

Integrating Gender and Nutrition within Agricultural Extension Services

Technology Profile
Type of Technology:
Physical

Fish Feed

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The Integrating Gender and Nutrition within Agricultural Extension Services (INGENAES)

project works to improve agricultural livelihoods focusing on strengthening extension and advisory services to empower and engage smallholder farmers, men and women. The technology profiles support INGENAES's goal of improving the dissemination of gender-appropriate and nutrition-enhancing technologies and inputs to improve women's agricultural productivity and enhance household nutrition. The technology profiles identify issues and opportunities to make technologies more attractive for men and women farmers, to increase men's and women's benefits from using technologies, and to design distribution models for extension agents, input suppliers, and mobile devices to get the technologies into men's and women's hands.

access loans without the guarantee of a male relative (McFerson 2012). While after the war new laws promoting gender equality were passed, they have seen little traction because of continued adherence to customary laws and weak implementation (ADFG 2011).

Sierra Leone is rich in natural resources, including arable fertile land, iron ore, diamonds, and titanium ore. It is situated in West Africa, bordering the Atlantic Ocean and Guinea and Liberia. Agriculture fuels the country's economy, contributing approximately half of the gross domestic product (GDP) (Larbi 2012). The agricultural sector is primarily small-scale, with 59.2 percent of the working age population classified as self-employed in agriculture (AgCLIR 2016). Despite its abundant land and natural resources, Sierra Leone remains one of the poorest countries in the world with a Human Development Index rank of 181 of 188 countries (UNDP 2015), and a life expectancy of 46 years, the lowest in the world according to World Health Organization (2015). The country is still recovering from a 10-year civil war, from 1991 to 2002, that caused severe loss of life, internal displacement of populations and loss of government presence in rural areas. Furthermore, between 2014 and 2016 the country was unexpectedly hit by an outbreak of the Ebola virus disease. One of the most contagious and fatal viruses, the Ebola outbreak suspended government operations. Farmers and farmer groups were unable to access their production and harvest due to household and local quarantines.

Sierra Leone ranks 145 out of 188 countries in the Gender Inequality Index based on indicators including maternal mortality ratio, adolescent birth rate, share of seats in parliament, population with at least some secondary education, and labor force participation rate (UNDP 2015). There are significant disparities between men's and women's literacy, education, land ownership, and access to legal services, and differences in employment opportunities. For example, literacy rates for women and men are 38percent, and 59percent respectively (UNESCO 2015). Customary laws and social norms contribute to these and other disparities. Under customary law, women cannot

Paramount chiefs who are mostly men are regarded as the “custodians of the land,” and usually manage family-owned land (ADFG 2011; USAID 2016; McFerson 2012). Less than 10 percent of paramount chiefs are women (AgCLIR 2016). Agriculture accounts for 72 percent of female employment, and just over 23 percent of male employment (FAO 2010, ILO 2005). Nearly 62 percent of those economically active in agriculture are female (FAO 2010). Compared to men, women dominate in crop and poultry farming, and post-harvest work including retailing micro-fish, fish processing, and fish marketing (ADFG 2011). Mining, a major industry in Sierra Leone, has led to environmental degradation of land since the war affecting women’s employment in agriculture. (McFerson 2012).

Technology Design and Dissemination

Fish is one of the most popular animal-source proteins consumed in Sierra Leone (SPRING 2015). It is primarily supplied from marine fisheries, inland fisheries and very limitedly from aquaculture. While fish is in high demand recent analysis shows that the availability of marine fish in Sierra Leone will decrease by 2020. (Hecht et al. 2012). The development of the aquaculture sector has the potential to help fill this gap in fish production (WorldFish 2016b). There is a need to increase availability and access of high-quality seed and feed to meet this objective.

WorldFish implemented the USAID-funded Sierra Leone Feed the Future Agriculture pilot project from July 2015 to September 2016 to test integrated agriculture-aquaculture systems to help increase farmers’ productivity and income and improve nutrition, particularly for women and girls. The project was based in Tonkolili District, which prior to the intervention had the highest concentration of existing fish ponds in Sierra Leone; however, only 13 percent were operational (WorldFish 2016b). Most pre-intervention ponds were 300 m² or less, which were too small to sustain a profit. Through the pilot project, WorldFish set the wheels in motion to transform fish farming into an income-generating activity and revitalize the aquaculture value chain in Sierra Leone.

WorldFish facilitated the development of 23 pilots to test integrated agriculture-aquaculture production systems and fish value chain interventions. The tested production systems were integrated rice-fish, integrated fish-vegetables, on-farm tilapia breeding and improved tilapia grow out practices. The project identified communities typically in inland valley swamps (IVS) and wetlands to participate in the pilot project. In total 23 *farmer learning groups* were formed together with implementing partners¹ to test and

BOX I DATA COLLECTION

Data collection took place during January 2017. Staff from WorldFish coordinated individual and group interviews with users and non-users of fish feed technology in Tonkolili District, extension staff, and fishmongers.

Five men in Mateleh Bana and four women from a group pond were interviewed. In Mabontor, six women from a group pond were interviewed and one man who was a community volunteer responsible for training the group. One woman and one man fish farmer from Nonkobar were interviewed. All of the fish farmers gave tours of their group ponds. Ten non-user women from a Farmer-Based Organization in Rowala who were not targeted by the project participated in a group interview at an Agricultural Business Center (ABC).

The woman aquaculture technician managing Makali Fish Farm was interviewed individually and led a tour of the facility. Two male laborers and one security guard at Makali were interviewed individually. A woman seeking employment at the fish farm, related to the manager, was also interviewed individually.

Three men from the WorldFish extension staff including two field extension staff and one coordinator were interviewed. The District Agricultural Extension Officer for Tonkolili was interviewed individually. Lastly, an aquaculture specialist based on Njala University was interviewed individually.

Additionally, seven women fishmongers were interviewed individually at the Mankeni market.

¹ Partners included: CARE, Caritas, Sustainable Nutrition and Agriculture Promotion Project, Catholic Relief Services, FAO, International Institute of Tropical Agriculture (IITA), Njala University, Sierra Leone Agricultural Research Institute (SLARI), Sierra Leone Ministry of Agriculture, Forestry and Food Security (MAFFS), Sierra Leone Ministry of Fisheries and Marine Resources (MFMR), and Sierra Leone Ministry of Health and Sanitation (MOHS).

learn about these new aquaculture-agriculture production systems. Some group members had limited or no knowledge of aquaculture prior to participating in the project. Each of the 23 groups included approximately 25 members. In total the project reached 412 farmers (WorldFish 2016a).

Partnering with the Ministry of Fisheries and Marine Resources (MFMR), WorldFish also rehabilitated the Makali Fish Farm², which served as a training and service center for group members. The station has eight operational on-site ponds, a 216-ton capacity feed mill, and a hatchery. The station provided the stock of Nile tilapia (*Oreochromis niloticus*) fingerlings to the 23 groups replacing an initial stock of stunted tilapia fingerlings which resulted in low yields.

In addition to sufficient land and fingerlings, fish feed is a critical input in fish farming. It is needed to ensure fish receive adequate nutrition to reach marketable size and weight. However, the lack of fish feed manufacturing businesses and high import costs on feed restrict farmers' access to this input. To address this constraint, WorldFish through the pilot project, promoted on-farm fish feed made from locally accessible ingredients. WorldFish initiated a fish feed value chain assessment to understand what crops, livestock resources, and fertilizers were available to farmers to identify accessible and cost-effective ingredients for the fish feed. The data from the initial assessment based on input from over 200 farmers were used to develop the current recommended fish feed formula.



Fish feed being formed into balls and drying at Makali Fish Farming Station © A. LaHood 2017

The fish feed formulation promoted by WorldFish contains a mixture of a protein, a carbohydrate, and fat oil or lipid. The recommended ratio of these components is 40-60percent protein, 30-50percent carbohydrate and 10percent fat oil or lipid. This fish feed is produced on small-scale farms with ingredients sourced from local markets. Farmers most commonly use fish meal for the protein and fat oil, rice bran as the carbohydrate, and cassava powder to bind the mixture together. Fish meal, the ground parts of dried fish from the marine fishery, is accessed through local fish markets. Rice bran, a byproduct of rice milling, is commonly obtained through local milling facilities like Agricultural Business Centres (ABCs), which sell excess rice bran. Cassava is mostly grown in rural areas as a secondary staple food. Other ingredients can be substituted depending on local availability.

The process of preparing the fish feed using these ingredients includes multiple steps. The cassava is washed and peeled, dried, and pounded manually. The fish waste is ground either by a hammer mill or by hand. The rice bran must be sieved to remove pieces of rice husk that could be harmful to the fish. Next, the rice bran and cassava are combined and ground down to a powder. Then the mixture is cooked for approximately 30 minutes. After cooling, the mixture is molded by hand into balls so they can sink to the bottom of the pond. It is recommended that farmers feed their fish two to three times per day to optimize the growth of the fish. Appropriate application of fertilizer and lime to stimulate growth of phytoplankton (natural food for tilapia) also contributes to fish health and nutrition.

² Makali Fish Farming Station was established in 1979 by the Government of Sierra Leone with funds from USAID in partnership with Peace Corps, but the farm was forced to close during the civil war.

Box 2

The Scaling up Aquaculture Production (SAP) Project (2017-2021)

Building on the lessons learned from the pilot project phase the SAP Project aims to scale up aquaculture in Sierra Leone by testing pro-poor business models to promote aquaculture as a profitable and sustainable agribusiness. In contrast to the pilot project, which utilized group ponds, the SAP project is using a household approach. One individual from each household-managed pond will be identified as the *primary farmer*. While the ponds will be managed at the household level SAP is encouraging farmers to form *cluster farmer groups* each with approximately 25 farmers. The main purposes of forming these groups are to facilitate labor exchange among group members and attract input and output markets given a larger concentration of fish farmers in a particular area. Similar to the pilot project, each *cluster farmer group* will include one or two lead farmers as well as two fish breeders, and one farmer researcher. SAP aims for 40 to 50 percent of the *primary farmers* to be women.

Project field staff stationed in project intervention areas will provide direct support to farmers along with local Ministry of Agriculture, Forestry and Food Security (MAFFS) extension agents and private sector partners. SAP's capacity development strategy emphasizes technical innovations, dissemination of innovations to farmers, and development of farmers' business and financial skills. All *cluster farmer groups* will be encouraged to develop savings and lending groups with support from the project. To ensure the sustainability of fish farming the project will also develop the capacity of private and public sector extension services (WorldFish 2016b).

Selected group members from each of the 23 groups received training on fish feed formulation and production process at Makali Fish Farming Station. They received a manual grinder to mix the fish feed ingredients and learned to use it. As lead farmers, they played two different roles. They were responsible for testing the productivity of the feed in the ponds. They also returned to their communities and trained group members on fish farm techniques including fish feed production. WorldFish and partner extension staff also provided technical assistance to the groups.

Upon review of the results from the pilot project, USAID requested that WorldFish implement a 4-year project beginning in 2017 to scale-up aquaculture production in Sierra Leone. The Scaling up Aquaculture Production (SAP) Project will design and test pro-poor business models with women, men, and youth tilapia fish farmers. (See Box 2 for more information).

Gender Analysis

Fish feed has the potential to improve the productivity of ponds and the quality of fish for consumption or sale. This gender analysis investigates differences in men's and women's participation in fish feed production and fish feeding as well as the benefits women and men gain through their participation in fish farming. To accomplish this, the analysis considers what is required to participate in and improve performance in fish farming and how men and women benefit through their participation.

The gender analysis is largely based on interviews with men and women from two different fish farming groups who participated in the WorldFish pilot project. These two groups differed in size, proportion of men and women in the group³, the number of ponds managed by the group, and experience with fish farming. The group in Mabontor had 30 members including 27 women and 3 men. A woman who led the group provided her family's land to construct the pond. They had limited experience with fish farming. In contrast, in Mateleh Bana 30 of the 45 members were men and 15 were women. This group managed three ponds constructed on land previously used for small-scale fish farming. Each pond was managed by a group of 10 men and 5 women.

While the scale of the two groups' fish farming operations, experience, and composition differed the division of labor between men and women group was quite similar. The fish farming tasks divided between and among men and women include pond construction and maintenance, procurement of fish feed

³ The other groups targeted by WorldFish typically included 50 percent men and 50 percent women. These two groups were outliers.

ingredients, fish feed preparation, feeding the fish, ensuring proper water quality and fish nutrition by applying lime or fertilizer, harvesting fish, and marketing the fish. In Mabontor the women said that the women constructed the ponds together while the three men in the group oversaw the operation. In Mateleh Bana, men, who made up the majority of members, said men constructed the ponds and women assisted them by carrying buckets of mud and water to build the pond. Women also cooked for the men during the pond's construction. In both groups, women are primarily responsible for the daily tasks in fish farming including fish feed production, feeding the fish, monitoring water quality, and applying fertilizer and lime. In both groups men and women harvest the tilapia together using scoop or gill nets. Women are responsible for selling the fish.



Women and boys harvest tilapia in Mateleh Bana © C. Silvert 2016

In addition to fish farming, men and women produce rice, horticultural crops⁴, beans and groundnuts, but are responsible for different tasks. Harvesting is carried out by both women and men, while men tend to clear the land and women plant rice and vegetables. Women also process rice, typically manually. However, some women reported processing rice at mills at local Agricultural Business Centres (ABCs). Additionally, women do most of the household work including childcare, cooking, and cleaning.

The analysis also draws on an interview with a widowed head of household in Nonkobar who managed two individual ponds breeding tilapia fingerlings in one pond and producing tilapia in the other. She constructed her first pond four years earlier with the assistance of the NGO MADAM. Shortly after the NGO's assistance ended she received technical assistance from WorldFish. Data from her interview are woven into the analysis to contrast challenges and opportunities associated with household-level managed ponds with those of group-managed ponds. This comparison is particularly relevant to WorldFish as it transitions testing pro-poor aquaculture business models with women, men, and youth farmers at household level in the SAP project (See Box 2).

In addition to these groups, the gender analysis is based on interviews with non-fish farmers from Tonkolili District, WorldFish and District extension officers, fishmongers, and aquaculture specialists including one technician and one academic expert. This gender analysis is organized around three areas of inquiry: time and labor; food availability quality and safety; and income and assets.

Time and Labor

There are two main tasks associated with fish feed including fish feed production and feeding fish which both affect the quality of the fish. In Mabontor and Mateleh Bana women are primarily responsible for these two tasks. Both men and women perceived these tasks to be women's work. A WorldFish baseline study found that a greater percentage of women than men agreed that women should prepare fish feed as well as other tasks including repairing and fishing gear nets, cleaning and processing fish, and fish marketing (Cole and Senesie 2016). While there is limited evidence from Sierra Leone on the gendered division of labor in aquaculture, beliefs about what is appropriate for men and women to do in aquaculture may draw on men's and women's roles in the fisheries sector and inland artisanal fishing. In aquaculture and the fisheries sectors, women control the quality of fish, but at different points in the value chain. In the fisheries sector, social norms discourage women from fishing at sea, but allow women to participate in post-harvest activities through which they directly control the quality of fish. Women dominate in this node of the value chain, making up just over 85percent of fish processors (Thorpe et al. 2014). In inland artisanal fishing, women manage most of the daily work AFDP 2011), which is similar to women's role in

⁴ These included hot peppers, okra, cucumbers, pumpkin, watermelon, sweet potato, and cassava.

aquaculture. Perceptions that household-managed fish farming tasks are an extension of the domestic sphere (Kelkar 2001) may also contribute to beliefs that fish feed production and fish feeding should be women's role in fish farming. For example, fish feed production shares characteristics with cooking which is perceived to be women's work.

Women are using similar techniques to formulate the fish feed to those recommended by WorldFish. Women in Mabontor and Mateleh Bana were responsible for collecting the ingredients, mixing, and cooking them. The women said they use rice bran, fish meal, and salt purchased by walking or taking vehicles to local markets. Women either pool rice from other families and pound it by hand to produce the rice bran or buy the bran from local ABCs which store the bran. In Mateleh Bana men said they harvest cassava locally and then women chop, dry, and process it for fish feed. Women then mix the ingredients together and cook it. Once it is cooked then they typically mold the mixture into balls and set them out to dry in the sun. This process, women said, takes about one hour each day. Women feed the fish with the improved fish feed two to three times per day, in the morning and the evening at the pond located within walking distance from women's homes.

The tasks of producing fish feed and feeding are shared among women within the two groups using their own innovative system. In Mabontor and Mateleh Bana the groups developed a system whereby the responsibility for both tasks rotates between women in the group. For example, one woman could invest one hour of her time and labor per day to produce fish feed and fish feeding over a five-day period and then hand that responsibility off to another woman in the group who would be accountable until it was another woman's turn. This "merry-go-round" system affects the amount of time or labor one woman would need to expend on either task while the fish mature to their full size. In Mabontor, these tasks rotated between the 27 women in the group. In Mateleh Bana men and women said that women were responsible for these tasks and the tasks rotated between households in the group. It is unclear, in this group dominated by men, if the men's wives or other women in their households who are not official group members participated in this rotation. In both communities, women said these tasks did not significantly affect their time spent on other activities. In contrast, the widowed woman who produced the fish feed and fed the fish on her own or with minimal assistance from her sons said these tasks did affect time spent on household activities.

Men and women lead farmers from the groups were given mixers from WorldFish and trained to use the mixer to blend the fish feed ingredients together. The mixer is intended to reduce the time it takes to produce the fish feed compared to manual mixing. The interviews suggest it is one aspect of fish feed production where men play a role. For example, in Mateleh Bana, the mixer was controlled by a man who was trained by WorldFish. Men said that women would bring their ingredients to him and he would mix it for them. In Mabontor they did not report using the mixer. It is unclear the extent to which either men or women at other project sites operate the mixer.

Women are primarily responsible for marketing fish from the ponds using a system that parallels their other fish marketing practices. In addition to marketing fish from the pond, women said they buy small quantities of dried marine-sourced fish from local markets and sell them in the nearby villages to earn income. Similarly, women said they sold the tilapia from their first harvest in their surrounding locales and anticipate continuing to do so with each additional harvest. At the same time, women will also continue to travel to markets to purchase dried fish to resell. There was a perception among men in Mateleh Bana that over time women will no longer need to travel to the markets to purchase the dried fish to resell for income. Instead they believed there would be enough fish available from the ponds that women would sell.

Food Availability, Quality, and Safety

Prior to the introduction of the improved fish feed by WorldFish, men and women with some fish farming experience in Mateleh Bana said they used termites and rice bran to feed fish once a day. An assessment conducted by WorldFish indicates that some farmers were also using a mix of rice bran, termites, and cassava (WorldFish 2016b). Before being trained through the WorldFish project these experienced fish

farmers said they had no previous technical training on feeding practices to stimulate healthy fish growth. After using the improved fish feed formulation and feeding the fish twice per day men and women reported seeing an improvement in fish growth compared to fish growth using previous methods. While feeding fish improved feed at appropriate intervals is critical for fish growth other factors are likely to have contributed to this improvement in the quality of the fish. For example, women said they were also trained by WorldFish on the application of lime and fertilizer to the pond to correct water pH ensuring fish receive sufficient nutrients, which they were also not doing prior to testing these systems.

Men and women in both communities described scenarios in which their participation in aquaculture increased their food availability through different pathways. Through increased access to fish through the fish pond, men said they believed it would lead to better nutrition for the entire community. Women also said the fish can also be sold to purchase food or exchange for other foods. For example, using money earned through the sale of fish from the last harvest a woman said she purchased more foods for her family including groundnuts and palm oil. The woman, who managed her own ponds, said she exchanged fish from her harvest for other food products during the Ebola crisis to ensure her family had sufficient access to food.

While this evidence suggests there is potential to improve food availability through fish farming, there are likely to be differences in men's, women's, girl's, and boy's access to food at the household level. In Sierra Leone, food is allocated in order of the status of individuals within the household. Typically, men who hold highest status in the household are given the largest pieces or highest quality food thus likely benefiting men more than women, girls, and boys (Pasqualino et al. 2016).

Furthermore, beliefs among men and women that fish can harm children could limit consumption of the increased availability of this important animal-source protein among children. Women in Mabontor reported that there was a common belief that if children eat fish, they could become witches or wizards. After receiving training from WorldFish on the nutritional value of the fish, women said they are now comfortable feeding fish to their infants and children. WorldFish extension staff also reported that this group of women participated in recipe acceptability studies for women, infants, and children, which may have contributed to the change in perception.

Income and Assets

Men's and women's participation in fish farming as a business requires access to land that is at least 500 m² in inland valley swamps or wetlands. In the Tonkolili District land is controlled by chieftom elders who have made land available for mixed-sex group managed ponds (WorldFish 2016b). In Mabontor the group leader said she provided her family's land to build the pond. Women in the group said she also allowed them to use her family's land around the pond to produce rice, which was integrated into the pond system. In Mateleh Bana the group leader said the group transformed the land from the groups' smaller ponds into new larger ponds.

Due to customary laws and social norms in Sierra Leone, women have less access and control over land than men. The land is managed by chieftom elders who are predominantly men (McFerson 2012; ADFG 2011). Therefore, it is likely more difficult for women to participate in fish farming, because it requires access to land. Furthermore, with limited control over land, women also have lower levels of decision-making power than men do at the household level about how to use land. The WorldFish project baseline study found that while women's participation in value chain activities including fish farming is greater than men's, men make more decisions on these activities (Cole and Senesie 2016). This is a notable finding as WorldFish transitions from targeting group ponds to household-level ponds.

Within the groups men and women said the harvest should be distributed equally among men and women members. However, at the household level women indicated that men decide what women's level of input will be on the use of income derived from fish sales. In Mateleh Bana, women reported that their husbands let them control the money earned from the first harvest because the harvest was very small. Women

reported they did not earn much income from that harvest. However, in future harvests with larger profits, women said the income would be controlled jointly between husbands and wives.

Men and women reported different preferences for how to spend the income from fish sales. Women said with increased access to income from fish sales they would buy nutritious foods for their households. Men said they would prefer to invest money from the sale of fish into women's small businesses to sell clothing.

Women's limited access and control of income affects their ability to pay for public transport to markets to purchase ingredients for fish feed. This payment for transport competes with other expenditures paid out of women's income, including children's education, household commodities, and other pond-related assets. Transport and fuel are increasingly costly, women fishmongers said, because of recent economic inflation and the lifting of a country-wide fuel subsidy in Sierra Leone.

The women in Mabontor said they pay for transport to and from the markets about once a month. One woman said using a vehicle she purchased 10 bags of rice bran and three bags of fish meal that she could use over the course of one month. Women said they are discouraged from operating motorbikes, a potentially cheaper transit option, because motorbikes are perceived to be unsafe for women to ride. However, if women are transporting larger loads of ingredients once a month, motorbikes are likely not a viable transport option.

As an alternative to traveling to markets some women in Mabontor said they go to Agricultural Business Centers (ABCs) to purchase rice bran. This government-supported agricultural services center is about 10 miles away from the Mabontor community. Women reported some difficulty in accessing the rice bran from these ABCs because the rice mills, which process the rice into bran, are often broken.

Farmer's access to savings and credit in the district is limited, particularly for women, which affects their ability to purchase inputs for fish farming. An assessment found that personal savings and funds from kin are the most promising ways for farmers to attain additional funds in Tonkolili District (WorldFish 2016b). The group in Mabontor, which was 90percent women, established a village savings and loan group into which members contributed 4000 – 5000 Leones every Friday. Women and men used the savings to buy a new stock of fish from Makali Fish Farming Station. It is unclear if the money is used for other inputs or to pay for transportation costs. The other group in Mateleh Bana did not report using a group savings system.

The rehabilitation of Makali Fish Farming Station has created employment opportunities. Currently one woman and four men are employed at the station. The station is managed by a woman with a high level of technical knowledge on fish feed production and fish farming. She is employed by the Ministry of Fisheries as is one male security guard. Additionally, WorldFish employs three men who maintain the ponds. They also supply fish to established fish farmers.

Issues and Opportunities

Over the next four years WorldFish, through the Scaling Up Aquaculture Project, will continue to develop the aquaculture sector in Sierra Leone (See Box 2). In contrast to the pilot project, WorldFish will shift from supporting group ponds to supporting household-level ponds. Each household will include one *primary farmer*. WorldFish plans to facilitate the formation of groups to serve as a mechanism for farmers to support one another through labor exchange and/or financial management. These groups would include one farmer per household called the *primary farmers* and potentially other members of households who work on the ponds. Using the findings from the gender analysis, which is based on interviews with men and women who participated in group ponds during the pilot project, this section highlights issues and

A widow managing her own ponds said she earns and controls the income from breeding fingerlings and producing tilapia. This income she said has increased her status in the community. She said people are surprised she has income because she is a woman. With the income from her farming business she pays for her children's education, extra school lessons and fees, and for food.

opportunities for WorldFish to consider as it tests pro-poor business models to scale up aquaculture production in the district.

In Sierra Leone, women's access and control of land and natural resources is limited including their decisions about how to use land. This means women are less likely to be able to make decisions about how to use land. As WorldFish shifts from supporting group ponds to household-level ponds, both men and women within the household should be consulted by WorldFish about the construction of ponds. If WorldFish continues to promote aquaculture-agriculture pond systems, both men and women should be engaged in the selection of crops.

Rice bran is often purchased through ABCs; however, because of rice mill maintenance issues this fish feed ingredient is not always accessible. Support to local ABCs to ensure mills are operational could improve women's access to rice bran and also benefit women who rely on the mill to process rice. Training targeted to men and women farmers on using alternative carbohydrate ingredients that require minimal time to process could minimize disruptions to fish feed production when rice bran is not accessible.

Women developed a system for sharing the tasks of producing fish feed and feeding the fish by rotating that responsibility between women in the group. Participation in this "merry-go-round" rotation limited the time and labor individual women invested in the pond. In the follow-on SAP project, WorldFish could connect women with other women within the same communities to explore ways they can share responsibility for producing the fish feed and feeding fish on individual household ponds. Through this group women could also form savings and loans groups which they could use to collectively purchase ingredients, pay for transport costs, and other inputs. Women who are not the designated *primary farmer* but may provide most of labor in daily fish pond maintenance should be included in these groups. This is critical to ensure that all women who are investing time and labor into the household-level ponds have access to the same resources as other women and men.

As the WorldFish project scales up it should consider ways to develop small enterprises to produce fish feed in bulk. Similar to the Makali Fish Farming Station, these enterprises could generate employment opportunities for women and men. Efforts should be made to ensure that women have equal access to employment opportunities as men including management and laborer positions. Women who are already building their capacity to produce fish feed through the project would be prime candidates to start their own fish feed production businesses or work as employees in those businesses. Development of these enterprises should consider constraints to access fish feed ingredients.

Similarly, as fish production scales up and more fish is produced, there could be opportunities for women to market larger quantities as fish traders. Fish marketing is dominated by women in Sierra Leone on small and large scales. Women fishmongers in the Makeni Market Fish Sellers Association for example trade on a large scale and earn income through their businesses which they often control and invest in their homes and children's education. There may also be opportunities to link women selling fish from household ponds to these established women fish traders.

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