also a perceived conflict between achievable gender-based expectations (e.g., as a caregiver) and career expectations. Some women fear having to change their values—such as a balanced life between career and family—to achieve success. Women recognize the need for strategic planning, networking, and other aids to advancement, and also recognize the barriers they create when not making use of these tools. Finally, energy spent simply worrying about these things creates a barrier itself.

Outer obstacles to women in physical oceanography may be loosely classified into three categories: external constraints that impact career decisions, challenges created by the male-dominated culture, and outright sexual discrimination or harassment. Examples of external constraints include dual-career couple decisions, child- and elder-care needs, the asynchronous biological and tenure clocks, and an overall inflexibility or lack of infrastructure in institutions to accommodate these constraints. Time (or lack thereof)

is invariably a constraint, which raises the question of unrealistic, or perhaps simply unspecified, expectations or metrics of success.

The challenges women face in a historically male-dominated culture include gender differences in communication and working style. Women frequently feel excluded from informal planning meetings, often arranged within an existing network of male colleagues. These cultural differences are exacerbated, and may even include outright hostility or harassment towards women, in the sea-going environment. Finally, perhaps as a cumulative result of the barriers and obstacles described above, women find the lack of senior women role models to be a significant barrier as well.

## B. How Mentoring Can Help to Remove the Obstacles

Workshop participants identified a number of ways in which mentoring can help remove obstacles and barriers to the advancement of women in physical oceanography. Foremost, mentors are role models who demonstrate through their actions and shared experience how to achieve a successful, stable career. Young women can then fashion their own path, using the examples of their mentors. Having a variety of role models (for example, with and without families, from senior and junior career levels, from academic and technical backgrounds, and from both male and female perspectives) is critical, because there is no one clear path to a successful career in physical oceanography.

Mentors are also interactive reservoirs of knowledge with information on potential strategies for overcoming obstacles common to women in

physical oceanography, such as handling dual careers for couples, planning for career and family (e.g., managing the tenure clock at academic institutions), dealing with criticism, and navigating an intimidating, male-dominated institutional network. The advice of a mentor can help young women make an accurate, realistic assessment of their strengths and weaknesses, help young women physical oceanographers understand the expectations placed on them by their colleagues and institutions, and help develop the community-wide idea of what constitutes success.

Mentors are very important advocates for young women. Mentors can actively push their charges to write proposals, give talks, attend workshops, and generally take risks a young woman might not normally pursue and that are likely to provide long-term benefits. Mentors can help address sexism and blatant discrimination in the workplace. Mentors can also lobby their institutions to develop policies and infrastructure that create a more supportive and rewarding work environment for women, and increase the overall community awareness of the issues and obstacles facing young women physical oceanographers.

Finally, mentors are a key source of support and encouragement for young women trying to rise through an unfamiliar and potentially unwelcoming system. Mentors can help women feel accepted, develop their self-confidence, and instill in them a healthy assertiveness and comfortable level of self-promotion. As mentioned before, mentors can encourage young women to take risks or attempt particularly difficult, but highly rewarding assignments. And, mentors

can also help women to find a balance between what is rewarded and what is enjoyable in their careers.

Mentors can help young women overcome obstacles to their physical oceanographic careers by being role models, providing important information, advocating for critical needs, and giving support and encouragement. The ideal outcome of successful mentoring will be a fundamental change in the culture of the oceanographic research community, where there is a greater awareness of obstacles facing women and an increase in the availability of resources for women to surmount these obstacles. Ultimately, we will achieve a working environment that is conducive to both men's and women's careers.

### C. Identified Goals for a Community-Based Mentoring Program

Having identified how mentoring can help young women with both inner and outer obstacles, workshop participants established five main goals for an effective community-based mentoring program: (1) The program should provide continuity of mentoring from a young woman's graduate career, through her postdoctoral years to the first years of her permanent job. (2) The program should establish a collective responsibility within the physical oceanography community for the mentoring of junior women in the field. Rather than assigning a mentor for each young woman, the aim is to collectively mentor the young women in the field. (3) The program should provide a variety of mentoring resources and mentors on a variety of issues. (4) The program should cast a wide net to avoid exclusiveness. (5) Involvement in this mentoring program should be open to 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.

## VI. Proposed Mentoring Program

Based on the goals of the mentoring program established at the workshop, participants designed a mentoring program for the physical oceanographic community. Three key components for the mentoring program emerged, each discussed in detail below.

### A. MPOWIR Internet-Based Mentoring

MPOWIR workshop participants identified avenues for using the Internet's broad reach and dynamic character to distribute mentoring-related information and enhance access to mentoring opportunities for early-career scientists throughout the community. Motivated by the interrelated goals of building mentoring resources for women in physical oceanography and providing resources and encouragement for potential mentors, Internet-based mentoring objectives include:

- Heighten community awareness of issues that impact retention
- Ease early-career scientist's access to potential mentors
- Provide resources for individuals seeking to undertake mentoring relationships
- Enhance access to mentors and support resources at smaller and non-traditional institutions
- Build and support a community concerned with the issues facing early-career scientists
- Establish a long-lived, dynamic resource that evolves in response to changing needs

Community awareness and individual access issues contribute to many of the retention obstacles identified at the MPOWIR workshop. To promote a broad change in perspective, information concerning the obstacles facing early-career

researchers, retention issues surrounding female scientists, and the potential impact of mentoring must be placed before the community in a wide variety of forums. Internet-based resources can provide a critical component of this effort, addressing a broad audience, facilitating active discussion and community participation, and disseminating a wide range of materials. For researchers at smaller institutions, enhanced information exchange afforded by network connectivity has provided access to colleagues, collaborations, and an array of resources previously available only within larger organizations. Informal interactions with colleagues often provide critical advice and can develop into either collaborative or mentoring relationships. A wide-reaching, active online community will bridge geographic separations by offering a venue for lively discussion and providing a forum for individuals from diverse institutions to interact and build both peer and mentoring relationships.

Relevance and longevity of the MPOWIR Internet-based efforts will rest on direct community involvement. By emphasizing dynamic, user-generated content and fostering active exchanges, Internet-based resources will serve as a focus for scientists concerned with retention and other early-career issues. Network-based content offers steady accumulation of material and information persistence, becoming increasingly valuable over time and offering opportunities for data mining. Direct community involvement will ensure that Internet-based resources evolve rapidly in response to changing needs.

Discussions within a working group defined a four-element system for delivering Internet-based mentoring:

1. Web-based resource library
2. List servers for topical information exchange
3. Mentor support site, including searchable database
4. Interactive community forum

Working-group participants spanned a range of career stages, from postdoctoral researchers to senior scientists, and thus a range of familiarity and comfort with Internet-based resources. Although all were facile with standard web access and document download, several were unfamiliar with the dynamic databases, online forums, and email lists, which will form the centerpiece of the MPOWIR site. Because these Internet-based efforts require broad community involvement to succeed, care must be taken to engineer clear, easy-to-use interfaces and to provide appropriate instructions and training.

The simplest, and probably first implemented, element of the MPOWIR Internet-based system will be a set of web pages offering an online resource library. Materials will include reports, retention data, and linked references to relevant resources (e.g., studies, reports, policy documents, websites). An MPOWIR steering committee will identify resources and post them to the site. This group might also produce synthetic material, such as lists of frequently asked questions (FAQs) and calendars of upcoming events. Effort will also be invested in concentrating resources that might aid early-career scientists, including announcements for fellowship opportunities, funding calls, and job postings.

As a first step toward community-building, MPOWIR list servers will provide an easy method for communicating with individuals interested in early-career and retention issues. List

sign-up will be conducted through a web-based interface, with the capability for researchers to enroll interested colleagues. Membership will be open, but lists will be moderated. In addition to a general broadcast list, other topical groups will be established in response to community needs. The various lists will provide a vehicle for enhancing awareness of retention issues, notifying the community about events and opportunities and initiating discussions that may remain within the lists or eventually migrate to other venues.

To help address mentor access issues, MPOWIR will strive to build an accessible online mentor community. Resources will be available to assist individuals who are willing to serve as mentors. As part of this endeavor, mentors will be able to upload into an online database information detailing their backgrounds and areas of expertise. Specified expertise might extend well beyond scientific interests to include negotiating the tenure track, successfully pursuing soft-money science, or dealing with dual-career relationships. This searchable database will be offered to early-career scientists to help them identify potential local mentors, to seek people capable of answering specific questions, or to seek mentoring from individuals outside their immediate surroundings. MPOWIR participants acknowledged that mentoring relationships can take many forms, and that multiple mentors might be needed to provide support over a broad range of issues. Effective mentoring often grows from highly personalized interactions that develop through direct contact. The online mentoring database will make it easier for early-career researchers to seek advice, facilitating initial contacts that might evolve into more general mentoring relationships. The database will also

provide a support network for mentors, who can tap community knowledge to enhance their ability to support their mentees.

A web-based forum will provide the core of MPOWIR's Internet-based community and information exchange. These highly interactive, user-driven sites have been used to promote lively discussion, exchange information, and build community for a wide range of endeavors. Discussions, to which users post a series of questions, responses, and comments, lie at the heart of online forums. The MPOWIR forum will support an arbitrary number of threaded discussions, organized such that users can easily browse and post to ongoing threads, search past discussions for specific content, or initiate new threads. The forum will be moderated and require that users register prior to posting material. Anonymous posting will be supported for registered users to facilitate participation in difficult discussions and the asking of potentially awkward questions. Given effective implementation and enthusiastic community participation, the MPOWIR forum could offer a powerful tool to unite the community, promote discussion and debate, distribute information, and share experience. Because the forum archives threads in a searchable form, the resulting database grows increasingly valuable over time. The collected threads can be mined for purposes such as gauging the community's primary concerns or surveying the issues troubling early-career scientists. Forum moderators will sometimes synthesize crosscutting themes that recur in multiple threads, using patterns of information flowing through the community to identify important issues. The dynamic and user-driven nature of web-based forums make them particularly responsive to changing community needs.

The MPOWIR forum should readily adapt to the ever-evolving challenges facing community education, retention, and mentoring efforts.

MPOWIR Internet-based mentoring resources will rely on careful interface design, professional execution, and ongoing maintenance to attract and retain the high level of community activity needed for success. Skilled designers and software engineers should be enlisted to help define structure and undertake technical implementation. The magnitude of design and implementation tasks is often underestimated. Proper investment of attention and resources at this early stage can enhance the impact of the resulting tools and ease the task of long-term maintenance.

## B. AGU Socials on Mentoring

The primary objective of the MPOWIR AGU Socials on Mentoring is to facilitate connections between junior and senior scientists in physical oceanography. The AGU socials will allow young scientists to network beyond the reach of their own institutions and introduce them to scientists at a broad range of career stages. Additionally, these planned socials are intended to facilitate the development of peer-mentoring networks that have been shown to be particularly effective for junior scientists.

A second objective of the MPOWIR AGU Socials on Mentoring is to enhance the sense of community within physical oceanography. Opening lines of communication among scientists at various institutions and career stages will allow individuals to better optimize career-related decision-making, increasing the likelihood that these individuals will succeed professionally.

This increased dialogue is particularly important for young women scientists who perceive a broader range of early career stresses than their male counterparts, due largely to the challenges of balancing career and family.

A final objective of the MPOWIR AGU Socials on Mentoring is to provide concrete advice about participating in mentoring relationships and about career development to both mentors and mentees. Although many individuals say they understand the value of mentoring, studies have shown that both mentors and mentees often lack the concrete skills needed to develop and maintain an effective mentoring relationship. An important element of the MPOWIR AGU Socials on Mentoring is to bring in experts who can provide this concrete advice.

The MPOWIR Steering Committee plans to sponsor Socials on Mentoring at all AGU Ocean Sciences meetings (the first was held in February 2006) and at alternate-year AGU fall meetings (starting in December 2006). The existing forum provided by these national meetings will allow the socials to reach a broad and diverse group of the target audience. Because many scientists attend national AGU meetings for other purposes, these socials will reach their desired audience at relatively low additional cost. The dependable schedule offered by these meetings will, over time, allow the physical oceanography community to count on the availability of this social networking resource, an important consideration for junior women scientists who are in the early stages of their careers, and for the mentors and potential mentors of these young scientists.

The format of the socials may vary from year to year, but each will include an evening program, divided between a content presentation to deliver useful and usable information and an open social component to facilitate networking among participants. In some years, the content element of the social may include a keynote speaker or a panel discussion. Sample topics might include “Dual-Career Couples,” “Job-Hunting Strategies,” and “Jump Starting Your Career in Physical Oceanography.” In other years, socials may take the form of rotating topical discussions at tables that mix scientists at various career stages. Sample topics for these discussions might include, “How to Form and Foster Research Collaborations,” “Overcoming Career Obstacles,” and “How to be Involved in a Mentoring Relationship.” In some years, separate content programs would be offered for junior and senior scientists, who would then mix during the social part of the program. For example, a program on “How to Find and Work with a Mentor” might be offered to junior scientists, while senior scientists participate in a parallel program on “Effective Mentoring Strategies” or “Retaining Women in Physical Oceanography.”

Socials will be advertised in the AGU Meeting Program, by email, and on the MPOWIR website. Effectiveness of the individual programs will be assessed from participant surveys collected at the end of the program and from follow-up emails. Demographic information about participants and suggestions for future content areas will also be solicited as part of this feedback.

Although these socials will specifically target the field of physical oceanography, a similar format could be adopted within other branches of AGU, or in other scientific fields. As the MPOWIR

steering committee gains experience with convening AGU socials, we expect to serve as a resource for other organizations that wish to implement a similar forum for their own field.

### C. Pattullo Conference

To facilitate the collective mentoring aspect of MPOWIR and to provide continuity in the mentoring young women receive from the community, workshop participants decided that a key element of a mentoring program would be a conference dedicated to the mentoring of junior women in the field. Bob Beardsley and Susan Lozier suggested naming the conference the “Pattullo Conference” in recognition and honor of June Pattullo. In 1957, June Grace Pattullo was the first woman to receive a Ph.D. in physical oceanography from the Scripps Institution of Oceanography, and she is believed to be the first to receive such a degree in the United States.

*Pattullo Conference Goals.* This conference is intended to help junior women make connections and gain community support by bringing them together with potential mentors. Physical oceanography is a small and relatively far-flung community; many women have no female colleagues in their home institutions that can act as mentors or role models. Meeting other junior women in the field and obtaining peer to peer support is also important. The conference should help build the confidence of junior women so that they are comfortable promoting themselves and their work to senior people in the field. Scientific presentations will facilitate networking, identifying mentors with similar interests, and establishing common ground with peers. Mentoring activities will play a key role

at the conference so that junior women can obtain advice and encouragement, hear about the experiences of senior scientists and peers, and share their own experiences. More concrete advice concerning, for example, strategies for success, funding opportunities, and balancing work and family obligations, should also be available. Finally, it is important to expose the senior scientists to the culture and concerns of junior women, and for them to be supportive and open to their needs.

*Participants.* Junior Women: Inclusive of all junior female physical oceanographers at U.S. establishments, including universities, government labs, and research institutions. Here junior is defined as being within one year of obtaining a Ph.D. and up to two years after obtaining a PI position. Therefore, women will have a chance to attend the conference during the critical periods in their career when they are making the transition between graduate school and a postdoctoral position and, perhaps even more critically, between a postdoctoral and permanent position. Senior Scientists: Ten to fifteen senior physical oceanographers, both men and women, will be invited to the conference by the conference committee. Here senior is defined as scientists with permanent positions, including research, faculty, and government positions. These senior scientists should have a variety of backgrounds in terms of scientific expertise, family, dual-career, size of department, length of career, and country of origin.

*Location and Duration.* A secluded location, where meals and activities are held communally, will promote interactions leading to networking and mentoring. The conference will be

held during the summer over the course of three or four days, depending on the number of junior women attending.

*Format.* Each junior scientist will present a 15–20 minute science talk. Talks will be split into approximately 90-minute sessions, with round-table discussions in between. These discussions will take place in smaller groups and cover issues, such as balancing work and family, strategies for funding, proposal writing, alternative career paths, and self-promotion. A poster session is planned for a couple of hours each evening following dinner, where senior scientists present posters outlining their career paths, past projects, and current research interests. The goal of this poster session is to facilitate the sharing of career experiences and to help junior scientists find mentors with similar backgrounds and/or research interests. It is noted that junior scientists may require different mentors for scientific advice versus career advice. It is also suggested that the conference agenda include planned outdoor activities to encourage socialization and networking. Finally, senior scientists will meet each day and discuss the impact of the various conference activities in order to assess their success and plan improvements or different approaches for the future. Also, loose ends, such as neglected issues or junior scientists who are not comfortable or have specific needs, can be discussed and actions taken.

## VII. Implementation

To implement the program outlined above, workshop participants focused considerable energy in establishing oversight responsibility, recruitment strategies, data collection, and metrics for success and funding needs. Each of these elements is discussed in this section.

### A. MPOWIR Steering Committee and Responsibilities

An MPOWIR Steering Committee is an essential component of the mentoring program. The general MPOWIR goal of promoting retention of women and minorities in the field should be reflected in the diversity of the committee composition. We envision a committee composed of ten members, including six women and four men, who are representative of a broad spectrum of work and family conditions. In particular, the committee members should belong to institutions differing in size, location, and type (academic/research/government laboratories), and be representative of different family situations. The term duration for each committee member should be three years, staggered, except for the lead PI and co-PI. The committee will meet face-to-face once per year. Conference calls, web-based communications, and additional meetings during national conferences will also be arranged, as needed. Because the primary committee responsibility is to oversee the implementation of the three tasks described above, the committee will include two members (a primary and a backup) as liaisons for each of the three tasks.

Additional committee responsibilities will include the preparation of annual assessments and reports and their dissemination to funding agencies, to the physical oceanography com-

munity, and to other institutions and organizations interested in the MPOWIR initiative. In particular, it is very important to reach the broader community at a department and/or institutional level, as some of the issues faced by young women in the field may arise from the overall “culture” of a given institution, which may be unsupportive, or perceived as unsupportive. The long-term goal is to promote a cultural change within institutions, leading to work environments where women feel accepted and supported. One specific proposed activity is to make a presentation at the Consortium for Oceanographic Research and Education (CORE) bi-annual Graduate Education Retreat. Finally, the committee can consider and start new initiatives, and plan for the long-term continuation of the program. A transition phase needs to take place, in which the present steering committee completes some of the necessary immediate tasks, including the preparation of a proposal to ensure future funding needed for the continuation of the program. The existing committee will also appoint new members to evolve to the new committee structure.

### B. Identifying and Recruiting Mentors and Mentees

Identifying and engaging mentors and mentees require a combination of broad entrainment and targeted recruitment. The first step is a series of general announcements advertising the MPOWIR organization. Letters will be sent to department heads at all domestic oceanography and related departments asking them to pass along information to their department members and encourage participation, especially among female junior scientists.

For mentees, we will follow a broad recruitment approach to inform all early-career female scientists of activities of potential interest to them. MPOWIR events will be advertised to potential mentees in a variety of forums, including the website/listserv, announcements at scientific meetings, and advertising in *EOS*, *Oceanography* magazine, and other appropriate publications. At the same time, we will follow a more active “no woman left behind” policy to identify all young women in these crucial academic years at U.S. institutions and make sure they are aware of the opportunities and resources available to them through MPOWIR.

Recruitment of good mentors will follow a multi-pronged approach, consistent with the different roles mentors will play. For most MPOWIR activities (e.g., AGU socials, website interaction), we seek the participation of all interested mid-career to senior scientists. Recruitment will be through the same methods as described above for mentees. For the Pattullo Conference, especially the inaugural event, we seek a more carefully crafted group of both male and female mentors that have shown historic interest and talent for working with younger scientists. Mentors who attend the conference should include a representative cross section of scientists of various research fields, degrees of seniority, family situations, and institutional types. Invitations to attend the Pattullo Conference will be issued by the MPOWIR Steering Committee.

### C. Statistics, Metrics, and Tracking

From workshop discussions, there emerged a clear need to establish a database of physical oceanographers that would contain data describing the career history of individuals. The principal uses of the database would be to:

1. Refine and better establish the statistics of current issues
2. Provide sound statistics for future issues and analysis
3. Quantitatively assess and track the impact of MPOWIR activities

For the database to be useful for all three of these tasks, it would need to be both actively maintained and filled in historically. The nature of the data can be categorized in two types: personal and public. Public data are information that can be obtained by data mining publicly available resources. For example, publications, grants, and (non-commercial) appointments are generally available publicly, though not necessarily available via databases. Personal data would include information that is not readily available to the public or community, such as family situation (size), use of family leave, positions applied for, grant success, salary, and committee invitations. It is clear that obtaining personal data will require both the permission of individuals and their participation in providing the data. It is likely that legal advice will be needed and policies researched for the inclusion and use of such personal data. The collection and use of public data may also require the establishment of privacy policies because the data will be individual based. An obvious privacy policy would be to not give out any named individual data for any reason, even if the data were publicly available elsewhere.

#### *Target Pool*

The U.S. physical oceanography research and educational community is usefully defined as comprised of those individuals who at sometime in their career have met one of the following criteria:

1. Graduated from a U.S. institution (either Masters or Ph.D.)
2. Held a post-doctoral position or research assistant position at a U.S. institution
3. Held a principal-investigator position at a U.S. institution

These criteria are designed to include individuals who may have left or joined the U.S. system during their careers.

### *Data Sources*

Many institutions and organizations already maintain databases on individuals and their careers. For example, educational institutions are known to actively maintain their own databases of graduates, which contain such information as current employment and address. Professional societies, such as AGU and the American Meteorological Society (AMS) also have databases of their members and their availability and utility to MPOWIR needs to be explored. To obtain comprehensive individual data, however, the most reliable source will be the individuals themselves. Active surveying of individuals is likely to be a necessary activity and will probably require significant resources. Survey data would be both quantitative and descriptive. Because the science of surveying is complex, it is recommended that professional consultants be involved in the design and analysis of surveys.

### *Metrics for MPOWIR Activities*

#### **1. *Metrics for the MPOWIR Internet-Based Mentoring Program***

The MPOWIR Internet-Based Mentoring Program inherently contains natural measures for use as metrics. For instance, web servers can easily log hits on pages, re-visits, volume of downloaded content, and other

such quantities, all as a function of time. List-servers can similarly log email activity, subscription rates, release rates, and volume of traffic. A measure of success for web presence would be growth of such measures. We also suggest measuring, as a function of time, the volume and age of materials (e.g., self-help brochures, awareness presentations) made available as a resource; stagnation in the materials would indicate inactivity.

#### **2. *Metrics for MPOWIR Meetings and Workshops***

The success of MPOWIR meetings and workshops (e.g., the Pattullo Conference and the AGU Socials on Mentoring) can, in part, be measured by attendance. This measure can be augmented with estimates of the fraction of the community reached, the relative fractions of re-attendance and new attendance. The impact of a workshop, meeting, or seminar on an individual will be hard to gauge; anecdotal indications do not necessarily fit the statistical measures. However, the career statistics of the fraction of the community who have attended MPOWIR activities could be compared to the career statistics of those who have not.

#### **3. *Statistics for the Mentoring Program as a Whole***

A direct and short-term measure of success for the mentoring program will be to see if the self-reported perception of access to good mentors changes for the community as a whole. Ultimately, the goal of the MPOWIR programs is to improve the retention of women in physical oceanography. Such retention can only ultimately be monitored through analysis of the community with thorough statistics collected over time. Examples of quantities where we need to see improvement and that could be easily tracked with the da-

tabase include the continuation rates from graduation to post-doc and from post-doc to principal investigator, and the percentage of women in leadership roles (principal investigators, department chairs, and participation on committees).

#### D. Funding for MPOWIR Efforts

Various planned MPOWIR activities require funding:

- Pattullo Conferences
- AGU Socials on Mentoring
- Internet-Based Mentoring
- Tracking and statistics of physical oceanography graduates and scientists
- Steering committee logistical and administrative support

A basic cost analysis is described for each element in this section. This analysis is quite preliminary and meant to be only a starting point for a future proposal to the sponsoring agencies. Pending the actual details of any future proposed effort, these estimates may change considerably.

Pattullo Conferences are a key aspect of the MPOWIR outreach effort. These conferences are envisioned to be in the spirit of a Gordon Research Conference, with a relatively small number of attendees at an inclusive location to foster personal interactions. To provide a basis for cost estimation, workshop participants considered a conference for 50–75 people. Facility and catering costs are the dominant expense associated with the conference. It is anticipated that travel costs will be provided to the mentees involved in the program. Based on discussion with people who have run similar meetings for members of the oceanographic community, it is estimated that \$100K per conference event is a reasonable cost.

As a balance to the Pattullo Conferences, a more open opportunity for MPOWIR outreach is possible through the AGU annual meetings. In particular, a mentoring social has been proposed as an annual event, to coincide with either the AGU fall meeting, or the AGU/ASLO/TOS Ocean Sciences meeting. These socials are anticipated to involve roughly 100 attendees. Costs for reserving a room and catering, as well as an honorarium for an invited speaker, are estimated at \$2–3K per event.

Another anticipated component of the MPOWIR effort involves the tracking of graduate students and scientists in the physical oceanography disciplines. This exercise will be facilitated through direct effort of the oceanographic community (e.g., the tracking efforts of the education offices of various graduate programs). However, for a serious and sustained tracking effort, professional contract services will be needed. The cost estimate for this is uncertain, as it would depend of the specific level of service required. It is suggested, however, that funds be sufficient to cover the initial development of a database and an associated tracking effort over three to five years.

Two additional activities will require support for a sustained MPOWIR effort: the MPOWIR website and the ongoing efforts of the steering committee. The website will have an initial cost associated with contracting professional services, followed by modest maintenance costs as the program evolves. In addition to the website, the administration of all MPOWIR related efforts will require the attention of a dedicated steering committee. Their activities include occasional meetings and travel, along with modest administrative support costs.

## VIII. Next Steps

The next phase of this community effort will be to secure funds for the three main initiatives. It is envisioned that the deans of the oceanographic institutions and university programs will be asked to fund the AGU events, while funding for the Pattullo Conference and the Internet-Based Mentoring Program will be sought through the government agencies. It is planned to contact several professional societies (AGU, The Oceanography Society, Marine Technology Society, and AMS) to ask for their help in advertising this effort and for co-sponsorship of the AGU activities.

To pursue these initiatives, subcommittees have already been formed, whose membership is comprised of workshop participants. Communication among the workshop participants will be facilitated via a newsletter that summarizes MPOWIR events.

# Appendix 1: MPOWIR Workshop Attendees

1. Alistair Adcroft (NOAA/GFDL, Princeton University)
2. Lisa Beal (University of Miami)
3. Robert Beardsley (Woods Hole Oceanographic Institution)
4. Amy Bower (Woods Hole Oceanographic Institution)
5. Deirdre Byrne (University of Maine)
6. Antonietta Capotondi (National Oceanic and Atmospheric Administration)
7. Paola Cessi (Scripps Institution of Oceanography)
8. Victoria Coles (University of Maryland)
9. Agatha DeBoer (NOAA/GFDL, Princeton University)
10. Kathleen Donohue (University of Rhode Island)
11. Rana Fine (University of Miami)
12. Silvia Garzoli (AOML/NOAA)
13. Weiqing Han (University of Colorado)
14. David L. Hebert (University of Rhode Island)
15. Kathryn Kelly (Applied Physics Laboratory/University of Washington)
16. Kara Lavender (Sea Education Association)
17. Craig M. Lee (Applied Physics Laboratory/University of Washington)
18. Steven Lentz (Woods Hole Oceanographic Institution)
19. Susan Lozier (Duke University)
20. Jennifer MacKinnon (Scripps Institution of Oceanography)
21. Mathew Maltrud (Los Alamos National Laboratory)
22. Julie McClean (Scripps Institution of Oceanography)
23. Jeffrey Paduan (Naval Postgraduate School)
24. Ruth Preller (Naval Research Laboratory)
25. Kipp Shearman (Oregon State University)
26. Louis St. Laurent (Florida State University)
27. Fiammetta Straneo (Woods Hole Oceanographic Institution)
28. LuAnne Thompson (University of Washington)
29. Donna Witter (Kent State University)

## Appendix 2: MPOWIR Workshop References

Prior to the workshop, the steering committee supplied participants with background reading material and links to web pages with pertinent information.

1. The 2004 National Science Foundation report on *Women, Minorities and Persons with Disabilities in Science and Engineering* is available at: <http://www.nsf.gov/statistics/wmpd>
2. The Government Accountability Office (GAO) released a report in July 2004 regarding federal agency compliance with Title IX. Congress asked the GAO to assess compliance with Title IX in regards to mathematics, engineering, and science. This report can be found at: <http://www.gao.gov/new.items/d04639.pdf>
3. The National Science Foundation is sponsoring a National Research Council study on *Gender Differences in Careers of Science, Engineering, and Mathematics Faculty*. The Council's work is underway, so a final report is not available, but more on this effort can be found at: [http://www7.nationalacademies.org/cwse/Gender\\_differences.html](http://www7.nationalacademies.org/cwse/Gender_differences.html)
4. You have been sent the main body of the report, *National Analysis of Diversity in Science and Engineering Faculties in Research Universities*, but further information on this report, including its data and data sources, can be found at: Nelson, D.J. 2002. *The Nelson Diversity Survey*. Norman, OK; <http://cheminfo.chem.ou.edu/faculty/djn/diversity/top50.html>.
5. Some relevant studies on gender bias include:
  - a. Trix, F., and C. Psenka. 2003. Exploring the color of glass: Letters of recommendation for female and male medical faculty, *Discourse and Society* 14:191–220.
  - b. Wennerås, C. and A. Wold. 1997. Nepotism and sexism in peer-review. *Nature*, 387:341–343.
  - c. Watson, D., A.C. Anderson and J. Hjorth. 2005. Mysterious disappearance of female investigators. *Nature* 436:174.
6. *Academe Online* has a whole issue (November/December 2004) on balancing faculty careers and family work: <http://www.aaup.org/publications/Academe/2004/04nd/04ndtoc.htm>
7. A February 12, 2005 *Boston Globe* article, *Women and science: The real issue*, by John Hennessey, Susan Hockfield, and Shirley Tilghman was written in response to the well-publicized comments of Laurence Summers, President of Harvard University, last winter. The *Boston Globe* article can be found at: [http://www.boston.com/news/globe/editorial\\_opinion/oped/articles/2005/02/12/women\\_and\\_science\\_the\\_real\\_issue/](http://www.boston.com/news/globe/editorial_opinion/oped/articles/2005/02/12/women_and_science_the_real_issue/)
8. You can listen to an audiotape (~ 10 minutes) on *Women in Science* from the 9/26/2005 edition of *Science Friday* on National Public Radio: [http://www.sciencefriday.com/pages/2005/Aug/hour2\\_082605.html](http://www.sciencefriday.com/pages/2005/Aug/hour2_082605.html)
9. A popular tradebook on the subject of women and careers is: *Why So Slow? The Advancement of Women*, by Virginia Valian, MIT Press, 1998.

# Appendix 3: MPOWIR Workshop Agenda

## MPOWIR: Mentoring Physical Oceanography Women to Increase Retention

Workshop Sponsored by the National Science Foundation and the Office of Naval Research

Held at the Airlie Center, Warrenton, Virginia, October 9–12, 2005

### Sunday Evening: October 9th

- 5:30 Reception in the Jefferson Room, Sponsored by the Nicholas School of the Environment and Earth Sciences, Duke University  
Welcome: Susan Lozier, Duke University
- 6:30 Dinner
- 7:30 Opening remarks in the Meadow Room: Susan Lozier, Duke University  
Introductory remarks:
  - 1. Terri Paluszkiwicz, Physical Oceanography Program, ONR
  - 2. Eric Itsweire, Physical Oceanography Program, NSF
  - 3. Rana Fine, University of Miami
  - 4. Victoria Coles, University of Maryland
- 8:00 Overview of workshop: Merlin Walberg, Meeting facilitator
- 8:15 Small group activity:
  - 1. Personal anecdotes that highlight the value of mentoring
  - 2. Challenges and responsibilities for workshop participants
- 9:15 Large group summary: Merlin Walberg
- 9:30 Close

### Monday: October 10th

- 7:30–8:30 Breakfast
- 8:30 Reflections on Sunday evening discussion: Merlin Walberg
- 9:00 Guidelines and goals for workshop: Merlin Walberg
- 9:15 National context: Small group discussions of *National Analysis of Diversity in Science and Engineering Faculties in Research Universities*
- 9:40 Physical oceanography context:
  - 1. MPOWIR survey results: LuAnne Thompson, U. of Washington
  - 2. Funding statistics: Julie McClean, Scripps Inst. of OceanographyPast and ongoing efforts at the institutional level:
  - 1. The MIT report: Paola Rizzoli, MIT
  - 2. Mentoring at home institutions: Amy Bower, WHOI
  - 3. The ADVANCE program: LuAnne Thompson, U. Washington
- 10:30 Coffee break
- 11:00 Small group discussions: What are the obstacles and barriers for women in the field of physical oceanography?

- 12:00 Debrief in large group:
1. Which of these obstacles can be addressed by a mentoring program?
  2. Ideal outcomes for a community-based mentoring program
- 1:00 Lunch
- 2:00 Cultural biases: Merlin Walberg and Susan Lozier
- 3:00 Small group discussions: Design of ideal mentoring program
- 5:00 Break
- 5:30 Presentation and discussion of proposed mentoring programs
- 6:30 Break
- 7:30 Dinner

### Tuesday: October 11th

- 7:30-8:30 Breakfast
- 8:30 Reflections/Open discussion
- 9:00 Proposal of a mentoring program: Steering Committee
- 9:30 Designing the mentoring program - Nuts and Bolts I
- 11:00 Coffee break
- 11:30 Designing the mentoring program - Nuts and Bolts II
- 1:00 Lunch
- 2:00-3:45 Open
- 3:45-5:15 Designing the Mentoring Program - Nuts and Bolts III
- 5:30-6:30 Guest Speaker: Susan Solomon, Senior Scientist, NOAA; *Shattering the Glass Ceiling: Some Thoughts on Where We Are Going and How to Get There*
- 6:30 Dinner
- 8:00 Dessert reception followed by evening activity
- 9:30 Close

### Wednesday: October 12th

- 7:00-8:00 Breakfast
- 8:00 Reflections
- 8:30 Nuts and Bolts IV- for presentation preparation
- 9:30 Coffee break
- 10:00 Presentations to large group, joined by representatives from AGU (Dr. Jill Karsten), DOE (Dr. Anjuli Bamzai), NASA (Dr. Eric Lindstrom), NOAA (Dr. Chet Koblinsky), NSF (Drs. Larry Clark, Eric Itsweire, Elise Ralph, Mary-Elena Carr and Gisele Muller-Parker), and ONR (Dr. Manny Fidereo)
- 12:00 Discussion and closing comments
- 12:30 Break
- 1:00 Lunch and departure

## Appendix 4: MPOWIR Workshop Guests

On the last morning of the conference, representatives from funding agencies and professional societies were invited to hear a summary of the workshop outcomes and to provide feedback on the planned mentoring activities.

Dr. Anjali S. Bamzai  
Program Manager  
Climate Change Prediction Program  
U.S. Department of Energy

Dr. H. Lawrence Clark  
Director  
Division of Ocean Sciences  
National Science Foundation

Dr. Mary-Elena Carr  
Biological Oceanography Program  
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Dr. Manny Fidereo  
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Dr. Jill L. Karsten  
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National Oceanic and Atmospheric  
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Dr. Eric J. Lindstrom  
Physical Oceanography Program Scientist  
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Dr. Gisele Muller-Parker  
Associate Program Director for Ocean Education  
Division of Ocean Sciences  
National Science Foundation

Dr. Elise A. Ralph  
Associate Program Director  
Physical Oceanography Program  
Division of Ocean Sciences  
National Science Foundation

## Appendix 5: Ancillary Issues

*The Atmosphere at Sea.* Although conditions for women working at sea have undoubtedly improved over the last twenty years, there is still a wide range of social standards and practices to be found on different research vessels, with some ships being perceived as providing a more comfortable working environment for women, and others providing one that is less so. To counteract this inequity, training and information on appropriate behavior should routinely be provided to scientific parties and ships' crews as part of cruise orientation and safety training for sea. At the October 2005 University and National Oceanographic Laboratory System (UNOLS) Council meeting, it was recommended that ship operators include this information as part of the orientation lecture given to the science party and new crew. It was recommended that the procedure for reporting inappropriate behavior also be presented. At the annual UNOLS Research Vessels Operators meeting in April 2006, the operators plan to produce a common procedure for implementing the above for all of the academic research fleet.

*Mentoring Metrics and Visibility.* MPOWIR workshop participants recognized that one way to improve the community's recognition of the importance of mentoring was to raise its visibility and make it an explicit part of one's evaluated work. To this end, workshop participants proposed that a mentoring component be added to the National Oceanographic Partnership Program (NOPP) as one of their metrics and that mentoring awards should be developed through various professional societies.

*The Culture of Physical Oceanography.* Workshop participants expressed concern that input from younger scientists, both men and women, is not often sought at an institutional level. This can create a "top-heavy," intimidating atmosphere for the young oceanographer eager to become more involved in larger efforts or projects. To combat this problem, MPOWIR participants proposed that a deliberate effort be made to increase the representation of young scientists on national committees; this will be pursued with national agencies and professional societies. In a similar vein, workshop participants called for an evaluation to be conducted by the National Academies Ocean Studies Board on the impacts of physical oceanographic culture on diversity in our field and on advancement within it.

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