

# Gender integration in aquaculture research and technology adoption processes: Lessons learned in Bangladesh



RESEARCH PROGRAM ON  
Livestock and Fish



RESEARCH PROGRAM ON  
Aquatic  
Agricultural  
Systems



# GENDER INTEGRATION IN AQUACULTURE RESEARCH AND TECHNOLOGY ADOPTION PROCESSES: LESSONS LEARNED IN BANGLADESH

---

## Authors

Cathy Rozel Farnworth, Nasrin Sultana, Paula Kantor and Afrina Choudhury

## Citation

This publication should be cited as: Farnworth CR, Sultana N, Kantor P and Choudhury A. 2015. Gender integration in aquaculture research and technology adoption processes: Lessons learned in Bangladesh. Penang, Malaysia: WorldFish. Working Paper: 2015-17.

## Acknowledgments

With Paula's passing, there is a sudden void in our world: the void created through losing a mentor, a friend, a teacher, a nurturer. Paula, in her life and her work, was immensely inspiring and supportive in shedding light on gender issues—always with articulate and intellectual grace. She was passionate about her work, yet she was humble and never imposed her opinions on others. Instead, with much warmth and selflessness, she worked with us to pave the way for others to form their own approaches to improving the lives of people. We hope that through our work, the light of her legacy will continue to shine on us and the people that we work with.

Paula—we miss you.

# CONTENTS

---

List of acronyms	4
Executive summary	5
Introduction	7
Starting points: Gender in aquaculture interventions in Bangladesh	8
Gender roles and gendered benefits in aquaculture	8
An overview of gender integration in aquaculture interventions	8
Moving forward	10
Study research question and methods	13
Fieldwork findings	16
WorldFish-led AIN project	16
Technology-methodology intervention	16
Beneficiary appraisals of the learning approach	17
Gender-transformative approach in conventional training	18
Technology-methodology intervention	18
Beneficiary appraisals of the learning approach	20
Challenged Ponds	21
Technology-methodology intervention	21
Beneficiary appraisals of the learning approach	22
Solidaridad SaFaL	24
Technology-methodology intervention	24
Beneficiary appraisals of the learning approach	25
Additional cross-cutting findings	26
Changes in intra-household food distribution	26
Changes in community-level gender norms	26
Conclusion	28
Forward-looking action research priorities	29
Notes	32
References	33

# LIST OF ACRONYMS

---

AAS	CGIAR Research Program on Aquatic Agricultural Systems
AIN	Aquaculture for Income and Nutrition
BSFF	Bangladesh Shrimp and Fish Foundation
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CIMMYT	International Maize and Wheat Improvement Center
CSISA	Cereal Systems Initiative for South Asia
CSISA-BD	Cereal Systems Initiative for South Asia-Bangladesh
HKI	Helen Keller International
IRRI	International Rice Research Institute
NGO	nongovernmental organization
SaFaL	Sustainable Agriculture, Food Security and Linkages
USAID	United States Agency for International Development

# EXECUTIVE SUMMARY

---

A number of development partners and projects, including WorldFish as part of both the Cereal Systems Initiative for South Asia-Bangladesh (CSISA-BD) and the Aquaculture for Income and Nutrition (AIN) projects, the nongovernmental organization (NGO) Katalyst, and the international NGO Solidaridad, design and implement technological interventions that aim to improve the production and productivity of household ponds for fish consumption and sale. These projects have developed gender-responsive methodologies and are working towards gender outcomes. It is expected that interventions will strengthen women as value chain actors in their own right, improve their ability to work together with men to provide adequate household food and nutrition security, and help strengthen their agency more broadly. The purpose of the current study, conducted in 2014, was to

- carry out a rapid assessment of the technology knowledge transfer approaches used in these projects;
- draw together recommendations to assist WorldFish to develop and deepen its efforts to integrate gender-transformative approaches with technical interventions;
- contribute to enhancing the analytic and forward-planning capacity of women and men managers of household ponds using improved polyculture technologies for fish and other aquatic products.

Integrating social and technical interventions is at the heart of the WorldFish gender strategy. This strategy is based on the understanding, drawn from gender research conducted over many decades, that stand-alone interventions focusing either on disseminating a particular technology or on fostering gender-transformative change will fail to deliver expected development outcomes. Technologies cannot be delivered in a gender-neutral way because their impacts are not gender neutral; the operating environment is shaped by gender relations (Farnworth 2010; Manfre et al. 2012; Ragasa et al. 2012). On the one hand, ignoring the social context may limit the benefits of a technological intervention, as barriers to adoption or to benefiting from adoption among marginalized groups are not addressed. On the other hand, stand-alone gender interventions lack the explicit livelihood incentive that motivates participation and in some contexts makes participation culturally acceptable for women. In contrast to these isolated alternatives, the expectation is that interventions that combine technology dissemination with gender-responsive dissemination methodologies will result in lasting productivity, development and equity outcomes.

The fieldwork component of this study focused on building an understanding of how gender is being integrated within homestead aquaculture technology delivery and participatory research initiatives in order to draw out lessons to be applied and tested at scale. The study reviewed a selection of different gender integration participatory research and technology transfer methodologies in Bagerhat District, Faridpur District and Khulna District in southwest Bangladesh.

The projects studied were the USAID-funded AIN project; the WorldFish gender-transformative approach in conventional training pilot (within CSISA-BD); the WorldFish Women-Led Participatory Action Research on Homestead Challenged Pond Aquaculture (Challenged Ponds); and the Solidaridad Sustainable Agriculture, Food Security and Linkages (SaFaL) Project.

Small group discussions were held separately with women and men farmers in project sites. Roughly equal numbers of women and men were interviewed, totaling 57 respondents in all. Key informant interviews were held with project field staff.

The findings show that regardless of methodology, targeting women helps to enhance their status at community level and to strengthen their voice in intra-household bargaining. Overt recognition and promotion of women and their capacities by external actors is important. However, the gains of involving women can be ephemeral. Securing long-lasting change can only succeed if women and men themselves take charge of, and feel they benefit from, changes in gender relations.

Innovative methodologies for aquaculture technology development and dissemination need to focus on promoting farmer adaptive capacity and assisting them to take charge of their own learning processes. Working with development partners, value chain actors, communities, families and individuals to identify and challenge gender-based constraints to women's full participation in aquaculture, and to build on existing positive norms, is essential.

Research agendas for the future can seek to combine the participatory action research methodology developed by the Challenged Ponds research project with the enabling environment and value chain focus of SaFaL and Katalyst, and the gender-transformative approach piloted under CSISA. Based on the findings outlined in this study, a combined technology and gender-responsive methodology seems to hold potential for fostering sustained improvements in livelihood security for resource-poor women and men in rural Bangladesh. Operationalizing and testing this combined suite of technological and methodological interventions under various conditions is the next step.

# INTRODUCTION

---

WorldFish and the CGIAR Research Programs on Aquatic Agricultural Systems (AAS) and Livestock and Fish (L&F) are working extensively in the country with various aquaculture and fisheries technologies. These include homestead and entrepreneurial fish pond systems, shrimp and prawn systems, traditional and improved *gher* (modified paddy field with raised dike and ditch) systems with vegetable culture on the dikes, cage systems, and floodplain aquaculture. These systems are integral to providing fish, one of the most important sources of animal-based protein in the diet of resource-poor households and a rich source of important micronutrients and vitamins such as calcium, zinc, iron and Vitamin A. Women and children in particular can receive tremendous health benefits when they are able to access, cook with and consume micronutrient-rich fish (particularly small indigenous fish known as mola). The consumption of micronutrient-rich fish is especially beneficial within the first 1000 days from conception, leading to long-term development benefits for mother and child (Brems and Berg 1989; Ashworth 1998; Ransome and Elder 2003; Stein and Qaim 2007; de Schutter 2012; Shenggen 2012).

Several studies conducted in Bangladesh have shown that overall levels of fish production, productivity and utilization can be strengthened when women fishers and managers of aquaculture technologies access resources effectively together with men. The studies show that these gains are tied to women playing a strong role in decision-making processes within households, broader value chains, and community and other knowledge networks (Shirajee et al. 2010; Belton et al. 2011; Rahman et al. 2011; Morgan et al. 2013; Terry 2014). However, the basis for these claims, the pathways through which the improvements are achieved, and the benefits and consequences for equity and gender relations need to be critically reviewed. This is particularly true when considering the success of initiatives beyond the life of a typical donor project. Improved understandings are required of the sources of information, the types of services women and men use, and the ways in which gender relations influence how—and if—women and men access, manage and control aquaculture technologies and benefit from their use.

In obtaining these improved understandings, it is helpful to understand gender identities as fluid and dynamic. Women and men have multiple identities and roles—as spouses, as co-workers, as parents and in wider kinship networks. They renegotiate gender relations within their households and the communities within which they live in response to wider societal changes and new economic opportunities.

This working paper is part of a review of aquaculture technologies and gender in Bangladesh in the period 1990 to 2014. It assesses how gender has been integrated within past aquaculture technology interventions, before exploring the gender dimensions associated with current approaches to transferring knowledge about homestead aquaculture technology. It draws out existing knowledge, identifies research gaps, and selects practices to build upon—as well as practices to move away from. The review examines the research and practice of WorldFish and other development partners in Bangladesh through consultations, a review of gray and published literature, and fieldwork. It aims to contribute to the development of aquaculture technology dissemination methodologies that strengthen and underpin women’s participation in aquaculture.

# STARTING POINTS: GENDER IN AQUACULTURE INTERVENTIONS IN BANGLADESH

## Gender roles and gendered benefits in aquaculture

Development partners rarely consider women to be primary actors in the aquaculture sector in Bangladesh. It is overwhelmingly considered a male occupation and business, as commercial ponds away from the homestead tend to be managed by men. However, in some rural Bangladesh contexts, women do provide labor (family or hired) in commercial aquaculture, with a combination of religious and cultural norms and poverty influencing the extent of women's presence in such employment (Belton et al. 2014a).

Approximately 20% (4.27 million households) of the rural population operate or have access to a household pond (Belton et al. 2011). Such ponds, often very small in size (50–150 decimals or 2023–6070 square meters), are generally understood to belong to the family, and in some cases to several related or extended families. They are typically multiuse—for washing clothes and utensils, watering animals, and bathing. Fish are harvested from most household ponds, and can make an important contribution to household food security and nutrition, with people in rural areas mostly consuming carp and small indigenous fish (Belton et al. 2011; Morgan et al. 2013; Belton et al. 2014b). However, although the development of aquaculture is mitigating a decline in the consumption of fish from capture fisheries, almost no data exists on whether the consumption of fish from household ponds by the most resource-poor consumers, or by women and children, has increased (Belton et al. 2014b; Terry 2014). While one study of the Development of Sustainable Agriculture Project (2001–2005) shows that overall household fish consumption is higher from women-managed ponds than from men-managed ponds (Murshed-e-Jahan et al. 2010), a second study indicates that even though individually operated ponds targeted by the Mymensingh Aquaculture Extension Project (1989–2003) increased nutrient availability at the household level, the proportion of stunted girls increased

within the project area (Kumar and Quisumbing 2011).

Although household ponds are generally not perceived as “women-managed,” some studies show that women conduct a significant percentage of tasks related to fish production in household ponds, including feeding and fertilizing, limited harvesting using push nets and hooks, and fish sorting, processing and drying (Shirajee et al. 2010). In some cases, women conduct farm-gate sales (Shirajee et al. 2010). Other studies indicate less participation, with women only feeding fish and fertilizing ponds (DANIDA 2008). Men are typically involved in stocking, harvesting using cast nets, and marketing in formal markets (Shirajee et al. 2010; Rahman et al. 2011). Thus, household ponds tend to be operated jointly by women and men, reflecting the influence of the prevailing gender division of labor and particularly the acceptability of women's presence in marketplaces.

Generally speaking, yields from household ponds are low due to ineffective management across the production cycle. Indeed, the USAID-AIN 2014 draft annual report indicates that in many cases very few tasks are performed regularly by either women or men apart from basic stocking and occasional feeding with household food leftovers. Hence, improving the management of household ponds has been a mainstay of efforts to increase women's involvement in aquaculture.

## An overview of gender integration in aquaculture interventions

The way in which gender has been conceptualized in and integrated into aquaculture initiatives in Bangladesh over the past 30 years has varied along with organizational missions and mandates, project objectives, and donor interests, among other factors. Even so, targeting women for interventions focused on homestead ponds has been part of a wide variety of initiatives. This is partly because household ponds are within



women's sphere of activity and so are perceived as an "extra" source of income that women can exploit in ways that do not challenge existing gender roles, and partly because men are primarily involved in other income-generation activities. However, research about the intersections of gender roles in aquaculture activities signals that individualized approaches to promoting livelihood activities may fail to reflect realities of conflict and cooperation on the ground. The types of technologies selected, who takes responsibility for carrying them out and who benefits reflect gender and social relations in households, communities and wider society. Engaging with individual women or men as though they were not embedded in wider social relations can lead to unintended negative project outcomes or projects that perform at less than their potential. This failure to identify and mitigate gender-based and other social constraints can lead to the justification of gender-exclusive, socially exclusive project interventions as being economically rational (Box 1).

The interview with BRAC staff described in Box 1 points to the key gender-based constraint to women's effective participation in value chains: their lack of decision-making capacity relative to men. Based on the understanding that gender-based constraints serve to harm

the capacity of farm families to develop resilient and adaptive livelihood strategies over the longer term, WorldFish prefers to work with both women and men farmers. Targeting women for development interventions in Bangladesh is not in itself problematic. Indeed, gender-specific targeting may be the only way to reach women and start to engage with gender relations; it may also form an essential first step to enhancing women's confidence, visibility and value (Kabeer and Subrahmanian 1996). The understanding of gender that informs and underpins this women-centered targeting strategy is key. Frequently, targeting women is the beginning and end of the gender integration approach, and progression towards engaging both women and men is not anticipated. In such cases, engagement with spouses and community leaders tends to be instrumental and performed only in order to gain access to women. However, instrumental approaches fail to recognize the ways in which individuals and institutions can play a role in creating and maintaining gender inequalities. This makes it very difficult to lock in project-induced gains for women over the long term.

Many aquaculture projects over the past 20 years in Bangladesh have promoted the simplistic equation of "targeting women = gender integration," particularly at homestead

### **Box 1. Sidelining women farmers in the interests of effective commercialization: BRAC Fisheries**

Over the past 40 years, the BRAC Fisheries program's strong focus on targeting women—as is common across BRAC's agriculture activities—has faded in its commercial value chain interventions. The rationale for this shift provides interesting material to consider in efforts to advocate for increased gender integration. BRAC began work in fisheries in 1976, and in 1998, BRAC Fisheries was established. At that time, BRAC was highly dependent on donor funds, particularly from the World Food Program and the International Fund for Agricultural Development. BRAC policy was to ensure that 90% of beneficiaries were women, and international donors also required a strong gender focus. Over time, as the sector became increasingly commercialized, women's de facto participation in BRAC projects declined. In 2008, BRAC commenced the Fisheries Enterprise project. This project has no donor support and therefore does not need to meet donor requirements regarding target groups. The net effect has been to increase the involvement of wealthier farmers and other value chain actors. Women are not specifically targeted, although they are potentially involved as support to male businesspeople or as hired labor. According to the BRAC staff interviewed, women's lack of effective decision-making capacity prevents their direct participation in value chain development; they are often seen by men to hamper the value chain's professionalization and commercialization (BRAC Fisheries Enterprise staff, personal communication, 24 August 2014).

level (Shelly and D’Costa 2001; Rahman et al. 2008) and in current homestead and cage aquaculture initiatives (Morgan et al. 2013). In an effort to achieve a higher level of integration, some aquaculture projects have applied “family” or “couple” approaches. However, the gender approach of these projects has typically involved only training both women and men in aquaculture technologies (Terry 2014) with no effort to foster critical questioning of how gender and social issues affect livelihood outcomes. These projects have therefore missed the opportunity to stimulate discussion and reflection by the target families on the underlying causes and effects of gender inequalities on the effectiveness of livelihood strategies, and on the ability of women in particular to implement lessons from training. As a consequence, the gains from the projects have been weaker than expected (Terry 2014).

The work of CARE stands out in its attempts to work with complex understandings of gender and gender relations. The Fisheries and Aquaculture chapter of the *Gender and Agriculture Sourcebook* highlights five particularly successful CARE projects implemented over the past 20 years in Bangladesh (World Bank et al. 2009). These projects include two promoting integrated rice-fish production, one enabling resource-poor families to engage in prawn production, one promoting cage aquaculture, and one working with farmer participatory research to increase productivity through improved farming practices. Over the course of these projects, CARE (i) developed adult-learning-inspired, farmer-led research models to provide extension and foster technology adaptation as well as adoption; (ii) implemented a family approach within the farmer research model that involved purposefully engaging spouses and family members in extension activities; (iii) engaged households in discussions on the importance of mutual support to achieve livelihood security; (iv) worked to improve gender capacity among staff; and (v) recruited gender-balanced field teams to strengthen engagement of women and men in projects (Debashish et al. 2007; World Bank et al. 2009).

The current emphasis on value chain development in Bangladesh is opening up new areas in which to think about gender

integration. An example is the work of Katalyst, described in Box 2.

## Moving forward

The objective of WorldFish’s work in Bangladesh is to work with women and men to promote their effectiveness as managers of household ponds and thereby strengthen livelihoods and other development outcomes, such as food and nutrition security. Over the longer term, WorldFish expects these efforts to enable women to enter currently male-dominated parts of the household pond value chain—particularly marketing—and to enter medium-scale aquaculture businesses.

The underlying premise of WorldFish’s work on gender-transformative approaches is that sustainable, systemic change in gender relations is a prerequisite for achieving a range of broader development outcomes. Anticipated outcomes include improved productivity, more rational economic decision-making untrammelled by prescriptive gender norms, and personal empowerment (defined as the ability to make and carry out minor as well as life-changing choices important to the person making those choices; Kabeer 2000). This premise is substantiated by decades of work on gender that indicates that there is a causal relation between more equal gender relations in the household and in community structures, as well as better agricultural productivity and development outcomes (World Bank et al. 2009; World Bank 2012; FAO 2011; O’Sullivan 2014).

Although much work is being done on developing empowerment indicators, such as the Women in Agriculture Empowerment Index (IFRPI 2012; Sraboni et al. 2013), WorldFish understands that empowerment is a process as much as an outcome, and it is collective as much as individual. The achievement of empowerment rests upon the transformation of enabling conditions, such as the institutional rules and norms that limit what resource-poor women and other marginalized groups are able to be and do.

**Box 2. Engaging women in household pond aquaculture value chains: The work of Katalyst**

Katalyst is an autonomous project under the Ministry of Commerce that is implemented by Swisscontact and other agencies. It does not work directly with producers due to concerns around encouraging donor dependence. Rather, Katalyst focuses on building the capacity of value chain actors who interact with farmers, creating a sustainable market system operating in the interests of resource-poor actors. Its overall aim is to commercialize the smallholder fish sector by introducing improved technologies and management practices, as well as ensuring that this effort generates a profit for commercially motivated value chain facilitators.

Katalyst began work on farmed fish in 2004–2005 by training nursery owners to train farmers to develop better pond management practices—for example, appropriate fertilizer use. In 2009, recognizing that direct involvement in training was not a sustainable model and could not continue, Katalyst selected fish feed producers to act as scaling agents. It promoted commercially valuable fish, such as tilapia and koi, which require supplementary feeding to be produced successfully. The pathway envisaged was to involve fish feed agents in working with farmers to develop structured feeding and broader management practices, thus increasing productivity and leading to positive returns to investment for both farmer and company. However, an assessment in 2012 showed that large-scale farmers captured the majority of the benefits. This led to a recalibration of the model to focus on small farmers with household ponds (defined as less than 150 decimals, with most much smaller) for whom Katalyst has developed a semi-optimum stocking model. This facilitates proportional feeding, thus lowering investment costs significantly while still encouraging commercial actors to continue their involvement.

Katalyst's research shows that women do almost all feeding in household ponds, albeit on an occasional basis, using household food leftovers. Therefore, Katalyst is working to convince large feed suppliers that there is a vast, underserved niche market of women in the household pond sector in Bangladesh. In order to roll out extension, Katalyst proposes to build on underutilized capacity among feed company extension agents. They will be trained to target and train women managers of small household ponds using a simple 2-week feeding chart for supplementary feeds alongside other technologies. The challenge will be to show that women are actually changing their practice significantly; this will ensure that private sector actors continue to work with women. Katalyst is therefore testing information communication technologies to obtain data on how much feed women purchase. Katalyst recognizes that women fish farmers require working and investment capital, and is therefore working with nongovernmental financial service providers to help develop loan packages for women. The possibility of increasing their client base provides incentive for the financial service providers.

It is vital to ensure that when women make financial investments in fish feed, these investments are rewarded through improved sales. Therefore, Katalyst is working to address the key barriers of women's weak access to markets and to market information. Whereas men are able to check information in marketplaces, many women have limited ways to share information. However, Katalyst argues against promoting the direct participation of women in selling fish. It does not see women replacing men as fish sellers in the near future; nor is there a competitive advantage to women selling fish. The key need, they argue, is to focus on strengthening women's voice in intra-household decision-making processes so that women have a strong say in what and when to sell and in expenditure decisions. This requires awareness-raising activities alongside improved market linkages (Swisscontact and Katalyst staff, personal communications, 26–27 August 2014).

To foster such transformation, WorldFish is particularly interested in supporting learning processes that focus on developing a suite of critical skills (such as the willingness to question the status quo), improving decision-making capacity, and enabling participants to define and take charge of their own development pathway. These capacities are vital to ensuring that farmers are adequately equipped to exercise their agency (the ability to form a goal and act upon it) and build the anticipatory capacity needed to meet climatic and other challenges ahead (Douthwaite et al. 2001; Tschakert and Dietrich 2010; Okali and Naess 2013). The agenda of ensuring appropriate fit of specific technologies with the present circumstances of the user is not sufficient: learning systems have to be aligned with complex, ever-changing real-world situations.

In household pond systems, this can be translated as working with women to enable them to become and to be valued by others as effective managers of household pond aquaculture technologies—independently, in partnership with other women and together with men. Development partners can help support women and men to secure objectively measurable benefits (improved incomes, more equitably distributed household food and nutrition security, etc.) for themselves and their families over the long term.

Society constantly changes, thus altering gender norms and behaviors in unplanned, undirected processes. Development partners can work to identify and support changes that are beneficial to the empowerment of both women and men through the design and delivery of technical programs. One part of this support involves providing safe spaces for project beneficiaries to experiment in their own ways with new behavioral models within the household and the community, and to assist them to engage with wider marketing, social and other networks. Another part of such support involves working with market actors and other networks to help them become more open and receptive to engagement with women as market players and as decision-makers. Above all, the process has to focus on developing the skills and agency of women and men farmers and other target groups to enable them to direct and manage change processes, as opposed to merely responding to such processes.

It is therefore essential to create mechanisms that lock in gender-transformative change to ensure that women, men and their families are able to maintain their gains and build on them. This is challenging because gender generally remains contested ground in the agriculture and aquaculture sectors. Lessons learned about the benefits of merging social and economic development, and how to go about doing so, have not been widely documented, shared, scaled or embedded into existing practice. This working paper aims to contribute to filling this gap. It adds to the existing knowledge by assessing ongoing practices in southwest Bangladesh that merge social and technical issues in household pond aquaculture extension. The aim is to support the development of a gender-transformative action research model to pilot. Eventually, the goal is to scale out this model as part of standard aquaculture interventions and build a robust evidence base on how and why merging technical and social aspects in aquaculture knowledge transfer approaches leads to more lasting and equitable outcomes.

## STUDY RESEARCH QUESTION AND METHODS

The focus of the fieldwork component of this study, conducted in 2014, was on building an understanding of how gender has been integrated within homestead aquaculture technology delivery. The study considered the effects of several gender integration and technology knowledge transfer methodologies to date in order to draw out lessons learned to be applied and tested at scale. These methodologies have been used by various organizations to deliver very similar aquaculture technologies to very similar target farmers in terms of assets and location. The initiatives took place in the southwest districts of Bagerhat, Faridpur and Khulna—a climatically and agro-ecologically homogenous part of Bangladesh. Ruling out as many variables as possible allowed this study to have a strong analytic focus upon the methodologies themselves, and in particular, upon their gender content and the interface between formal trained scientists and farmer scientists. The core research question and related analytic model informing this study was the following:

Which technology-methodology interactions have the most potential for sustained adoption, adaptation and use of the technology and transformation of gender relations for women's and men's economic, social and personal empowerment?

The projects studied were the following:

- WorldFish-led AIN project
- WorldFish gender-transformative approach in conventional training pilot (within International Rice Research Institute [IRRI]- led CSISA-BD Project)
- WorldFish Challenged Ponds—a participatory action research multi-partner project that involves technology dissemination
- Solidaridad SaFaL project.

Small group discussions were held separately with women and men farmers in four villages—one per project. In each case, women were the project beneficiaries, with men interviewed in their role as household members and thus indirect beneficiaries. Four group discussions were held in each community—two with women and two with men. Roughly equal numbers of women and men participated in the discussions, totaling 57 respondents in all.<sup>1</sup> Approximately one-third of respondents lived within extended families, and two-thirds lived within nuclear families. Key informant interviews were carried out with project field staff to obtain a detailed understanding of the project methodology. Table 1 summarizes and compares key features of each project.



Husbands and wives at a training session in Faridpur.

Project	Donors and partners	Target group for homestead aquaculture	Technology and methodology (farmer level)
AIN (2011–2016)	WorldFish led; USAID funded; partners include Community Development Centre, SpeedTrust, Bangladesh Shrimp and Fish Foundation (BSFF), Solidarity Centre, Helen Keller International (HKI), Bangladesh Fisheries Research Forum	Women	Eight technical sessions, one focused on gender and environment
Gender-transformative approach in conventional training (2014 pilot; revised approach to be tested at scale in 2015–2016)	IRRI led; USAID funded; partners include WorldFish and the International Maize and Wheat Improvement Center (CIMMYT)  (The gender-transformative approach pilot is led by WorldFish and implemented with support from local partner Society Development Committee.)	Women; some sessions with spouses and mothers-in-law; community members	Technical sessions expanded over production cycle; gender integrated in all eight technical sessions
Challenged Ponds (2013–open ended)	Funded by and implemented within the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) and AAS, as well as USAID-funded projects AIN and CSISA-BD	Women	Monthly participatory action research sessions across production cycle
SaFaL (2013–2016)	Funded by Embassy of the Kingdom of the Netherlands in Bangladesh; partners include Solidaridad	Women and men	Lead farmers (women and men) trained in good agricultural practices, including aquaculture

**Table 1.** Summary of the four projects.

	Material support	Study village	Status in study village
	Free vegetable seeds or training allowance (for sessions where vegetable seeds are not provided); one record book and one guide book per group; gill nets (16 provided for a particular trial); orange-fleshed sweet potato vines; mola brood	Jaipur Village, Bongram Union, Morelganj Upazila, Bagerhat District	First fish production cycle completed
	Free mini packet of vegetable seeds or voucher; training manual for each individual; record book; training allowance	Shrengal Village, Dangi Union, Nagarkanda Upazila, Faridpur District	Two training sessions completed at time of fieldwork
	Quality fish fry of species suited to shaded pond provided free for research purposes; magnifying glass; record book; weighing scales	Phultala Village, Batiaghata Upazila, Khulna District	First production cycle completed
	Record book; one part per thousand equipment for measuring salinity; thermometer to check water temperature; lead farmer receives umbrella, cap and bag	Moddhopara Village, Sahosh Thana Union, Dumaria Upazila, Khulna District	First production cycle completed

## FIELDWORK FINDINGS

An overview of each project is presented in the following subsections, followed by a description and discussion of the technology-methodology intervention. The section concludes with a discussion of cross-cutting findings.

### WorldFish-led AIN project

The WorldFish-led AIN (2011–2016) project (WorldFish n.d.) is funded by USAID Bangladesh as a subcomponent of its Feed the Future Program. It has four components as shown in Table 2.

WorldFish is the implementing agency and works closely with government and private sector agencies like the Department of Fisheries, the Bangladesh Fisheries Research Institute, and the BSFF. AIN operates in the Barisal, Khulna and Dhaka divisions of Bangladesh. It aims to improve the livelihoods of 1 million households, and to add over USD 200 million in fish and shrimp production to the Bangladeshi aquaculture industry. Within AIN, Component 2 supports household ponds. This component specifically targets resource-poor and vulnerable households and provides technological training on the farming of nutrient-dense fish species, vitamin A-rich orange-fleshed sweet potato, dike vegetables, and nutrition. In 2014, Component 2 selected 14,448 new household fish farmers (88% women). Overall, 10,337 training sessions on aquaculture technologies and nutrition were delivered to farmers registered in 2013 and 2014. Farmers registered in 2012 were provided with 586 refresher training sessions through community facilitators. In total, Component 2 has trained 20,698 farmers (USAID-AIN unpublished draft report).

AIN also works to promote access to quality feed by training semi-automatic feed mill entrepreneurs, working with raw material suppliers to assist farmers who wish to prepare their own quality feed mixes, and training farmers directly in improved feed formulation. A pilot project has enabled 500 resource-poor women to acquire improved fish seed and fish feed, and this will be expanded to new areas as relationships with feed millers develop.

#### Technology-methodology intervention

AIN promotes household pond polyculture based on a mix of various carp (model 1), tilapia and other species (model 2), and mola (indigenous species) with carp (model 3). In 2014, mola was promoted to 20% of farmers alongside their existing fish cultures (a total of 12,527 farmers). Extension staff identified commercial and neighboring farmer sources of mola and ensured their delivery to target farmers, either directly or through farmers. Mola is a micronutrient-rich small fish that WorldFish promotes for consumption, especially by women and children.

The WorldFish training team provides training to extension facilitators, community facilitators and the staff of partner NGOs. These people then provide training to the target farmers. Training covers eight modules, with four sessions in each module. Each module takes 2 hours (30 minutes per session) to deliver, and training is provided approximately every 3 weeks. The training program includes five modules on aquaculture across the whole production cycle from prestocking to harvesting, two primarily on nutrition (dike vegetable cropping management, nutritious

No.	Project components	Objectives
1	Fish and shrimp seed	Dissemination of improved-quality lines of fish and shrimp seed
2	Household aquaculture	Improving the nutrition and income status of farm households
3	Commercial aquaculture	Increasing investment, employment and fish production through commercial aquaculture
4	Institution and policy	Policy and regulatory reform and institutional capacity building to support sustainable aquaculture growth

**Table 2.** The WorldFish AIN project.



feeding for children and nutrition), and a gender-focused module. This module discusses themes such as the difference between sex and gender, gender equity and equality, gender discrimination and how to tackle it, and how to move towards women's empowerment.

Training is delivered at two demonstration ponds in each village. One pond is used to demonstrate bad practice, the second to demonstrate good practice. Methods used include lectures, presenting images (e.g. of pests, liming, etc.), demonstrations and role play. In the second year, a refresher course spread over four sessions is provided. This recaps the initial training package. In the third year, a member of the group who is proactive and demonstrates good technical and social understanding is selected as a community facilitator to help provide long-standing support. Community facilitators each manage two producer groups. In 2014, 445 community facilitators were selected (160 in Khulna—all women—and 285 in Barisal—188 of whom are women). Community facilitators are trained in venues within villages on leadership and technical skills with respect to household ponds and dike cropping management.

Material support is offered in the form of orange-fleshed sweet potato vines, vegetable seeds, gill nets that are particularly designed to help women operate them easily and frequently (provided to 16 women for a trial), mola brood, and a financial compensation for attending the training. (This is provided in every session except for the session where vegetable seeds are provided.) Each group leader receives a record book and a guide book, which they manage on behalf of the whole group.

In 2014, from the Khulna region alone, productivity from a sample of 135 homestead ponds (out of a total of 20,000 homestead ponds) increased by 1179 kilograms per hectare, a 53-kilogram increase from ponds of 11 decimals on average. The percentage increase in productivity for the women farmer trainees<sup>2</sup> was 109%.

### **Beneficiary appraisals of the learning approach**

Small group discussions held separately with seven women and seven men showed that

women still lacked confidence in deploying particular technologies. However, the majority of women participants in the small group discussion reported that their status in the household had improved. They felt respected and valued as people of knowledge. Although women's engagement in direct selling of fish has not been promoted as part of this project, it appears that some men are open to this possibility, provided women can demonstrate their capacity and follow visible gender norms such as veiling. Individual comments, which typify the majority of responses, included the following:

#### **Applied knowledge**

- We did not use fertilizer in the past because we did not know about it. Now my husband applies fertilizer. I learned what to do from the training and suggested using fertilizer to my husband. I cannot do it alone. I am worried I will get the calculation wrong. So my husband does it (stated by a woman small group discussion participant and echoed by the others).

#### **Intersections between increased knowledge, confidence and value**

- Now [that we are selling fish] I can give some money to my son. He is happy about my work. We can sell vegetables and buy household goods (woman small group discussion participant).
- I earn money now. It's just a small amount, but it makes me feel proud. My earnings raise my confidence and bring peace to my mind (woman small group discussion participant).
- Now I get respect from everyone in the family. They ask my opinion about everything. Before the project my husband did not see me as important; now he does. Now we work together and I contribute to household income. So my husband values me (woman small group discussion participant).
- Following the training, my father listens to me. He didn't do that before. My father takes my advice willingly and tries to follow it (woman small group discussion participant).
- Now our wives can talk with people intelligently. They've learned a lot about fish farming. They can advise us about fish and vegetable farming. They are so much more confident (man small group discussion participant).

## Marketing

- Women can sell fish from home. If they don't know the market price they can find out over the phone. Fish farming is a process just like school. When people study more, they learn more. Similarly, when women learn more about fish culture, they will improve their knowledge. Then they will be confident and capable of selling fish (man small group discussion participant).
- If women do not break social customs such as using the veil and showing respect to elders, it will not be a problem for us if women sell fish (man small group discussion participant).

## Gender-transformative approach in conventional training

The CSISA-BD project is a 5-year USAID-funded project working through a partnership between three CGIAR centers: IRRI, WorldFish and CIMMYT. It aims to test and disseminate new cereal system-based technologies in six hubs that are expected to increase annual family income by at least USD 350 for 60,000 farming families. The CSISA-BD project works to improve cropping intensity, productivity and profitability of a wide range of aquaculture systems, while reducing risks inherent in the production process through simple alterations to management practices. The project works with value chain actors to help solicit quality inputs and strengthen market linkages. Training sessions, demonstrations and linkage events are the principal means by which aquaculture technologies are promoted.

The CSISA model consists of an 8-hour training session conducted over 2 days. This is followed by the selection of a demonstration farmer from among the trainees. Demonstration farmers are expected to exhibit their learning in practice to others so that they may replicate similar results themselves. Only women are targeted for the homestead-based aquaculture system. Data shows that the training is effective for increasing the productivity of the demonstration farmers. Data collected from eight women homestead demonstration farmers in 2013–2014 from the Faridpur hub shows a production increase of 172% (level of significance 1%). These demonstration farmers receive input support that the other trainees

do not, which may enable them to more fully apply the management practices. However, production monitoring data from 16 directly trained farmers in Faridpur who did not receive input support showed a production increase of 166%.

The process of engaging target farmers involves WorldFish staff and local partner NGOs meeting with Union Parishad (village-level decision-making body) members to explain the program. Following this, community meetings are held during which WorldFish staff explain why they wish to work with women. Women frequently do not participate in such meetings, so small mixed-gender group meetings are then held in different parts of the village. In such meetings, men are encouraged to motivate their wives and other female household members to join the project. Each group has 20 to 25 members.

The gender-transformative approach in WorldFish's conventional training methodology is being piloted within the CSISA-BD project in two villages of one of its six hubs. The impulse to integrate gender-transformative approaches into WorldFish's homestead aquaculture training arose from a study conducted in 2013 (Morgan et al. 2014) that showed that even when women are targeted directly for technology dissemination, take-up is constrained due to the complex set of gender relations within which technology adoption decisions are made. One study finding was that the demonstration farmer model hampers women's active participation. This model relies on having a lead farmer who receives additional inputs compared to other participating farmers because his or her pond is to act as a model for learning. Other farmers are expected to model their behaviors on that of the lead farmer. The WorldFish gender-transformative approach has abandoned the demonstration farmer approach due to findings that the unequal provision of free inputs led to conflicts within the family for those women not receiving them (Morgan et al. 2014).

### Technology-methodology intervention

The WorldFish gender-transformative intervention draws upon the HKI training manual, *Nurturing Connections*. The manual was launched in a joint WorldFish and HKI International Women's Day event (2014) in Dhaka called "Inspiring Change:

Institutionalizing Gender in Nutrition and Agricultural Interventions.” The conventional technology training package developed by CSISA-BD, typically delivered over a 2-day period, has been redesigned. The training is modularized to interact with the different stages of the production cycle and is specifically designed to address social and gender issues that may emerge as a result of applying the technology-related learning. The latter was accomplished through combining technical aquaculture training with gender consciousness-raising exercises adapted from the HKI manual. While the standard CSISA training curriculum dedicates half an hour to a gender awareness exercise, the WorldFish gender-transformative approach attempts to coordinate its work on identifying and tackling gender-based constraints with real-time technology delivery. Gender forms part of every single technical training session.

The starting point is the understanding that intra-household gender relations form a potential constraint to women’s ability to effectively work with, apply and share in the benefits of improved household pond technologies. The revised training package includes a specific focus on promoting learning processes and on interrogating gender norms. It encourages collaborative intra-household decision-making and also seeks to create an

enabling environment at the community level. The current curriculum is shown in Table 3.

In the field, 2 hours are spent on technology training, and the third hour is spent discussing gender issues. Families are involved from the beginning of the intervention. Changes in production and in knowledge, attitudes and practices (both technical and social) are being monitored among participating women and their spouses through survey research methods and process documentation.

As with the conventional CSISA-BD extension approach, material support is offered to all participating farmers in the form of a voucher for vegetable seed (or the seeds themselves), 100 grams of mola seed, and a contribution towards travel costs. Farmers are provided with the contact details of fish seed suppliers. In the future, farmers will be given fish seed vouchers and encouraged to obtain the seed directly from the input supplier. The WorldFish gender-transformative approach uses the regular linkage event provided by CSISA towards the end of the production cycle. This brings together value chain actors and community members. However, the key difference is that while this event will likewise showcase successful producers, a gender norms exercise from *Nurturing Connections* will be carried out with community members. A local theater

Conventional technical training on homestead pond polyculture technologies	Accompanying gender sessions developed from HKI <i>Nurturing Connections</i> manual (sample activities)
Introduction, rules and commitments	Demonstrating and building trust (whole family)
Pond preparation	Power hierarchies; obstacles to listening
Stocking management	Interactions between identity and decision-making
Post-stocking management	Who decides about the pond (whole family)
Horticulture and family nutrition	Intra-household allocations of food and power; self-esteem building
Harvesting, restocking, marketing, income and expenditure	Assertiveness training
Gender awareness and nutrition education	Exploring gendered behaviors (with husbands)
Linkage event with value chain actors, community members, etc.	Community theater skits on gender and livelihoods; community meeting on gender norms
Project review and future planning	Change in gender norms over time

**Table 3.** Gender-transformative approach in conventional training.

group will also perform skits with gender messages for the community as part of an effort to spark dialogue on the consequences of gender inequality for livelihood outcomes.

### **Beneficiary appraisals of the learning approach**

The fieldwork findings show that the 10 women and 9 men participating in gender-segregated group discussions (and a further 7 women in a second round of discussions) considered that the support women have received in this project to date has led to a more scientific understanding of how to support healthy pond functioning and how to intervene appropriately. The respondents associated improved analytic capacity resulting from the training with higher social standing and participation in community-level knowledge sharing networks. Improved analytic capacity was further considered to strengthen women's voice in intra-household decision-making processes, both between spouses and also with other family members. Representative comments included the following:

#### **Training approach**

- We were taught in a practical, hands-on way and so we found the training easy (woman small group discussion participant).
- Because we belong to a five-member small learning group who live close to each other, we discuss with one another. If we forget anything we can remind each other. This helps us solve problems and answer any questions that may arise. The trainer's visits also help to clear up any queries we have (woman small group discussion participant).
- Because our husbands, fathers-in-law and mothers-in-law were included in some sessions, it was easier for them to understand what we told them. They don't create any barriers to our participation (woman small group discussion participant).

#### **Applied knowledge**

- Before, we released fish without preparing and cleaning the pond. Now we clean the pond before releasing fish and feed them regularly. Male members like it. They trust us to manage the pond, and it enables them to earn another source of income (woman small group discussion participant).
- Before, we used to hire labor for liming the pond. They used to guess how much lime to

use. Now I know the actual amount of lime that is required per decimal (woman small group discussion participant).

### **Intersections between increased knowledge, confidence and value**

- Now I feel confident because I know much more than before about fish and vegetables (woman small group discussion participant).
- We now have the belief and self-confidence that we can continue fish culture (woman small group discussion participant).
- After the training, not only my wife's status but the social status of the whole family increased. Sometimes villagers ask us about fish culture. This never happened before and it makes us proud (man small group discussion participant).

### **Intra-household decision-making**

- Since they (other family members) were included, they heard it from the masters themselves. They believe us now about the benefits of investing (woman small group discussion participant).
- Following the training, family members take my opinion seriously. Now I can participate more in decision-making not only for fish but for other household decisions like what to buy for different members and children's education (woman small group discussion participant).
- Now my husband and I share my learning. If we get any new ideas, for fish or anything else, we share with each other (woman small group discussion participant).
- Our husbands listen to what we say, but if our opinions do not match we usually have to accept our husband's decision (woman small group discussion participant).
- We have to earn power through experience (woman small group discussion participant).
- If women earn money, we will move up the household power hierarchy and get equal power (woman small group discussion participant).
- If my wife and I have different opinions, I will try to understand which one will make the business more profitable. Then I will decide. It does not matter whose opinion I accept. The well-being of the family is the most important thing (man small group discussion participant).

## Challenged Ponds

The Challenged Ponds project is a joint action research initiative of AAS, the CGIAR Research Program on Water, Land and Ecosystems (WLE) and CCAFS, in partnership with the CSISA-BD and AIN projects.

The Challenged Ponds project grew out of earlier WorldFish projects in southern Bangladesh that reported shading of household ponds through fruit and other trees as a significant production constraint to fish farming, since fish feed requires sunlight to develop. Sunlight also helps to maintain good water quality by improving levels of oxygen. In many cases, such ponds are seasonal, meaning that they dry out at some points in the year. A large number of ponds are located in areas of high salinity, and so household ponds represent important sources of (moderately) fresh water for household needs and irrigation. Women prefer shaded ponds when the ponds are close to their homes. This is because women are reluctant to fell valuable trees and because the ponds are used for personal hygiene, such as washing and bathing. The trees therefore help to ensure privacy. As a consequence of these issues, and because the water is relatively saline in many areas where WorldFish operates, fish production is typically low or zero. In recognition of the potential productive value of these ponds and the need to adapt production to women's preferences, WorldFish initiated research to test technologies that can increase production in these adverse aquatic conditions. The research used participatory action research methods and learning-by-doing technology knowledge transfer approaches.

WorldFish began work with eight communities in 2013, forming women's groups of up to 12 members. Selection criteria included the presence of a shaded pond on or near the homestead, an indication of interest by women farmers in participating in the project, and that the shaded ponds were mainly managed by women at the household level from the outset. Typically in WorldFish interventions, many partners are involved in delivering project activities. In this project, WorldFish staff work directly with the women as co-researchers.

### **Technology-methodology intervention**

The technology-methodology intervention seeks to balance a women farmer-led participatory action research process with formal research

hypotheses and parameters. The research process is facilitated by WorldFish staff, and WorldFish has its own technical and sociological research interests. Women farmers conduct research on technologies in their own ponds as opposed to demonstration ponds, with support from WorldFish in developing experimental designs. They are shown how to record the results and report back to their group on a weekly basis with their findings and any challenges they have encountered. WorldFish staff guide the research process through staging monthly visits, providing advice, offering limited training in technologies such as how to lime ponds or kill predatory fish, and obtaining updates on farmer learning processes. The word "training" is deliberately avoided by the staff involved, with meetings being construed as events in which discussions and idea-sharing take place. However, expert trainers are involved in sharing technical information about pond preparation, stocking, etc., generally through hands-on learning approaches plus some lectures. It is unclear whether and how the women involved differentiate this experience from other technical training. At the end of the first production cycle in 2013, all the women's groups came together for an end-of-year sharing workshop.

The Challenged Ponds project offers considerable material support in the first production cycle. It provides fingerlings of different species, weighing scales and a magnifying glass. The fingerlings are provided from a single source, free of charge, to ensure consistency for research purposes. In the second cycle, farmers buy fingerlings and feed and are reimbursed by WorldFish. Record books are also provided to each farmer researcher to document results and encourage record-keeping behavior. WorldFish is planning to provide water quality control kits to enable the farmers to measure and manage water quality.

The project is working in eight locations over two zones: freshwater and saline. Different fish species thrive in different zones, so the farmers are experimenting with various fish species in order to contribute towards species recommendations for particular habitats. In the first cycle of the project, farmers decided to experiment with different fish species, including carp, tilapia and various indigenous species. These were released into a cluster of ponds. A different cluster released other species. In the second cycle, farmers worked with species

selected from the first cycle's learning but experimented with different stocking densities. In Barisal, for instance, 12 women set up three trials in 12 ponds (four ponds—i.e. four farmers—per trial, utilizing three species in combination) in 2014. Table 4 summarizes the trials and indicates key research parameters.

Research results from April 2013 to March 2014 showed no significant variation in fish production between the freshwater and saline regions, though average yield was higher in the freshwater region. Overall annual productivity increased more than 100% from the baseline, with 76% of the fish produced consumed at household level. These large increases reflect that the ponds were not used productively before the project came along, so the baseline for production was nil or close to nil. As one woman said, "You can't really say those ponds were a little productive (before the project). In the rainy season, some koi fish would grow. Maybe one or two we could eat. You could say the ponds were just lying around." The increase in productivity was further facilitated by the free inputs supplied and the controlled research environment within which the ponds were operating. As the women in the small group discussion confirmed, "Apa [sister] provided everything. The medicine, everything."

### **Beneficiary appraisals of the learning approach**

The fieldwork findings from the small group discussions with 6 women and 6 men in the first round, and 10 women in the second round, show that women considered the initial support they received from WorldFish as important for their learning process. They also valued the learning-by-doing approach used, stating that their relative independence from WorldFish encouraged them to develop new ideas and use technologies in different ways. Many linked their increased knowledge to enhanced recognition and value in the family, and some to increased recognition in the community. The learning-by-doing approach has enhanced the analytical skills of many of the women, and has seemingly done so to a greater degree than the other learning methods reviewed in this study. This is demonstrated through the greater number of comments women respondents made regarding their ability to independently apply learning to solve problems they identified in their ponds, as well as in the women's enthusiasm regarding the outcomes of production. These results are shown in their comments:

### **Training approach**

- Before, we women wouldn't go down into these ponds. When Shumona Apa [the WorldFish staff member] said she wanted to tackle these ponds with us women, we were eager; we said, let's see if we women can do it. Before men start this, let's see how we women can do it (woman small group discussion participant).
- If we don't understand something, we ask each other or show [the problem] (woman small group discussion participant).
- Practical doing helps us remember better (woman small group discussion participant).
- We told them to give us a book because we can't remember everything. If they would give us a book, it would be good. If not to everyone, maybe a book for every four of us. If the book is with one of us, then we can read it from time to time. But the WorldFish staff forget a lot of things (several women small group discussion participants).
- Shumona Apa [the WorldFish staff member] brought a man from Khulna to show us how to kill predatory fish and use lime. He taught orally but also showed us practically. He took us to the pond, made us melt the lime and made us apply it. Then he made us spread the retinol powder to kill the predatory fish. He didn't teach everything at one go. He comes often (combined testimony from several women small group discussion participants).

### **Applied knowledge**

- After a few months, I harvested fish for home consumption. While I was cutting the fish, I noticed that the fish stomach contained a lot of fat. A few days later, when I checked another fish, it seemed to me to have less fat and to be generally weaker. I realized that the fish were not getting an equal share of the food. I decided to give more feed to improve their growth rate (woman small group discussion participant).
- I observed that catfish (*magur*) do not come to eat in the daytime. They hide in another layer. So I started to give feed at night. The catfish now come out and eat the food (woman small group discussion participant).
- If someone came and told us to put *ruikatla* (a species of fish) in my shaded pond, that wouldn't feel good for my confidence. We have learned to do it for ourselves and see which one isn't working well and which is working well. We decide which one to choose (woman small group discussion participant).

- This year I modified the culture system from last year. WorldFish told us to continue fish polyculture in the shaded pond, but my shaded pond is already full with fry. This time I released all of my fish seed to my sunny pond. I want to see what happens to the production (woman small group discussion participant).
- Now my wife tries to be the first among the 12 women. She's working really hard on fish culture. When I harvest fish from the pond, she runs to me to find out how many, and she keeps a record (man small group discussion participant).
- Last year I used my brother's pond for experiments. This year I am using my father-in-law's pond, because my knowledge of fish culture has increased and my confidence has also increased. At first, my father-in-law did not give me permission to use his pond for experiments, but now after seeing the production he told me this year to culture in his pond. My brothers-in-law do not cause me any problems. When I harvest fish I give them some. Next year maybe we'll be able to culture jointly (woman small group discussion participant).

**Intersections between increased knowledge, confidence and value**

- Before this research project, we felt shy when talking to people, but now we can talk intelligently. This research has helped us to increase our courage, and we have already explored some new techniques (woman small group discussion participant).
- Our knowledge increased after joining the research project. Before, we did not have any knowledge about how to cultivate fish in shaded ponds. But now we know. Now we are called researchers (woman small group discussion participant).
- My wife catches fish from the pond when guests come to our house, and she also can handle a cast net. She became smart and can talk with people confidently. This is different from before (man small group discussion participant).
- After participation, our status in the community has increased. Now people talk positively about our fish farming. And our husbands talk about our work with pride (woman small group discussion participant).

**Intra-household decision-making and strengthened roles**

- After this research, our wives are better able to participate in the decision-making process. They can advise us about fish culture. This research helps to increase their decision-making ability (man small group discussion participant).
- Women's participation in different household decisions has increased because now they talk more logically (man small group discussion participant).
- Before the project, I was not able to provide a good-quality lunch to my children. They used to be embarrassed in front of other children, and so used to return home during the lunch break. But now I can give them lunch with rice and a big piece of fish. This makes my children very happy, and sometimes they even take an extra piece of fish for their friends as well. Seeing their happiness, I am very happy as a mother (woman small group discussion participant).

Species	Trial 1 Pangus with carp			Trial 2 Tilapia with shing and magur (catfish)		Trial 3 Koi with carp and mola			
	Stocking density (no. per decimal)	Stocking weight (grams)	Sampling weight (grams)	Stocking density (no. per decimal)	Stocking weight (grams)	Sampling weight (grams)	Stocking density (no. per decimal)	Stocking weight (grams)	Sampling weight (grams)
Pangus	100	25	100				15-20	5	45
Carp	15-20	5	45						
Tilapia				100	5	30			
Shing			10-15	0.2	0.2	3			
Magur			10-15	1	2	10			
Koi							80	0.3	20

Stocking date: 21 July 2014. Sampling date: 27 September 2014.  
Source: USAID unpublished draft report.

**Table 4.** A sample Challenged Pond trial in Barisal.

## Marketing

- Our social context has not changed yet. If we go to the market for selling fish or anything else, people will say bad things about us, and so will our relatives (all women small group discussion participants).
- The main obstacle is in selling fish. My husband will not allow me to go to market (woman small group discussion participant).
- Sumonaapa [the WorldFish staff member] taught us how to talk with people, and our confidence level has now increased. So we can go out to sell our fish (two women small group discussion participants).
- My husband is not present at home most of the time, and in my family there is no other male to go. So I have to go to the market. When I started going to the market, many people said bad things (woman small group discussion participant).
- Women can sell fish to *paiker* [fish buyers] from home, because they can now talk with people more confidently and are much more aware about selling (man small group discussion participant).
- If they learn the process of selling from the training, then definitely they will be able to do it. The main problem is that there is a chance of being cheated by the *aratdar* [middleman] (man small group discussion participant).

## Solidaridad SaFaL

The Solidaridad aquaculture program (2013–2016) is a component of Solidaridad's SaFaL project. SaFaL aims to create product-market combinations that encourage farmers to utilize better farming practices, leading to higher productivity and product quality and therefore higher incomes. Access to local, national and international markets will be promoted. SaFaL supports farmers to address social and environmental issues on their farms in line with international standards. The project works with 57,000 farmers and has established 1000 producer groups, of which 500 are aquaculture producer groups. Each of these focus on a single product, selected from tilapia, black tiger shrimp, freshwater prawn and pangasius.

SaFaL targets households that have not been reached by similar programs. It conducted a baseline survey in 2013 that scanned 93,000 households. The survey established each

household's productive resources in order to locate households meeting the project's selection criteria. These included the potential to become effective market actors. From these 93,000 households, 57,000 were selected through community-level meetings. They were then subdivided further into horticulture, aquaculture and livestock common interest groups. SaFaL required that households in the aquaculture component manage a minimum pond size of 8 decimals. In some cases, households with smaller ponds (5–8 decimals) were allowed to participate, particularly if the pond was managed by a woman considered to have entrepreneurial potential.

SaFaL does not target women specifically, opting to work through mixed groups. Informally, SaFaL attempts to ensure that 30% of the membership of a common interest group is female. This has proven relatively easy to achieve with respect to livestock and horticulture, with 80% and 47% of membership being female, respectively, but considerably more difficult with aquaculture, where only 8% are women. Women in Jessore are more strongly represented in aquaculture than in Khulna.

## Technology-methodology intervention

All training for farmers is delivered by lead farmers drawn from common interest groups. Following selection, lead farmers are trained in various aquaculture technologies and business skills. The training program commences with training on good governance of producer groups. The technological training focuses on promoting specific fish species in order to help build sufficient bulk to interest buyers. Modules include training on pond preparation, fry selection and release, managing water quality through the use of probiotics, identifying and managing fish diseases, etc. These sessions are conducted by subject matter specialists. Lead farmers are then trained in enterprise management and developing business plans by Solidaridad staff and staff from their partner NGO Uttaran. Training is offered in a venue to 50 lead farmers and delivered mostly through lectures, with some images. The lead farmers then train group members in all technologies except nutrition and business planning. SaFaL provides training on business directly to common interest groups. Nutrition training is offered to all farmers, with a particular focus on



women members of the farming households (though men can also join), through volunteers who are drawn from the group's membership. These volunteers are trained by nutrition technical staff of SaFaL and partner NGOs.

Since the success of the whole program depends on the efficacy of the lead farmers, SaFaL spends considerable time on identifying suitable candidates. It does this through direct observation and through discussion with producer groups. All lead farmers need to have completed secondary school (demonstrated through a secondary school certificate), to be energetic and willing to take on the role, and to have sufficient time to devote to this responsibility. While women form 20% of lead farmers across SaFaL, in aquaculture only 3% of lead farmers are female. Respondents to the study noted that while SaFaL and partner staff train lead farmers in a classroom setting on concepts, the farmers themselves tend to demand practical examples.

To promote farmer links to other value chain actors, SaFaL is developing memorandums of understanding with input suppliers to offer high-quality inputs. SaFaL is promoting links to wholesale markets and processors, and is planning to establish collection hubs and cool chains (cool vans) to ensure that market actors receive fresh produce. It recognizes that private sector actors rarely have a mechanism for or interest in reaching small farmers, let alone female small farmers, and is working with such actors to develop appropriate strategies. At the same time, however, it is proving difficult to bring women into the market as active players.

Furthermore, SaFaL has found it difficult to engage women managers of household ponds unless the ponds are adjacent to their homes. This is primarily due to women's significant household and care responsibilities. Working to strengthen the economic participation of rural women significantly increases their workload, and this remains a challenge for the project. In SaFaL's experience, women participate much more actively in meetings now than in the past. This is supported by the choice of venue, with meetings for women held in members' homes or in a local school, thus enabling higher participation. However, this restricted geographical base makes it difficult to promote

women's social capital—in particular, links to market actors—and to widen and deepen knowledge-sharing networks. Men typically exchange information in marketplaces and other public settings that are largely closed to women. In response, SaFaL is planning community-level meetings to highlight the value of women's entrepreneurship and why it is important to support women in becoming more assertive market actors.

### **Beneficiary appraisals of the learning approach**

The Solidaridad SaFaL project is the only project of those reviewed that is working explicitly to recognize women farmers as value chain actors and to encourage them to develop linkages with other actors accordingly. This requires challenging long-held gender norms and—for those women and their families who are willing to change—securing community support for their changed behaviors. To date, this aspect of the project has had limited success. The six women and six men participants in the small group discussions reported that the presence of women in the public space of the market seriously harms family standing in the eyes of the community, and more specifically in the eyes of in-laws, particularly children-in-law. However, two women respondents reported that they are selling at the local market in the company of male relatives. One of them is a lead farmer, and the other is a schoolteacher who already experiences higher mobility. They were eager to get involved in selling following the training program. However, they face considerable negative sentiment in their community. Other findings from the small group discussions are similar to those presented for the other three projects; we cite here from discussions around marketing.

### **Marketing**

- Before, my father sold fish, but now I take my father with me to sell fish in the market (woman small group discussion participant).
- Now I tell my husband where to sell fish. I try to find out the market price over the phone (woman small group discussion participant).
- Our social context is changing day by day. Some women go to the fish market to sell fish. Ten or twenty years ago no one could contemplate that (woman small group discussion participant).
- Our community is still conservative. Men don't want to send their wife or daughter-in-

- law to the market to sell fish (woman small group discussion participant).
- At first I was ashamed to sell fish at the market, but now it seems easy. I don't care what others say (woman small group discussion participant).
- I belong to a Muslim family, so my husband won't send me to the market. However, I can sell fish from home (woman small group discussion participant).
- Women selling fish challenges long-practiced social customs (both women and men small group discussion participants).
- Women going to the market to sell fish brings shame upon the husband and other men of the household. The community talks badly about such men (men small group discussion participants).
- The fish market is a complex place full of cheats roaming around. Women lack knowledge of this and could be easily cheated (both women and men small group discussion participants).
- Women stay at home. Therefore they lack good information on comparative prices in different markets. They are at risk of being cheated by middlemen (men small group discussion participants).

## Additional cross-cutting findings

In this section, we describe emerging outcomes not discussed above. These emerging outcomes are, in most cases, common to all projects and thus not discussed separately. In cases where specific projects have specific outcomes, these are highlighted.

### Changes in intra-household food distribution

All participating farmers across all projects reported an increase in fish consumption at home after participation in the project. Most of the projects encourage vegetable production and consumption alongside that of fish. This is reflected in higher levels of vegetable intake reported across beneficiaries.

Some changes appear to have occurred around intra-household food distribution practices. Culturally, women are responsible for food preparation and distribution. The onus is often on them to relinquish their share or eat less if there is not enough to go around (World Bank 2008; Kumar and Quisimbing 2011). However, now that production has increased, women are

eating more. A few men are also offering larger portions of fish to their wives in recognition of their contribution to food production. In most projects it appears that women's increased consumption of fish is related mainly to increased production and to household size, with women in smaller households claiming more equal food distribution, rather than a deeper shift in intra-household food allocation practices. However, women respondents in the WorldFish gender-transformative approach (within CSISA-BD) small group discussion reported on the effect of an activity focused on intra-household food distribution done as part of the training with women and their spouses:

- There was an exercise with family members on distributing food and on how we usually make sure they eat better before eating ourselves. So usually we don't have much on our plates. In the past, men didn't notice this. As long as they got a big piece or the head, they were happy. Now, following this exercise, men check what we are eating. They acknowledge that we work hard all day and make sacrifices and should eat equally (consolidated comments across many women small group discussion participants).

There are strong dietary preferences for large fish. The comment below was widely echoed. This is important because WorldFish is promoting the production and consumption of small indigenous species (e.g. mola), which are highly nutritious.

- Sometimes my husband tells me to keep small fish for home and big ones for sale, but I tell him to keep big ones for us. Small fish and big fish have a different kind of taste. Men usually like to eat the big ones (woman small group discussion participant).

Both women and men respondents asserted that children's needs are central and that they take these into consideration when deciding whether to sell or consume fish at home.

### Changes in community-level gender norms

In all four projects, it became clear that initiating contact first with community leaders, then with men household heads, and finally with women is essential to effectively targeting women for aquaculture interventions. Regardless of the

actual technology and methodology offered, women are unable to participate in training or to adopt specific technologies without men's consent and wider community support. Demonstrating that the whole household will benefit through women's active economic participation is vital. Many women said, "It was a very good idea that they called our husbands to the meeting. Otherwise, maybe my husband and mother-in-law would not have allowed me to come." However, merely instrumental engagement with community leaders and men heads of household to secure women's participation will in the long run fail to secure the enabling environment so important to the ability of women to realize their agency. Purposeful efforts to engage with the actors and institutions shaping the opportunities available and acceptable to resource-poor women are needed to foster shifts in the attitudes and practices creating and maintaining gender inequality.

Furthermore, fieldwork findings indicate that it can be difficult for projects to correctly identify producer group leaders. In one SaFaL project, for instance, farmers selected a woman who was already empowered and active. It is certainly simple to start with apparently strong, vocal leaders who are willing to take risks, challenge social norms and lead by example. However, in this case the woman selected appeared to be more concerned with promoting her own economic agenda than supporting group members. Skillful observation and deeper awareness of social dynamics is required to ensure that selected leaders are committed to the well-being of all. In some cases, quieter women may prove to be strong, resilient, capable leaders, provided they are encouraged and receive capacity development in assertiveness and leadership skills as required.

Across the projects, fieldwork findings about women's access to markets for selling fish are interesting due to their contradictory nature. On the one hand, it is evident that community opinion matters very much, and that community norms largely do not support women's access to public marketplaces. On the other hand, there seems to be some room to challenge these norms, particularly for resource-poor women with few alternatives and for women and families in a position to tolerate disapproving remarks. The majority of women and men across all projects agree that women

can engage in farm-gate sales to middlemen, known as *paiker* and *aratder*, without incurring community disapproval. In such cases, their husbands need to agree to them doing so. It is likely that selling from home enables women and men to argue that women are not moving from private space. Importantly, despite women's general lack of direct participation in selling fish in markets, the data suggests that the four project interventions enabled women to have a much stronger say in deciding what and when to sell. Women involved in the SaFaL project appear to have the strongest voice. This may be due to their improved understanding of how markets function as a consequence of their training. Overall, these dynamics signal ongoing contestation around women's mobility norms, which need to be better understood and engaged with to amplify women's own ongoing efforts to improve their freedom of movement and decision-making capacity.

The findings suggest that projects that carefully stage women's entry into direct marketing are needed. First steps may include improving links to middlemen (*paiker* and *aratder*) to facilitate farm-gate sales. It may be possible to create a cadre of women with relative freedom of movement (possibly the most resource-poor or older women) in a village to engage in initial bulking by purchasing from individual women and then selling the bulked product. This would help reduce the transaction costs of buyers from outside the community—which many buyers do not contemplate incurring given the small quantities involved in farm-gate sales—and also provide local women bulkers with useful income. At the same time, working closely with input providers and buyers to facilitate their recognition of women managers of household ponds as a source of fish is necessary. It is critical that women farmers understand how markets function and that they receive accurate information on pricing. For this, the potential of information communication technologies for delivering real-time information should be studied, developed and rolled out.

The findings show that regardless of methodology, targeting women helps to enhance their status at community level and to strengthen their voice in intra-household bargaining. Women's increased capacity to plan and manage the pond and their increased technological knowledge are seen as conferring transferable skills relevant to broader decision-making processes. While men remain the key decision-makers in all areas, women have become more influential. This is because women are seen as making a stronger economic and food security contribution to the household and—critically—because they are thought to have become better, more capable thinkers. Overt recognition and promotion of women's capacities by external actors is important in this process.

Men as well as women reported that women had higher levels of confidence with respect to discussing fish farming ideas with their husbands and relatives, in community-level meetings, and with other actors. However, how the knowledge is transmitted may affect this confidence, particularly in relation to applying technical knowledge. Women receiving training under AIN appear less confident about applying some of their new skills, whereas women involved in the Challenged Ponds project appear to have gained stronger analytical and problem-solving skills and to be more confident in applying these skills themselves.

Broader discussions with respondents showed that gender roles and responsibilities sometimes appear impervious to change. They are long-standing and deeply held. However, the findings show that when people see the benefit of adopting new practices—for example, improving the management of underutilized resources such as household ponds—they are ready to change their behavior and in the process challenge gender norms when it seems expedient to do so. This is particularly the case when women are involved in activities that bring clear economic benefits to their households or that enable them to perform their culturally ascribed roles more effectively, such as providing sufficient healthy food to the whole family.

However, the historical overview shows that the impacts of involving women can be ephemeral: Women may not be able to secure long-standing, sustainable change in their roles and responsibilities. Apparent changes towards more equity in intra-household food distribution may not last. Securing long-lasting change can only succeed if women and men themselves take charge of—and feel they benefit as individuals and as families from—changes in gender relations.

As with all societies around the world, Bangladesh is not standing still. Gender relations are changing rapidly. WorldFish and other aquaculture actors can build on positive, broader transformations to design gender-equitable technology transfer interventions. Innovative methodologies for technology development and dissemination need to focus on promoting farmer adaptive capacity and enabling them to take charge of their own learning. This is not a gender-neutral process, as the findings of this and other studies show. Working with development partners, value chain actors, communities, families and individuals to remove gender-based constraints to women's full participation in aquaculture is essential.

The findings of this rapid assessment indicate that building upon the participatory action research methodology developed by the Challenged Ponds project and combining it with the enabling environment and value chain focus of SaFaL and Katalyst, as well as the gender-transformative approach piloted under CSISA-BD, holds potential for fostering sustained improvements in livelihood security for resource-poor women and men in rural Bangladesh. Operationalizing and testing this combined suite of technology and methodological interventions under various conditions is the next step. The following recommendations are made to inform this action research process:

## Gender-responsive project design process

- **Embed project design and implementation in the understanding that gender is complex and relational.** Addressing gender inequalities requires sophisticated, nuanced strategies that involve women and men, boys and girls, as well as the institutions within which people live and work: the household, community bodies, value chain networks and platforms, etc.
- **Develop outcome pathways that identify and challenge gender-based constraints to—and build on gender-based opportunities for—the adoption and adaption of selected technologies.** Identify and involve actors, including nontraditional partners (women’s networks, financial service providers, theater groups, information communication technology companies, etc.), to overcome constraints and exploit opportunities throughout the life of the project.
- **Develop specific activities to engage with women and men, in-laws, and the broader community (including decision-making bodies and opinion formers).** Gender transformation has to be led, ultimately, from within. Contribute towards the ability of people to identify the costs of gender-based constraints and the opportunities opened up by challenging them through discussion workshops, theater and other activities. Support them to design their own steps towards achieving gender equality.

- **Monitoring and evaluation indicators need to build on emerging best practice on capturing empowerment processes.** The indicators should be subjective as well as objective.

## Technology-methodology interactions

The overall intervention should work on three fronts at once and combine them skillfully into a mutually reinforcing package. The package combines the (i) technology intervention with (ii) innovative, learning-by-doing participatory methodologies that simultaneously (iii) work for changes in gender relations. The purpose is to create positive synergies between the three components that reinforce each other and lock in gender-transformative changes with the aim of sustaining the ability of women and men to develop their own adaptive livelihood strategies.

Learning-by-doing methodologies:

- **Enable all farmers to learn using their own resources.** Promote learning by doing in farmers’ own ponds rather than in demonstration ponds in order to promote control over experimental design.
- **Explicitly move away from the language of “training,” “experts,” “trainees” and other forms of language that promote hierarchies of understanding.** Promote co-learning approaches.
- **Distinguish technological content from learning processes.** Take farmers through research design processes that they can continually adapt to fit their own situations and needs, and enable them to develop their own strategies for change.
- **Ensure that researcher requirements for study design are harmonized, as far as possible, with farmer-led and co-led research processes on technologies.** This will facilitate reporting in respected journals and contribute towards scaling up and scaling out.
- **Promote flat learning and knowledge-sharing structures.** Move away from top-down lead farmer models to horizontal ones that promote group-sharing learning processes, both within groups and between groups.

- **Promote technologies as menus rather than packages.** Promote farmer ability to understand, select from and adapt a range of technologies. As part of this, farmers need to understand the implications of making trade-offs between choices.
- **Promote adaptive capacity.** Move learning out of thematic silos. Discuss wider change processes (climate change, urbanization, etc.) with farmers and how they may impact on specific technologies. Work with farmers to design research processes that are transferable to new situations and that facilitate continual learning about and adaptation of technological mixes.
- **Foster understanding of the whole family in the technologies.** Involve men and other household members in gender and technology learning processes.

Gender-transformative approaches:

- **Link women's empowerment to the empowerment of the whole family.** Frame the promotion of women's agency through the technology intervention within broader goals centering on achieving family well-being. Ensure that work to identify and alleviate women's—and men's—gender-based constraints is associated with the ability of the family to achieve goals they consider important (for example, health, nutrition and education).
- **Ensure that direct links between women's contributions and entitlements are made.** Build direct associations between women's improved capacity to contribute to the household economy (income generation; household food and nutrition security) and their right to secure benefits in terms of more equitable food distribution and voice in cross-cutting expenditure decisions (e.g. investments in household ponds and other businesses, children's education, and other important goals).
- **Challenge negative and promote positive gender norms.** Adapt activities from the *Nurturing Connections* training manual (and others) to foster reflection and action around gendered attitudes and practices that limit family livelihood security or promote it.

Value chain development:

- **Develop the business case for gender equality.** Engage household-level and wider market actors in discussions about the consequences of gender inequalities for effective value chain development.
- **Develop incentives and strategies.** Create incentives to encourage value chain actors to develop win-win strategies that promote women's inclusion at all levels of the value chain, both horizontally and vertically.
- **Take to scale.** Identify scaling agents in the value chain and provide training as required to enable them to work with women managers of household ponds and other female value chain actors.
- **Move step by step.** Develop a staged strategy in collaboration with value chain actors, opinion formers, community-level decision-making bodies, etc., to deepen and broaden the participation of women household pond managers in horizontal and vertical value chain interactions. (Example: Step 1. Support farm-gate purchases of inputs and sales by women. Step 2. Develop village-level bulking facilities and cold chains. Step 3. Support women to enter formal marketplaces by creating women-only zones, promoting chaperones if required and safe travel arrangements, ensuring women are well-informed regarding market pricing and consumer demand, etc.) These steps may be taken consecutively or simultaneously; they should be mutually reinforcing.
- **Facilitate women's participation in various levels of the value chain.** Promote female participation as local marketing agents, bulkers and middlemen (*paiker* and *aradter*), as well as in other roles.
- **Promote real-time market information.** Link women as well as men value chain actors to real-time price and other information through information communication technologies (such as mobile phone services or local Internet kiosks made accessible to women).

Multistakeholder national learning platforms to lock in progress:

- **Set up multistakeholder learning platforms on gender and technology to share lessons learned on gender-responsive and gender-transformative methodologies.** This will support scaling up and scaling out of successful approaches as part of standard practice. Learning platforms should include actors within and outside the sector to ensure that innovative technological approaches being piloted and deployed by other agencies are not missed, innovative methodological approaches are shared, and cross-cutting associations between gender issues are made (such as how gender-based violence may affect economic participation).



Wives and husbands at a training session in Faridpur.

# NOTES

---

- <sup>1</sup> In the WorldFish gender-transformative approach fieldwork, there was some shifting of participants between the two small group discussions held among both women and men. In all, 19 people participated (10 women and 9 men).
- <sup>2</sup> All but one of the sample farmer trainees were women.



# REFERENCES

---

- Ashworth A. 1998. Effects of intrauterine growth retardation on mortality and morbidity in infants and young children. *European Journal of Clinical Nutrition* 52(S1):34–42.
- Belton B, Ahmed N and Murshed-e-Jahan K. 2014a. Aquaculture, employment, poverty, food security and well-being in Bangladesh: A comparative study. Penang, Malaysia: CGIAR Research Program on Aquatic Agricultural Systems. Program Report: AAS-2014-39.
- Belton B, Karim M, Thilsted S, Murshed-e-Jahan K, Collis W and Phillips M. 2011. Review of aquaculture and fish consumption in Bangladesh. *Studies and Reviews* 2011-53. Dhaka: WorldFish Center.
- Belton B, van Asseldonk IJM and Thilsted SH. 2014b. Faltering fisheries and ascendant aquaculture: Implications for food and nutrition security in Bangladesh. *Food Policy* 44:77–87.
- Brems S and Berg A. 1989. *“Eating Down” During Pregnancy: Nutrition, Obstetric, and Cultural Considerations in the Third World*. Washington, DC: World Bank.
- [DANIDA] Danish International Development Agency. 2008. *Impact Evaluation of Aquaculture Interventions in Bangladesh*. Copenhagen: Evaluation Department, Ministry of Foreign Affairs of Denmark.
- de Schutter O. 2012. Women’s rights and the right to food. Report submitted by the Special Rapporteur on the right to food. Report No. A/HRC/22/50. Human Rights Council Twenty-Second Session, United Nations General Assembly, Agenda Item 3: Promotion and protection of all human rights, civil, political, economic, social and cultural rights, including the right to development.
- Debashish KS, Shirin M, Zaman F, Ireland M, Chapman G and Nandeeshia MC. 2007. Strategies for addressing gender issues through aquaculture programs: Approaches by CARE Bangladesh. The 8th Asian Fisheries Forum 2007. Special Symposium – Gender and Fisheries: Solutions through Gender Research, Kochi, India.
- Douthwaite B, de Haan NC, Manyong V and Keatinge D. 2001. Blending “hard” and “soft” science: The “follow-the-technology” approach to catalyzing and evaluating technology change. *Conservation Ecology* 5(2):13. Retrieved from <http://www.consecol.org/vol5/iss2/art13/>
- [FAO] Food and Agriculture Organization of the United Nations 2011. *The State of Food and Agriculture 2010-2011: Women in Agriculture-Closing the Gender Gap for Development*. Rome: FAO.
- Farnworth CR. 2010. Gender-aware approaches in agricultural programmes: A study of Sida-supported agricultural programmes. *Sida Evaluation* 2010:3.
- Gillespie SR and Haddad L. 2001. *Attacking the Double Burden of Malnutrition in Asia and the Pacific*. Manila: Asian Development Bank.
- [IFPRI] International Food Policy Research Institute. 2012. *Women’s Empowerment in Agriculture Index*. Washington, DC: International Food Policy Research Institute.

Kabeer N. 2000. Resources, agency, achievement: Reflections on the measurement of women's empowerment. In *Power, Resources and Culture in a Gender Perspective: Towards a Dialogue Between Gender Research and Development Practice*. Proceedings from a Conference Arranged by the Collegium for Development Studies, Uppsala University, in Cooperation with Sida, 26–27 October, Uppsala Universitet, Sweden.

Kabeer N and Subrahmanian R. 1996. Institutions, relations and outcomes: Framework and tools for gender-aware planning. IDS Discussion Paper 357. Brighton: Institute of Development Studies.

Kumar N and Quisumbing AR. 2011. Access, adoption, and diffusion: Understanding the long-term impacts of improved vegetable and fish technologies in Bangladesh. *Journal of Development Effectiveness* 3(2):193–219.

Manfre C, Rubin D, Allen A, Summerfield G Colverson K, Akeredolu M and MEAS project. 2013. Reducing the gender gap in agricultural advisory and extension services: How to find the best fit for men and women farmers. MEAS Discussion Paper No. 2. MEAS discussion paper series on good practices and best fit approaches in extension and advisory service provision.

Morgan M, Choudhury A, Sultana N, Braun M, Beare D, Benedict J, Rajaratnam S and Kantor P. 2013. *Understanding the Gender Dimensions of Adopting Climate-Smart Smallholder Aquaculture Innovations*. WorldFish.

Murshed-e-Jahan K, Ahmed M and Belton B. 2010. The impacts of aquaculture development on food security: Lessons from Bangladesh. *Aquaculture Research* 41:481–95.

Okali C and Naess LO. 2013. Making sense of gender, climate change and agriculture in sub-Saharan Africa: Creating gender-responsive climate adaptation policy. Future Agricultures Working Paper 057.

O'Sullivan M, Rao A, Banerjee R, Gulati K and Vinez M. 2014. *Levelling the Field: Improving Opportunities for Women Farmers in Africa*. Vol. 1. Washington, DC: World Bank Group. Retrieved from <http://documents.worldbank.org/curated/en/2014/01/19243625/levelling-field-improving-opportunities-women-farmers-africa>

Ragasa C, Berhane G, Tadessa F and Seyoum A, 2013. Gender differences in access to extension services and agricultural productivity. *The Journal of Agricultural Education and Extension*. 19(5) 4374–68.

Rahman MA, Mustafa G and Barman BK. 2011. Impacts of aquaculture extension activities on female fish farmers in different areas of Bangladesh. *Bangladesh Journal of Zoology* 39(2):213–21.

Rahman M, Naher K, Sarwer RH and Huda MZ. 2008. Impact of BRAC and PDBF sponsored homestead vegetables programme on the socio-economic development of rural women in Mymensingh District. *Journal of Bangladesh Agricultural University* 6(2):423–28.

Ransom E and Elder L. 2003. *Nutrition of Women and Adolescent Girls: Why It Matters*. Population Reference Bureau. Retrieved from <http://www.prb.org/Publications/Articles/2003/NutritionofWomenandAdolescentGirlsWhyItMatters.aspx>

Shelly AB and D'Costa M. 2001. Women in aquaculture: Initiatives of Caritas Bangladesh. In *Global Symposium of Women in Fisheries*, Sixth Asian Fisheries Forum, 29 November, Taiwan.

- Shenggen F. 2012. Improving food and nutrition security information for better measurement and effective decision-making. Presented at 2012 International Scientific Symposium on Food and Nutrition Security: From Measurement to Effective Decision-Making, 17–18 January 2012, Rome.
- Shirajee S, Salehin M and Ahmed N. 2010. The changing face of women for small-scale aquaculture development in rural Bangladesh. *Aquaculture Asia* 15(2):9–16.
- Sraboni E, Quisumbing AR and Ahmed AU. 2013. *The Women's Empowerment in Agriculture Index: Results from the 2011–2012 Bangladesh Integrated Household Survey*. Dhaka: International Food Policy Research Institute.
- Stein A and Qaim M. 2007. The human and economic cost of hidden hunger. *Food and Nutrition Bulletin* 28(2):125–34.
- Terry G. 2014. Literature review on gender issues in aquaculture value chains and in fish consumption in Southern Bangladesh. Dhaka: WorldFish.
- Tschakert P and Dietrich KA. 2010. Anticipatory learning for climate change adaptation and resilience. *Ecology and Society* 15(2). Retrieved from <http://www.ecologyandsociety.org/vol15/iss2/art11/>
- World Bank. 2008. Whispers to voices: Gender and social transformation in Bangladesh. Bangladesh Development Series Paper No. 22. Dhaka: World Bank.
- World Bank. 2012. *World Development Report: Gender Equality and Development*. Washington, DC: World Bank.
- World Bank, Food and Agriculture Organization of the United Nations, and International Fund for Agricultural Development. 2009. *Gender in Agriculture Sourcebook*. Washington, DC: World Bank.
- WorldFish. n.d. Reaping the rewards of aquaculture in Bangladesh. Accessed 30 October 2014. [http://www.worldfishcenter.org/our-research/ongoing-projects/reaping-the-rewards-aquaculture-bangladesh#.VFIXG\\_0tC70](http://www.worldfishcenter.org/our-research/ongoing-projects/reaping-the-rewards-aquaculture-bangladesh#.VFIXG_0tC70)



**This publication should be cited as:**

Farnworth CR, Sultana N, Kantor P and Choudhury A. 2015. Gender integration in aquaculture research and technology adoption processes: Lessons learned in Bangladesh. Penang, Malaysia: WorldFish. Working Paper: 2015-17.

© 2015. WorldFish. All rights reserved. This publication may be reproduced without the permission of, but with acknowledgment to, WorldFish.



Contact Details:  
WorldFish, PO Box 500 GPO,  
10670 Penang, MALAYSIA  
[www.worldfishcenter.org](http://www.worldfishcenter.org)

**Photo credit:** Front cover, Afrina Choudhury/WorldFish  
**Photo credit:** Back cover, Sheikh Md. Farid/WorldFish



**100% RECYCLED**

Paper made from recycled material

*Harnessing research that makes a difference*



RESEARCH PROGRAM ON Livestock and Fish



RESEARCH PROGRAM ON Aquatic Agricultural Systems

