

Improving Gender Equity in Aquaculture Education and Training: 30 years of experiences in the Pond Dynamics/Aquaculture, Aquaculture, and AquaFish Collaborative Research Support Programs

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Abstract

The AquaFish Collaborative Research Support Program (CRSP) is dedicated to improving gender equality in the aquaculture and fisheries sectors and in the CRSP arena. It intends to create equal opportunities for women and men to participate in the Program's research, training, educational, or other activities. Recognizing the barriers women face and the complexity of the issue, the AquaFish CRSP has taken a mindful approach towards gender integration by intentionally focusing on women beneficiaries of its research and outreach, along with women participating within the program itself. CRSP works towards gender equality by mandating gender projects in a cross cutting way as well as an individual way.. Even with these policies firmly in place and real dedication to the goal of improving gender equality, gender-segregated statistics from AquaFish displays characteristics of a 'leaky pipeline' as seen in other fields of science. During the original Pond Dynamics/Aquaculture CRSP (PD/A) and subsequent Aquaculture CRSP (ACRSP) (1982-2008), 36.8% of the 683 degree seeking students were women, which increased to over 40% during the last three years of the ACRSP program. In the more recent AquaFish CRSP program (2006-current),

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100 students completed degree programs with 55 being women (55%) from 2008-2010.

Although reaching a 50% target for training women is a major accomplishment, The same proportion is not entering higher positions in science or research careers. Contrary to assumptions that women undertake short-term training opportunities more readily than long-term, women still make up less than 50% of the CRSP short-term trainees. More research is needed to fully understand leaks in the pipeline and other barriers to women's participation.

Introduction

Globally, women play an integral role in the aquaculture and fisheries sectors. Even though women's roles and responsibilities are beginning to change in some countries, there are still constraints that can limit their participation. Some constraints that women face in aquaculture and fisheries are: time availability and allocation, land ownership and access to water, credit and labor, and access to training and extension services. Lack of training opportunities can trap women in these vulnerable and poorly paid positions without any prospects of getting ahead (UNFAO, 1998).

According to FAO, "Gender discrimination stems from the low value attached to women's work and is perpetuated in their limited access to credit, processing technology, storage facilities and training" (FAO, 2010). Even in developed countries today, such as the United States of America, women earn \$0.82 for every dollar a male earns in an equivalent job, or about a 15% disparity in equal pay for equal work. Few women reach the upper

echelons of management in medicine, science, business, fisheries, or agriculture. Since the beginning of the International Decade for Women in 1975, efforts have been made to improve the living conditions of women and to correct the imbalances between men and women but more is yet to be achieved.

Methods and Discussion of Challenges of Involving Women in Science Programs

The AquaFish Collaborative Research Support Program (CRSP) (2006-present) and its predecessors -- the Pond Dynamics/Aquaculture (PD/A) CRSP (1982-1996) and Aquaculture CRSP (1996-2008) -- have long recognized the marginalization of women, inherent social and economic inequalities, and the vulnerable positions that women occupy in the aquaculture and fisheries sectors. Through equity in training opportunities, the CRSP (refers to all three CRSPs: PD/A, ACRSP, and AquaFish CRSP) has been able to provide women the tools to empower themselves, increase bargaining power, and enter new career opportunities. The increasing number of women graduates in academic, entrepreneurial, and governmental positions as well as their visibility in training courses and through community and regional involvement is helping to influence the enrollment of women students in degree programs. However, the involvement of women in high power positions in the aquaculture and fisheries sectors has been a challenge and the same stands true for the involvement of women graduates in higher positions in science and research fields.

Women have long been under-represented in science, engineering, and technology careers (Blickenstaff, 2005) and academic employment (Bagihole, 2000 as cited in

Bebbington, 2002). While women's representation has improved at the global scale in more recent years, the collective quantitative data on women in the science fields still show that women are not remaining in science at the same rate as men – a phenomena called the 'leaky pipeline.' Blickenstaff (2005) and others have described the system that carries students from secondary school through graduate school and on into their careers as a pipeline in which various holes or leaks occur, causing students to drop out. For example, a student may begin university pursuing a science degree and change course halfway through or a student might graduate with a science degree and decide to pursue a different career. The concern is that women leak out more often than men (Blickenstaff, 2005). The problem appears to be progressive and persistent, meaning that women's participation continues to drop along the whole pipeline, and that over time this issue has not gone away (Cronin and Roger, 1995).

The CRSP is no stranger to this issue and for the past 30 years has actively worked toward gender equity in all its projects. The CRSP data on women graduates support this leaky pipeline metaphor despite the extra attention given by the CRSP to gender equity and equality. After years of informal equity standards, an officially sanctioned 50% benchmark was set with the start of the AquaFish CRSP program for training equal numbers of men and women in short- and long- term training.

If given equal opportunities and access from the beginning of their schooling, men and women could potentially enter research careers in equal proportions. However, the increase in women graduates has not been accompanied by an associated increase in the proportion of women in academic science, engineering and technology careers (Bebbington,

2002). A study in the UK showed women were 2% or less of the professors in many sub-disciplines of science, engineering and technology (Bebbington, 2002). A similar phenomenon is seen with CRSP students and researchers as explained later on in the paper. Glover (2002) showed that even in science fields where women are well represented, such as biology, they aren't necessarily reaching the top of their fields. Equal pay for women has been and continues to be an issue, as well as the fact that women are more likely to be employed on short-term contracts and less likely to apply for research grants, even though they are as successful as men when they do apply (Blake and LaVelle, 2000 as cited in Bebbington, 2002). Why is this happening? What are the barriers that prevent women from moving through the pipeline into careers in science and research?

A number of theories have been proposed as to the barriers facing women in science. The following are a few possible explanations for the leaks in the pipeline that keep women from moving up the ladder in science. The explanations below are adapted from Bebbington (2002), Blickenstaff (2005), and Glover (2002). Most of these hold true in developed and developing countries.

- *Balancing work and family demands.* The demands of family and work are inescapable for women and are exacerbated in developing countries where women spend large amounts of time fetching water, caring for children, and harvesting food. The CRSP short-term training data show that this issue is more complex than initially thought. When CRSP training courses were local and short-term, they were not necessarily better attended by women. And, conversely, when training is far away and long-term –

requiring the student to leave their home country to pursue a degree in the US—we found a greater percentage of women participating.

- *Societal gender roles.* Gender roles are imposed on us almost as soon as we are born. Women may feel pressure to be the primary care provider at home and men and women both may be reluctant to wholly accept and encourage women in the field of science because those are not the traditional gender roles to which they have grown accustomed.
- *Science curricula and pedagogy are more geared toward men.* This can start from a very young age with science books featuring significantly more boys than girls doing the science or teachers paying more attention to male students and continues through graduate school with more male students and professors moving into higher positions.
- *Women's work is often overlooked/undervalued.* People have little incentive to get ahead if it is perceived they will not be recognized for their work. This is often the case with women's contributions to research.
- *Women's personal values.* Ultimately a woman may value the education itself more than the career. Women may hold different definitions of success based on ethnicity, culture, and personal values.
- *The culture of science itself.* Many of the explanations above could be considered part of the culture of science. The masculine nature of that culture may contribute to the underrepresentation of women. If women have a sense that they won't get ahead or won't feel welcome in the field, they might choose other career paths.

The challenges of mainstreaming gender in science and technology research projects are many. Key elements of a framework CRSP uses to address these challenges include

developing an initial process, defining program objectives, identifying leaders and mentors, and accountability measures to vet the overall process and ensure success (Figure 1). The initial process looks at the big picture for achieving gender equality; programming describes more specific program level objectives for gender mainstreaming; leadership discusses the importance of empowering champions and role models; and accountability is a reflective approach to help identify what works and does not work in gender mainstreaming. This model is meant to be an iterative process where successes, actors, and outcomes are fed back into the system creating a positive feedback loop of mentoring, development, and eventually gender mainstreaming.

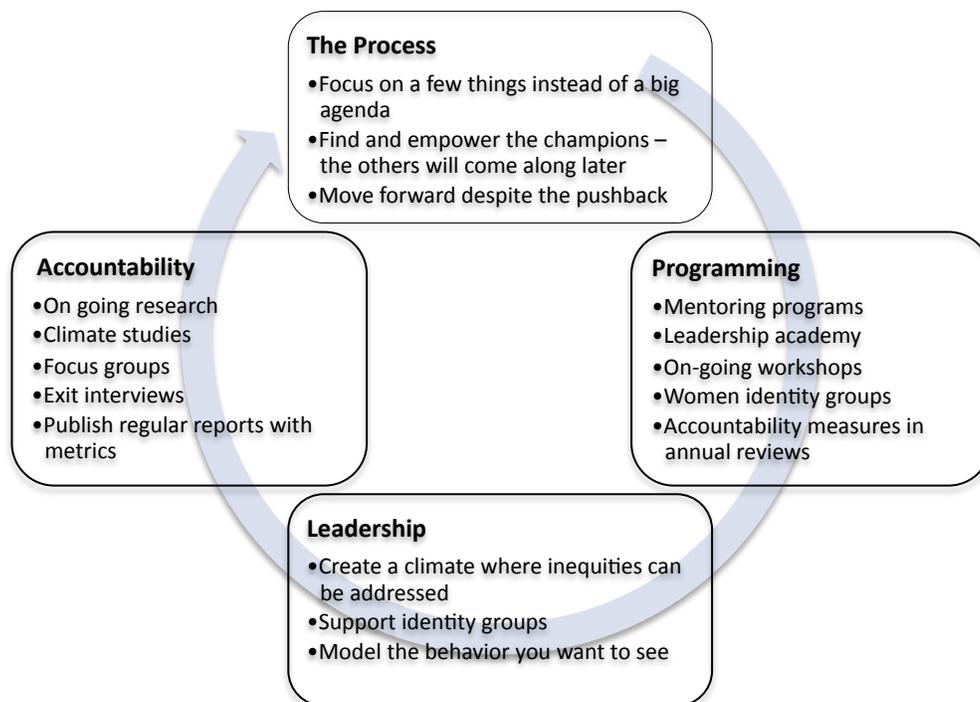


Fig. 1. Contextual diagram outlining the process for mainstreaming gender into science and research programs

The AquaFish CRSP has addressed some of the challenges of involving women in science and creating equal opportunities for women and men to participate in the Program's research, training, education, or other activities. As a gender-responsive organization, the CRSP has adopted a multi-faceted approach to promote and integrate gender equality. Some of the specific actions taken by the AquaFish CRSP include:

- a) Collection and analysis of disaggregated data from individual projects to gauge the gender inclusiveness success;
- b) Promoting participation of women in formal and informal training opportunities provided through the CRSP by setting a 50% benchmark for women in training courses;
- c) Mandating that all core research projects have a strategy for integrating and addressing gender (a Gender Strategy);
- d) Working with each of the core research projects to ensure it has at least one gender-focused investigation; and
- e) Providing specific extension and technical services for women related to sustainable aquaculture and aquatic resource management.

A Synopsis of AquaFish CRSP Training

Long-Term Training

The CRSP has strived to provide training for students who were interested in aquaculture and would presumably go on to work in the aquaculture field, whether as owners or managers of private farms, officials in government organizations, members of non-

government organizations, or faculty in institutions of higher education involved in research and extension. As such, CRSP long-term training efforts focused on teaching general biological and ecological knowledge, scientific principles, and research methodologies, and provided students with early experience in conducting experimental work. Long-term training typically took the form of participation in degree programs (BS, MS, or PhD) at higher educational institutions, either in the US, a participating Host Country, or a third country. The hope is that these students will be the next generation of researchers and research administrators in aquaculture, fisheries, and related sciences. The goal is to empower these graduates with the ability to do research, generate new knowledge, and solve pressing problems in their home countries.

During the Pond Dynamics/Aquaculture CRSP (PD/A) and ACRSP (referred to collectively from now on as ACRSP) from 1982-2008, 683 students completed degree programs with full or partial support from CRSP (Aquaculture CRSP 2008). Of those students for which gender data were reported, 36.8% were women (Table 1). The number of women completing degree training programs supported by the CRSP increased dramatically beginning in about 1999, and the percentage of women candidates was consistently greater than 40% during the last three years of the program (2006-2008). The percentage of women seeking degrees decreased as the degree level increased: of those seeking a BS, 41.8% were women; of those seeking a MS, 33.1% were women; and of those seeking a PhD, 30.5% were women (Table 2). This finding is consistent with the idea of the losses of women being progressive and persistent down the career pipeline. That said, at least 30% participation by women was achieved at all degree levels over a nearly 30-year period.

Table 1. Numbers of students completing degree programs with CRSP support from 1984-2010. ACRSP data for degree completion is presented from 1984-2008 and AquaFish from 2008-2010. Data for degree completion starts after program inception; thus, degrees were completed in 1984 even though the first CRSP began in 1982. For AquaFish, the first degrees overlapped with the final year of ACRSP (both CRSPs ran concurrently) and thus, independent data for 2008 is presented for ACRSP and AquaFish.

Year	Total Number (data not collected)	% Women	Year (cont'd)	Total Number	% Women
1984	4	0.0	2000	34	32.4
1985	16	37.5	2001	54	38.9
1986	13	38.5	2002	15	20.0
1987	17	47.1	2003	3	0.0
1988	6	16.7	2004	76	34.2
1989	16	12.5	2005	47	38.3
1990	20 (2)	33.3	2006	37 (1)	50.0
1991	10	10.0	2007	36	47.2
1992	13	38.5	2008	29	44.8
1993	9	11.1	Year Unknown	98 (3)	41.1
1994	11	27.3	ACRSP Total	683(7)	36.8
1995	25	36.0	2008	17	72.2
1996	12	25	2009	63	50.8
1997	12 (1)	54.5	2010	20	50

1998	27	29.6	AquaFish Total	100	55
1999	43	44.2	TOTAL	783 (7)	39.1

Table 2. Degree programs completed by men and women over the 25 year history of the ACRSP (1982 -2008).

Degree	Total Number	% women
	(data not collected)	
BA/BS	304	41.8
MS	275	33.1
PhD /PostDoc	82	30.5
Data not available	22 (4)	27.8
All degrees	683	36.5

As of 2010, the AquaFish CRSP program (as differentiated from PD/A and ACRSP) has trained or is currently training 273 students in degree programs with 130 being women (47.6%) (AquaFish CRSP, 2010). In 2008-2010, at least 50% of the students completing degrees each year were women (Table 1). When combined with the previous three years of ACRSP data, it shows that over half (51%) of the graduates in the past five years were women. Increasing gender equity in educational opportunities is a major achievement in itself. But while it appears that have equal number by gender, this does not yet mean that we are seeing the same proportion entering higher positions in research careers. So who is doing the work now?

With regard to women in science leadership roles, the AquaFish CRSP program has one woman US Principal Investigator out of seven total PIs (14.3% women), only slightly higher than the three out of 24 (12.5%) in the older ACRSP program. In addition, the CRSP's Lead Principal Investigator and director is a woman. An analysis of all the PIs, Co-PIs, and Investigators across all seven core research projects in the AquaFish CRSP, however, shows 25 women out of 99 personnel (25%). Where have all the women graduates gone? One of every potential two women degree holders is not yet represented in the scientific leadership of the Program. More women should be in the pipeline as recent graduates. Since smaller percentages of women graduated before 1999, fewer were available to be senior researchers, principal investigators, and executive research administrators. This number might increase in the coming years as women graduates make it further down the pipeline.

Short-Term Training

Short-term training supported by the CRSP over 30 years includes learning opportunities focused on specific topics and the courses are compressed into short time periods of between half a day to two or three weeks up to six months. Learning opportunities most frequently occur as short courses, workshops and seminars, and participation in conferences. The target audiences for this type of training are typically farmers, extension agents, government officers, other stakeholders, or students who want to learn about aquaculture basics or need specific new skills to apply on their farms, in their research or production facilities, in their private enterprises, or in their education and outreach efforts. Information presented includes the current state of knowledge about targeted aquaculture

species, whereas skills training included topics such as pond construction, broodstock management, fish propagation, hatchery rearing of larval fish, fingerling production, water quality monitoring, computer and software training, extension methods, and survey methodologies, marketing, record keeping, to name a few. Other examples of short-term training include individualized aquaculture information relevant to a specific situation; on-the-job mentoring and training at field sites; and short internships to help participants develop particular skills.

Preliminary gender data for the short-term training in the current AquaFish CRSP, since its inception in September 2006, shows over 100 short-term training events with over 3,000 participants, of which approximately 34% were women. Women’s participation was approximately 30% for the first two years of the program, with an increase to about 40% in 2010 (Table 4). While these numbers may be increasing, they still don’t reflect the level of participation seen in long-term training.

Table 4. Non-degree programs undertaken by men and women over the history of the AquaFish CRSP.

Year	Total Number	% Women
2008	888	33.9
2009	1440	31.8
2010	694	39.6
TOTAL	3022	34.2%

Women are assumed to undertake short-term training more readily than long term training because it is typically local and does not require a significant time commitment. These data do not support this assumption and, furthermore, they suggest a greater percentage of women participating in long-term and long distance degree training. Perhaps the short-term training opportunities have not been well advertised, accessible, or they are not of as much interest to women as to men.

Another factor may be cultural mores and gender roles in the locations where the short-term events are held. Lower percentages of women were trained in events in Africa (such as Kenya, Uganda, and Mali) than in Asia and Latin America. Unequal access to training may be a consequence of the geographical popularity of the aquaculture activity itself, or how widespread aquaculture is in a country or geographical area. Asia accounts for over 80% of the world's aquaculture production while Africa and Latin America account for about 4% together. That aquaculture is commonplace in Asia may account for the increased numbers of women trainees from Asia; however, this would not explain the higher numbers from Latin America, where aquaculture is not a mainstream activity. As more concerted efforts such as mandatory gender-focused investigations and country specific strategies are beginning to take place in short-term training efforts, and aquaculture becomes more geographically widespread, the number of women participants is expected to continue to rise.

Conclusions on Mainstreaming Gender into Science and Research Programs

Recently, women have made great strides in terms of equal rights, educational and professional opportunities, better wages, and political power. More women are in the formal workforce today than anytime in history. Because of the aging of the cohorts that made up the vanguard of aquaculture science, a large number of retirements are on the horizon and many top leadership positions will soon be vacant and some could be filled by women. Combined with an increase in women graduates, this might start the process of blocking the holes in the leaky pipeline. To achieve this, women will need to be retained in the pipeline for long enough to reach these leadership positions.

In order to have a better understanding of what the leaks are in the aquaculture science pipeline, future research should include follow up studies of CRSP women graduates. We need to think critically about the leaks and undertake intentional actions to bridge the gap between training and employment, and between employment and promotion to the highest levels. Qualitative research is needed to look at how and why these barriers persist. A deeper understanding of the leaks at different stages will require evaluating the processes beyond the statistics. Another aspect of the complex issue involves an epistemological approach (Bebbington, 2002) to understand women's relationship to science and the production of scientific knowledge. As the body of scientific knowledge continues to be built and refined, we need all perspectives and an ability to ensure the most objective and accurate accumulation of knowledge. Over the past many years, the PD/A, Aquaculture, and now AquaFish CRSPs have promoted gender equality and engaged women in training activities by collecting gender disaggregated data, setting explicit goals, and evaluating outcomes. These sustained efforts have been successful in increasing women's participation in long-

and short-term training over time. It is our hope that these efforts will have lasting effects on gender equity in the aquaculture and fisheries sectors all the way through the pipeline.

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