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CLIMATE-HOTSPOTS GENDER IMPACT ASSESSMENT

WorldFish

CGIAR

CGIAR GENDER Platform

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ATTRIBUTION

This work is a product of an evidence-based impact evaluation conducted on behalf of WorldFish Zambia by the Friedensau Institute for Evaluation (FIFE), Germany. The CGIAR Gender Platform funded this evaluation. The two projects that were evaluated in this study are

1. Aquaculture Technical, Vocational, and Entrepreneurship Training for Improved Private Sector and Smallholder Skills Project in Zambia, funded by NORAD (agreement number ZAM-18/0002) and

2. Piloting inclusive business and entrepreneurial models for smallholder fish farmers and poor value chain actors in Zambia and Malawi, funded by GIZ (contract # 81235254).

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About FIFE:

The Friedensau Institute for Evaluation (FIFE) is an interdisciplinary, self-governing evaluation and research-consulting institute located in Germany at Friedensau Adventist University (FAU). We conduct programme, project and strategy evaluations, feasibility studies, strategic planning facilitation, and project planning strategies for development and humanitarian aid organisations. Since 2010, we have worked with religious and non-religious-based non-profit organisations, industry associations, international organisations, and private institutions. We research and develop evaluation methods and models, carry out evaluations and contribute to networking and knowledge transfer for NGOs, philanthropic groups and foundations, social support businesses, corporate bodies, governments and UN agencies.

Contact:

Dr Kwaku Arhin-Sam (Author & Lead Consultant)
Friedensau Institute for Evaluation (FIFE)
An der Ihle 5A
D-39291 Friedensau || Germany
Phone Number: +49 (0) 3921 916-144
Email: kwaku.arhin-sam@fife.institute
Website: www.fife.institute

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AQ TEVET	-	Aquaculture Technical, Vocational, and Entrepreneurship Training
ATE	-	Average Treatment Effect
CAGI	-	Climate-Agriculture-Gender Inequality
CGIAR	-	Consultative Group on International Agricultural Research
CSA	-	Climate-Smart Aquaculture
FGD	-	Focused Group Discussion
FIFE	-	Friedensau Institute for Evaluation
GENDER	-	Generating Evidence and New Directions for Equitable Results
GFSF	-	Gendered Food Systems Framework
GPI	-	Gender Parity Index
IBEMs	-	Inclusive Business and Entrepreneurial Models
IDDS	-	Intra-household Diet Diversity Scale
IFIAS	-	Intra-household Food Insecurity Access Scale
IFPRI	-	International Food Policy Research Institute
IPW	-	Inverse Probability Weighting
KII	-	Key Informant Interview
NORAD	-	Norwegian Agency for Development Cooperation
Pro-WEAI	-	project-level Women's Empowerment in Agriculture Index
SME	-	Small and Medium-sized Enterprise
ZK	-	Zambian Kwacha

EXECUTIVE SUMMARY

Aquaculture is one of the fastest-growing food systems in the world. Nonetheless, Zambia's levels of fish production remain less than optimal despite Zambia being Africa's sixth-largest producer of farmed fish. The sector's potential for expansion and the suitable agro-ecological conditions to cultivate the industry are crucial to Zambia's economic growth. The business rationale of gendered value chain development is not fully being taken advantage of in the aquaculture sector. Women are not well positioned to participate in aquaculture value chains in the same manner as men nor reap equal benefits from their involvement in the value chain. These inequalities are exhibited in the gendered division of labour, distribution of benefits, access and control over assets and resources, and power relations in the value chain that are influenced by gender and social norms. These gaps often stem from structural inequalities, social norms and practices that restrict access to land, labour, capital, aquaculture inputs and social and institutional networks. The impacts of climate change on women smallholder farmers in Africa also increase their vulnerability in food systems.

This impact evaluation examined the extent to which interventions implemented between 2018 and 2022 by WorldFish Zambia have impacted fish farmers in districts across Luapula and Northern provinces in Zambia. The two projects that were evaluated are;

1) Aquaculture Technical, Vocational, and Entrepreneurship Training for Improved Private Sector and Smallholder Skills Project in Zambia, funded by NORAD: The overall goal of the project was to "increase the number of human resources working for the private sector and the number of smallholder commercial fish farmers with enhanced aquaculture knowledge and up-to-date practical skills to help sustainably grow the sector and make it more inclusive".

2) Piloting inclusive business and entrepreneurial models for smallholder fish farmers and poor value chain actors in Zambia and Malawi: The goal of this project was to support the establishment of inclusive business and entrepreneurial models that provide sustained access for smallholder fish farmers in Zambia and Malawi with productivity and profitability enhancing fish seed, feed and knowledge and increased access to fish for enhanced nutrition of consumers.

Specifically, the study assessed 1) the effect of WorldFish interventions on gender-equal access and control over resources, technology, and information among smallholder farmers, including productivity and food security, 2) the effect of WorldFish projects on climate resilience among smallholder fish farmers, and 3) the impact of WorldFish projects on gender equality and women's empowerment in aquaculture. To achieve the third (impact) objective, the evaluation tested the hypotheses that the two WorldFish projects have 1) enhanced involvement of women in aquaculture, 2) enhanced gender equality in access and control over resources, technology and/or information on aquaculture, 3) enhanced gender equality in climate resilient practices (knowledge and adoption of CSA aquaculture practices), 4) enhanced women's empowerment, and 5) enhanced gender equality in terms of benefits from the food system. The study compared results from fish farmers in districts where the WordFish projects were implemented (treatment districts) with fish farmers in districts without WorldFish projects (control districts). Also, it included small and medium size business owners supported in the treatment districts through WorldFish interventions (called hatchery and feed operators).

A convergent mixed method design was used for data collection using quantitative (survey questionnaire) and qualitative (key informant interviews and focus group discussions) methods. Survey responses were collected separately and individually from a male and a female adult in each household. The evaluation data covers 322 households (made up of 644 respondents = 322 female and 322 male) in the districts where WorldFish interventions were implemented (treatment districts) and 178 households (made up of 356 respondents = 178 female and 178 male) from districts where no WorldFish intervention was implemented (control districts). Meanwhile, 9 focus group discussions were conducted among fish farmers in the treatment and control districts, and 7 key informant

interviews were conducted with small and medium enterprise owners in the aquaculture industry within the treatment districts. In analysing the quantitative data, a descriptive analysis was drawn, followed by an impact analysis using Average Treatment Effect (Ate) Propensity Score Matching and a women empowerment analysis using the pro-Women in Agriculture Empowerment Index (pro-WEAI). The qualitative evaluation data were analysed using inductive coding approaches (ground-up), allowing narratives to emerge.

EVALUATION FINDINGS

⇢ *How have WorldFish interventions enhanced gender-equal access and control over resources, technology, and information among smallholder farmers?*

Gendered Access to Aquaculture Input and Output Resources

Over 70% of the farmers in those districts where WorldFish interventions were implemented (treatment districts) were found to have sustained access to critical input and output services due to the private sector-led Inclusive Business and Entrepreneurial Models (IBEMs) set up by the WorldFish projects.

Compared to farmers in districts where there were no WorldFish projects (control districts), farmers in the treatment districts have access to input and output resources such as quality fingerlings (female = 66%, male=70%), commercial feed (female = 59%, male=59%), on the farm extension services (female = 61%, male=62%), climate information services (female = 68%, male=62%) and off-take markets (female = 65%, male=60%) respectively. The findings show that for most households in both control and treatment districts, female farmers have the majority of access to these input and output services and resources. Specifically for the treatment districts, it was found that more female farmers mentioned having access to climate information (68%) and off-take markets (65%).

Gendered Access to Training on Aquaculture

The types of training that were assessed included gender and social inclusion, pond construction, biosecurity, managing a farm as a business, and integrated aquaculture and climate-smart aquaculture. The evaluation found that over 65% of the fish farmers in those districts where the WorldFish projects have been implemented have access to sustained training on aquaculture practices compared to the approximately 26% of the farmers in districts without WorldFish projects who mentioned ever having some training. The farmers in the treatment districts attributed their ability to access aquaculture training to WorldFish, and WorldFish supported IBEMs, that continue to offer training to their clients/customers (fish farmers).

The evaluation found commendable training offered by WorldFish and IBEMs beneficiaries, targeting male and female adults in the same farmer households. Such activity contributed significantly to more women in the treatment districts accessing information and knowledge in integrated farming (69%), managing farms as businesses (69%), gender and social inclusion (66%), and biosecurity (62%) compared to their male colleagues. Farmers in the control districts who mentioned having received the above training indicated receiving it through radio programmes and some through GIZ projects in their districts. Based on these results, the evaluation concludes that the WorldFish projects in the treatment districts have enhanced gender-equal access and control over resources, technology, and information among smallholder farmers.

⇢ *How have WorldFish interventions promoted climate resilience and productivity of smallholders (especially women)?*

Awareness and adoption (practice) of Climate-Smart Aquaculture (CSA) Strategies

Five CSA strategies were assessed (integrated aquaculture with crops on the plots you manage, integrated aquaculture with livestock, improved pond construction, water harvesting, and improved grain storage). The results revealed that among male and female farmers in the treatment districts, the average positive response of female farmers to climate resilience strategies was 73% compared to

male farmers' average of 71% awareness. This means (2%) more female farmers in the treatment districts have received information and are aware of climate resilience strategies for aquaculture than male farmers.

On the use of CSA strategies, the result shows that more fish farmers (average of 52%) in the treatment districts are practising the tested strategies than fish farmers in the control districts (average of 38%). It was also evident that female fish farmers in the treatment districts scored higher (average 52%) on all the evaluated strategies than their male partners (average 51%).

The most practised climate strategy among the farmers is integrated aquaculture with crops. In contrast, the less used strategy was improved grain storage. More than 50% of the total 644 farmers from the treatment districts are practising more climate resilience strategies (integrated aquaculture with crops/livestock, improved pond construction). The evaluation found that the difference between farmers in the control and treatment districts on the adoption of climate strategies is that while few farmers in the control districts who practised these strategies did not know they were practising climate strategies, the majority of farmers in the treatment districts were conscious of these strategies and had invested time and resources to adapt these approaches. Notably, the provision of training manuals and books by WorldFish was found to have played a critical role in sustaining these adopted practices, as more female farmers mentioned using these materials even for those who could not attend the offered training. Likewise, the study found that the on-the-farm and home extension services promoted climate resilience strategy adaptation within the treatment districts.

WorldFish interventions of linking feed and hatchery operators to larger aquaculture firms, providing them with training, and supporting them with product subsidies were found to have contributed immensely to the improved operations of IBEM beneficiaries in the targeted districts. The findings show increased agro-businesses that deal in aquaculture products, increased female entrepreneurs and farmers and a change in mindset on gender roles as significant impacts of WorldFish projects in aquaculture in the treatment districts. Still, drought, flooding, and lack of access to finance are challenges facing farmers and SME operators.

Productivity of smallholder farmers (in the season before this evaluation)

On average, 46% of farmers in the treatment districts stocked above 500 fingerlings compared to the number of farmers (37%) who stocked 500 fingerlings and more in the control district. Most farmers in both district types stocked their ponds with less than 201 fingerlings.

Compared to the control districts, more farmers (female=60/322 (19%); male 57/322 (18%)) in the treatment districts harvested between 100 and 300 Kg of fish. The percentage is the same for male and female farmers in control and treatment districts for fish harvests between 300 and 600 kg. Few farmers in the treatment districts harvested between 300 and 1000 Kg of fish. For some farmers, these measurements are guesses of estimations.

The evaluation found that many farmers in both control (female = 37%, male = 30%) and treatment (female = 30%, male = 29%) districts do not sell their harvested fish from the previous season. When it came to the sale per kilogram of fish, most farmers in the control districts (female = 11%, male = 13%) sold a kilo of fish for less than ZK30, while more farmers (female = 48%, male 45%) in the treatment districts sold 1 kg of fish above ZK31.

In both treatment and control districts, female respondents mentioned higher household monthly incomes than men. The majority of the respondents in the control districts (female=83%, male=81%) estimated a monthly household income of up to ZK1000 compared to farmers in treatment districts (female=75%; male=74%) with the same income levels. In addition, farmers in the treatment districts (female=25%; male=24%) received the highest percentages of household income above ZK1000 per month.

Based on the results, the evaluation found that the WorldFish interventions have promoted climate resilience and productivity of smallholders (especially women) within the treatment district.

How have WorldFish projects impacted gender equality and women's empowerment in the intervention areas?

Hypotheses Test Results:

Using an Average Treatment Effect (ATE) Propensity Score Matching, this evaluation further assessed the impact of WorldFish interventions on fish farmers in the two provinces. In doing so, the study tested eleven indicators. Out of the 11 indicators, the evaluation found that 3 showed significant differences between farmers in the treatment district and those in the control district. That is, the results indicated that WorldFish interventions in the two provinces had impacted 1) women's involvement either solely or jointly in access to information on aquaculture, 2) women's involvement either solely or jointly in control over the productive resources for aquaculture and 3) intra-household gender difference in knowledge of climate-smart practices. Examining the factors leading to the results from the ATE propensity score matching, the results show that the formation of women fish farmers groups, inclusive training modules, the realisation of profit and female role models, and general culture are among those factors that contribute to women's participation in the aquaculture value chain in the targeted region. Yet, existing gender roles and norms, the physical labour intensity of fish farming, and the financing issue limit equal gender participation within the industry. Specifically for the Intra-household Diet Diversity Scale (IDDS) and the Intra-household Food Insecurity Access Scale (IFIAS), the study found no significant difference between husbands and wives in households within the treatment and control districts.

Pro-WEAI Findings

Another rigorous analysis of the evaluation data examined the impact of WorldFish interventions on women empowerment among farmers in the treatment and control districts. Results from the pro-WEAI indicators that relate directly to aquaculture practices found that more farmers in the treatment districts reported that they have input in livelihood decisions (treatment =86%, control = 70%), ownership of land and other assets (treatment =95%, control = 92%), and control over the use of income (treatment =78%, control = 59%).

Overall, the evaluation found a higher aggregate pro-WEAI score among women in the treatment districts (0.88) than women fish farmers in the control district (0.83), meaning that more women in the treatment district were empowered. The proportion of empowered women is higher (65%) among farmers in the treatment districts than women in the control districts (58%). The average empowerment gap between women who did not achieve gender parity with the men in their households was lower in the treatment group (0.17) than in the control group (0.24). The findings suggest that the gap between female and male farmers in the treatment district is less than between female and male farmers in the control district. Within the treatment district, the three top indicators contributing to disempowerment were access to and decisions on credit, Work balance, and Visiting important locations.

In conclusion, this evaluation finds acceptable the hypotheses that WorldFish interventions have enhanced the involvement of women in aquaculture, improved gender equality in access and control over resources, technology and information on aquaculture, enhanced gender equality in climate resilient practices (knowledge and adoption of CSA practices), and enhanced women's empowerment. There was less evidence to support the hypothesis that there is improved gender equality in terms of benefits from food systems.

This evaluation also concludes that the two WorldFish projects have collectively enhanced gender-equal access and control over resources, technology, and information among smallholder farmers. The projects promoted climate resilience and the productivity of smallholders (especially women). Even so, the evaluation found that women fish farmers in the areas where WorldFish projects were implemented are empowered. However, despite focusing some of the project's activities on gender inclusiveness in the targeted districts, the impact of WorldFish interventions on gender equality in the aquaculture value chain has been minimal. That is because these interventions were too general in their scope to elicit women's empowerment without intentional activities that focused on the equitable distribution of resources and activities for women.

Recommendations

Based on the findings above, the study recommends the following.

1. WorldFish can successfully scale up its project interventions in the treatment district and, likewise, in the control districts and should do so by utilizing the findings of this study and other lessons learned from the two projects. This is because, despite the improved results, the findings also point to the fact that farmers in the two provinces still need similar interventions.
2. In similar future projects, WorldFish should adopt more rigorous and intentional gender empowerment tools and approaches that are useful for the specific contexts of Northern Zambia.
3. WorldFish should consider integrating future gender-responsive projects with other women empowerment projects by collaborating with different stakeholders who can support women or women groups with direct support, such as small loans and aquaculture tools and equipment.
4. Future and similar projects should highlight and adopt advocacy tools and approaches in activities towards achieving women's empowerment in aquaculture.

PART I

INTRODUCTION

1. BACKGROUND

Since 2018, WorldFish Zambia has implemented several interventions in the Luapula and Northern Provinces of Zambia. Two of the interventions are relevant to this evaluation. The first is the Aquaculture Technical, Vocational, and Entrepreneurship Training for Improved Private Sector and Smallholder Skills (AQ TEVET) project, which sought to "increase the number of smallholder commercial fish farmers with enhanced aquaculture knowledge and up-to-date practical skills to help sustainably grow the sector and make it more inclusive." Specifically, the AQTEVET project supported farmers with market opportunities and extension support services and linked them to input and output markets within the aquaculture value chain. Another project of relevance is the Inclusive Business and Entrepreneurial Models (IBEMs) for smallholder fish farmers and poor value chain actors. It aimed to establish inclusive business and entrepreneurial models that provide sustained access for smallholder fish farmers in the two provinces with productivity and profitability, enhancing fish seed, feed and knowledge and increasing access to fish for enhanced nutrition of consumers.

The interventions from WorldFish aimed at reducing the barriers between smallholder aquaculture farmers and access to improved aquaculture practices, inputs (feeds and seeds) and output (markets chains) in Zambia's aquaculture value chain and food systems. Activities under these projects included small-scale farmer training (including demonstrations and training manuals), supporting and equipping SMEs in the aquaculture value chain, and establishing innovation platforms. Specifically, these interventions engaged fish farmers through the following activities;

- offering training to male and female adults in a fish farming household,
- providing extension services to farmers only when both male and female adults of a fish farming household are present
- discouraging male farmers from attending meetings without their wives
- encouraging women to attend programme training instead of allowing only their male partners to attend meetings
- reserving a quota for female business owners and entrepreneurs under the IBEMs initiative.

These interventions seek to increase women's involvement in safe, sustainable, decent return entrepreneurial opportunities in aquaculture value chains and successful fish farming-related activities.

Meanwhile, in a wider three-staged research project, the CGIAR Generating Evidence and New Directions for Equitable Results (GENDER) platform identified the Luapula and Northern Provinces in Zambia Climate-Agriculture-Gender Inequality (CAGI) hotspot. In the second stage of the research, situational analysis in Zambia's climate change hotspot areas was conducted to examine the climate change trends, food system transformations and gender dynamics in the two provinces in more depth. It was done using the Gendered Food Systems Framework (GFSF) for the aquaculture subsector in Zambia. The GFSF identified the critical domains of gender transformation in food systems.

The current study, therefore, constitutes the final stage of the broader research project. The aim is to improve the understanding of how food systems contribute to gender equality and how gender equality can contribute to food systems. It also seeks to assess the impact of bridging food system barriers on gender equality and women's empowerment.

1.2. Evaluation Goals and Objectives

This impact evaluation study sought to evaluate the impacts of WorldFish interventions in the Northern and Luapula Provinces on livelihood and women empowerment outcomes and climate resilience. The specific objectives of the study are to;

- Evaluate the effect of WorldFish interventions on gender-equal access and control over resources, technology, and information among smallholder farmers, including productivity and food security.
- Assess the impact of WorldFish projects on gender equality and women's empowerment in aquaculture.
- Access the impact of WorldFish projects on climate resilience among smallholder fish farmers.

1.3. Evaluation Questions

The study asked the following questions;

- How have WorldFish interventions enhanced gender-equal access and control over resources, technology, and information among smallholder farmers?
- In what ways have WorldFish interventions encouraged more women's participation in aquaculture (smallholder productivity) in the intervention areas?
- How have WorldFish projects impacted gender equality and women's empowerment?
- How have WorldFish interventions promoted climate resilience and productivity of smallholders (especially women)?

1.4. Evaluation Hypothesis

Based on the GFSF, this evaluation tested the following hypothesis concerning WorldFish interventions;

1. there is enhanced involvement of women in aquaculture due to WorldFish interventions,
2. there is enhanced gender equality in access and control over resources, technology and/or information on aquaculture,
3. there is enhanced gender equality in climate resilient practices (knowledge and adoption of CSA aquaculture practices),
4. there is enhanced women's empowerment,
5. there is enhanced gender equality in terms of benefits from the food system.

1.5. Scope of the Evaluation

This external evaluation is summative. It covers all interventions implemented by WorldFish between 2018 and 2022. It includes the Aquaculture Technical, Vocational, and Entrepreneurship Training for Improved Private Sector and Smallholder Skills (AQ TEVET) project and the Inclusive Business and Entrepreneurial Models (IBEMs) for smallholder fish farmers and poor value chain actors project.

This impact evaluation study targeted the population of male and female smallholder fish farmers, hatchery, and feed operators in the Luapula and Northern provinces of Zambia. Even though all the WorldFish interventions in the two provinces focus on empowering fish farmers (both sexes) and small and medium enterprise owners through training and linkages to input and output resources, the interventions did not have gender equality and gender empowerment as explicit project goals. Nevertheless, the project activities and perspectives implicitly sought to encourage women's participation and ultimately contribute to gender equality and empowerment. Hence, this evaluation report focuses directly on those attributable interventions that sought to enhance gender equality and empowerment rather than a general assessment of women empowerment in the two provinces.

PART 2

AQUACULTURE AND WORLDFISH IN NORTHERN ZAMBIA

2. AQUACULTURE AND ZAMBIA

Zambia is a landlocked country of 752,000 km2, located on the Southern Tropics of Africa (Central Statistical Office, 2012; International Trade Association, 2020). It shares its borders with eight countries: Angola, Botswana, the Democratic Republic of Congo, Malawi, Mozambique, Namibia, Tanzania, and Zimbabwe (World Bank, 2022c). The country is characterised by savanna woodlands flora and 15 million hectares of water in the form of rivers, lakes, and swamps – the water bodies constitute 20% of the country's land mass) (Nyangu, 2016). Further, apart from (arable) land and freshwater, the country has abundant natural resources, including minerals, wildlife, and forestry. In terms of population size, Zambia has a population of 17.8 million, of which 50.5% are female and 56% reside in rural areas (Chikowo, 2022; World Bank, 2022b).

The Zambian economy operates on a capitalist model – guided by neo-liberal economic policies that foster trade liberalisation, foreign direct investment, and entrepreneurship to support export-led growth (Moyo, 2009). Zambia has abundant natural resources, including minerals, wildlife, forestry, freshwater and arable land, of which the country largely exports primary commodities, i.e., copper, cobalt, electricity, tobacco, flowers, and cotton (Chikowo, 2022).
A selection of the country's prominent physical assets is copper and the Mosi-O-Tunya Falls (Victoria Falls) (Miller & Roberts, 1978). These physical assets related to the mining and tourism sector contribute to the country's GDP (Figure 1 below). Alongside these sectors, agriculture contributes not only to Zambia's GDP but also to national food security. It is estimated that 85% of Zambians rely on rain-fed farming as a livelihood (Chikowo, 2022; IFAD, 2016; World Bank, 2022b).

2.1. Fisheries, Aquaculture, and Climate Change

Despite aquaculture being one of the fastest-growing food systems in the world, production in Zambia remains less than optimal (Avadí et al., 2022; Kaminski et al., 2018; Kruijssen et al., 2018a). Aquaculture contributes to less than 1% of Zambia's Gross Domestic Product (GDP), even though the country reportedly has 300,000 fishers, fish farmers and processors (Nyangu, 2016). Further, Fishakathon (2016) notes that the current national demand for fish is estimated at 120,000 tons per annum, but only about 70,000 tons are supplied, leaving a deficit of 50,000 tons, which is supplied through imports (Nyangu, 2016). The sector's potential for growth and the suitable agro-ecological conditions to cultivate the industry are critical to Zambia's developing economy, given the agriculture sector's potential contribution to the national GDP (Kaminski et al., 2018; Mulenga et al., 2020).

Despite the sector's growth potential, it is faced with several challenges. Smallholder fish farmers producers (9,615 households in Zambia) (Ministry of Livestock and Fisheries, 2019) lack production capabilities - possess knowledge gaps in this area and, at the same time, are unskilled in value addition techniques and marketing skills (Kaminski et al., 2018). More specifically, they lack access to extension services and financial capital to expand and enhance their production facilities to support value addition and enhance their enterprises' profitability. Further, besides possessing limited marketing skills, their social networks are limited, impacting their ability to penetrate wider markets or negotiate commercial markets. Aside from this, smallholder producers face supply-side challenges, specifically accessing a consistent supply of quality fingerlings, besides lacking efficient quality and affordable feed supply channels and cold storage facilities (European Commission, 2018). In addition, climate change effects such as drought and floods have implications for fisheries and fish farming (World Bank, 2019).

2.2. Gender and Aquaculture

Aquaculture is one of the fastest-growing food systems in the world. Nonetheless, Zambia's levels of fish production remain less than optimal despite Zambia being Africa's sixth-largest producer of farmed fish (Avadí et al., 2022; Kaminski et al., 2018; Kruijssen et al., 2018a). The sector's potential for expansion and the suitable agroecological conditions to cultivate the industry are crucial to Zambia's economic growth (Kaminski et al., 2018; Mulenga et al., 2020). Further, considering the depletion of natural fish stock, climate change effects on fisheries and the Zambian Government's interest in limiting fish imports from 52%, aquaculture is currently earmarked to meet increasing domestic and international demand for fish products (European Commission, 2018; Kefi & Mofya-Mukuka, 2015). Despite the sector's growth potential, the business rationale of gendered value chain development is not fully being taken advantage of in the aquaculture sector to respond to these concerns and achieve the Zambian Government's objectives. Women are not in a position to participate in aquaculture value chains in the same manner as men nor reap equal benefits from their involvement in the value chain (IFAD, 2016). These inequalities are exhibited in the gendered division of labour, distribution of benefits, access and control over assets and resources, and power relations in the value chain that are influenced by gender and social norms (IFAD, 2016; Kruijssen et al., 2018a).

2.2.1. Gender and aquaculture in Zambia

Similar to the global outlook, in Zambian aquaculture, men are largely involved in producing and marketing farmed fish and women mainly in value-adding, i.e., drying fish (Kruijssen et al., 2018a). Women's involvement in processing fish is determined by their gendered role as family caregivers, limiting their mobility to engage in activities significantly from their homestead. Further, women process and trade fish on a subsistence basis (The WorldFish Center, 2010). Female fish traders are driven to this aspect of marketing, considering their lack of access to credit and other resources as it requires a lower capital injection than fishing or fish farming (Béné & Merten, 2008). As already mentioned, these inequalities in opportunities are based on attitudes, beliefs, practices and "rules" determined by social institutions that ultimately relegate women to participating fish value chain nodes and activities with lower returns (Weeratunge & Snyder, 2009).

Against the backdrop of climate change and gendered impacts on aquaculture productivity above, WorldFish engaged in interventions to foster equitable, sustainable, productive, and climate-resilient (aquaculture) food systems in climate-agriculture-gender inequality hotspots in Zambia in collaboration with the CGIAR GENDER platform. WorldFish is specifically engaging in economic[1] and social[2] value chain upgrading. It takes into account two factors: 1) that aquaculture has the potential to expand and contribute to Zambia's GDP, and the business rationale of gendered value chain development can contribute to this economic growth and women empowerment simultaneously; 2) that the impacts of climate change on aquaculture and particularly women fish farmers need to be addressed.

[1] Economic upgrading is the process in value chains of moving to higher value-added activities, using more sophisticated or more efficient technologies and processes, increasing knowledge and skills, with the ultimate goal to increase the benefits derived from value chain participation (Gereffi, 2005)

[2] Social up- grading is described as the process of improving the working conditions, benefits, and rights of workers in a value chain with the ultimate goal of enhancing the quality of their employment and their wellbeing (Rossi, 2011 & Sen, 1999, 2000 in Barrientos et al., 2011).

2.3. Fish Farming in Northern and Luapula Provinces

Luapula and Northern provinces are in the northern zone of Zambia, which receives the country's highest rainfall. This region is highly endowed with water resources and has an average monthly temperature above 20°C, which is suitable for aquaculture. These features mean Northern and Luapula have the country's largest smallholder fish farmers[3]. A 2017–2018 livestock census shows that there were 9,615 households involved in fish farming countrywide as of January 2018, and Northern Province had the highest proportion at 33.9 per cent[4]. In 2020, WorldFish conducted a smallholder fish farmers' population census in the Northern and Luapula provinces. The report provided an overall situation and context of fish farming in these two provinces and is relevant for the present study. The census report found the following situations;

2.3.1. Fish farmers' background: The census found that a large proportion of fish farmers in the two provinces had between 1 and 5 years of experience in fish farming and that fish cultivation is usually for consumption and income. It was also found that almost all the fish farmers owned land, but women had a lower share of land ownership, and other farmers rented land for fish farming. Many farmers had also abandoned fish farming due to theft, inadequate access to quality fingerlings/seed, water shortages, activities of predators, lack of feed and flooding.

2.3.2. Fishponds: Earthen ponds were found to be used by almost all the farmers in the census. These ponds were not improved ponds and mostly lacked some characteristics of improved ponds, such as outlets to prevent flooding.

2.3.3. Gender, young farmers, and the division of roles in fish farming: The census found that fish farming followed a gender division of work. The results showed that women, men, and young people engage in different activities and decisions regarding fish farming and had different perceptions regarding who was engaged in or was responsible for certain decisions. Married men were found to insist on being responsible for decisions on land allocation, while married women mentioned those decisions to be jointly made. However, men and women believed that decisions on acquiring fingerlings were usually made together, even though more women than men held this view. More women were found to take up the role of fertiliser application than men, who said the decision to apply fertilisers was either jointly made or made solely by women. This was explained because these fertilisers were mainly organic and made from kitchen waste and leaves to which women have easy access. Similarly, decision-making regarding the marketing of fish was mostly made by women.

2.3.4. Access to input markets: Farmers used fingerlings from other farmers and or recycled fingerlings from their farms as their main source of fingerlings. Others sourced their fingerlings from a government hatchery, and only a few from local breeders. At the time of the census, almost none of the farmers used sex-reversed fingerlings. On feeding, more than 80% of the farmers did not use commercial feed, and the handful that used commercial feed travelled more than 20km to access commercial feed.

2.3.5. Access to extension services: According to the census, access to extension services was low. Over three-quarters of the active farmers had not received any extension services in the 12 months before the census. Most farmers access information on aquaculture from other farmers with little access to knowledge on best practices.

2.3.6. Access to output markets: Most farmers practised partial harvesting during the census. For the few who did complete harvesting, they harvested an average of 35kg of fish in each production cycle. Overall, most of the farmers sold their fish to neighbours at farm gates. The average income from fish farming was ZMW 1263.3 per growing cycle. The lowest reported income was ZMW 5, and the highest was ZMW 36,000.

2.3.7. Production constraints and opportunities: The two biggest constraints mentioned were a lack of fingerlings and access to or availability of feed. Both men and women farmers mentioned having similar constraints.

[3] Central Statistical Office. 2019. The 2017/2018 livestock and aquaculture census: Summary report. Lusaka, Zambia: Ministry of Fisheries and Livestock.

[4] ibid

PART 3

METHODOLOGY

3. METHODOLOGICAL APPROACH

This impact evaluation used a mixed-methodology design. It analysed qualitative and quantitative data. Primary data collection instruments used were Quantitative Survey (QS), Focus Group Discussions (FGD) and Key Informant Interviews (KII). Secondary data sources included project documents and other related literature.

3.1. Research Design

The evaluation used a convergent mixed method design where qualitative and quantitative data were collected concurrently, but the two datasets were analysed separately. The results were then merged during the interpretation of findings by mixing the two databases.

3.2. Data Collection Methods

Both quantitative and qualitative data collection tools were used to collect quantitative and qualitative data. The data collection exercise was divided into two: 1) collection of the quantitative data and 2) collection of the qualitative data.

Infographic 1: Data Collection Methods

3.2.1. Quantitative data collection tool

The quantitative data were collected using a survey questionnaire. The survey comprised questions from the mandatory pro-WEAI questions and other questions specific to WorldFish interventions in aquaculture. It also included questions on climate resilience strategy awareness and adoption, individual and household food insecurity and the dietary experience of farmers.

In administering the questionnaires, male and female adults[5] in each household were individually and separately interviewed. WorldFish interventions did not target only women; therefore, we assumed (for simplicity) that the eligible participant was either a woman or a man. Questionnaires were administered using the SurveyCTO client application on tablets. The template for the survey questionnaire was adopted from the International Food Policy Research Institute (IFPRI). The adopted template, therefore, necessitated the use of SurveyCTO. This data collection platform offered the possibility to use tablets for online and offline data collection. In total, 25 enumerators participated in the 15 days data collection exercise.

3.2.2. Qualitative data collection tools

Key Informant Interviews (KII) were conducted with SME owners, cooperatives and project staff to elicit detailed and contextual information about the project's contribution to the themes of this evaluation. It helped identify critical topics on which more information could be solicited in the survey work and for interpreting the quantitative results (triangulation).

Focus group discussions were conducted among smallholder farmers in control and treatment districts. The focus group discussions aimed to elicit a local understanding of empowerment and validate the survey questionnaire's domains. Like the KII, the FGDs provided additional information for interpreting the evaluation results. The qualitative data (KII and FGDs) were collected by two (country and lead) consultants from the evaluation team.

3.3. Sampling

The evaluation study used a multi-staged sampling technique to provide flexibility in anticipation of farmers' unavailability due to the farming season and the seasonal rains during fieldwork. The treatment and control districts, as well as the fish farmers in these, were purposively sampled on the three broad criteria;

- the availability of fish farming activities in the districts
- the production potential of the farmers
- the implementation of WorldFish interventions

Households for the treatment group were selected from seven districts in the two provinces where WorldFish interventions were implemented. Households for the control group were selected from five districts without WorldFish interventions in the two provinces.

The sampling criteria for fish farmers in the treatment districts were a) having a stocked pond(s), b) having taken part in training offered through WorldFish projects, and c) having harvested fish in the last 12 months. The sampling criteria for farmers in the control districts were a) having a stocked pond(s) and b) having

[5] Adult household members means household members older than 18 years. The two adult household members (male and female) may be married couple or not.

harvested fish in the last 12 months.[6] A total of 320 households were sampled from both the control and treatment districts.

Furthermore, respondents for the qualitative instruments were purposively sampled. The following table summarises the expected number of respondents.

Table 1: Qualitative Sample Frame

Tools	Respondents	Luapula	Northern
Key Informant Interview *(only in the treatment group)*	SME owners	4	4
Focus Group Discussions *(both treatment and control groups)*	Women	3 groups of 9 fish farmers = 3 FGDs (27 female fish farmers)	3 groups of 9 fish farmers = 3 FGDs (27 fish farmers)
	Mixed Group	1 group of 9 fish farmers = 1 FGD (9 mixed fish farmers)	1 group of 9 fish farmers = 1 FGD (9 mixed fish farmers)
	Men	1 group of 9 fish farmers = 1 FGD (9 male fish farmers)	1 group of 9 fish farmers = 1 FGD (9 male fish farmers)

3.4. Training of Enumerators and Data Collection

A team of locally recruited enumerators collected data for this evaluation with the help of a country country-based FIFE evaluation consultant. Selection of enumerators was based on their educational background (at least a bachelor's degree, with knowledge of agriculture, aquaculture, gender, and rural development), understanding of the local Bemba language and familiarity with the two provinces. The enumerators were trained before data collection, taken through the questionnaire's content, and translated key concepts and terms from English to Bemba. In addition, they were introduced to digital data collection techniques using tablets. The main topics of the enumerators' training included understanding the objectives of the evaluation, understanding the questionnaire content, role plays and discussions on framing of questions, use of tablets in data collection, loading and uploading data from the tablets to the server, carrying out field implementation and procedures to be followed in the field during data collection. The training also entailed pre-testing the questionnaire with the first two households. It ensured that the enumerators fully understood the questionnaire content, the order of the questions and the skip patterns in the tablet. After the pre-testing, minor revisions were made to the questionnaire.

3.5. Data processing and analysis

3.5.1. Quantitative data

The quantitative data was cleaned, organised, and analysed in Microsoft Excel, STATA and SPSS software. The quantitative analysis was done in two parts, which also inform the structure of this report.

Analysing simple differences in responses between farmers

First, the cleaned quantitative dataset was analysed descriptively. The description analysis used cross-tabulations to construct frequencies and percentages from farmers' responses within the control and treatment districts. The analysis disaggregated the results by treatment and control districts and

[6] The sampling criteria for selecting farmers in the two groups was based on the need of WorldFish to have only active farmers participating in both groups. It was also important because it provided data on fish production within the two groups.

respondents' sex in both districts. Results from the descriptive analysis drew comparisons of simple differences in farmers' responses in the treatment and control districts.

Testing the evaluation hypothesis

Secondly, the quantitative data was analysed using robust inferential statistical analysis. This part of the data analysis answers directly the evaluation questions and hypotheses. Thus, the analysis focused on the use of the quasi-experimental study design by employing propensity score matching that mimics the randomized assignment of units to farmers in the treatment and control (comparison) districts by selecting units for farmers in the control districts that share traits with farmers in the treatment district's units[7].

The analysis evaluated the impact (outcomes) of WorldFish interventions on households within the treatment districts using fish farmer households as the unit of analysis. It estimates the average treatment effect by comparing matched treatment and control observations. The matching used the propensity scores estimated from observable variables from the farmer household data. Mainly, the analysis used demographic variables and asset ownership indicators not influenced by the WorldFish interventions in the treatment districts. The overall justification was to find farmers with similar characteristics in the treatment and control districts and compute their difference in outcome to measure the effect of the interventions from WorldFish. The primary goal of the analysis in this section of the report was to test the 1.4. Evaluation Hypothesis by using 12 outcome indicators (labelled as Y). These were;

HYPOTHESIS 1:

- → **that there is enhanced involvement of women in aquaculture due to WorldFish interventions**
  - ⇢ Y1= Likelihood that wife is involved in aquaculture and also involved in decision-making

HYPOTHESIS 2:

- → **there is enhanced gender equality in access and control over resources, technology and/or information on aquaculture.**
  - ⇢ Y2= Likelihood of women's involvement either solely or jointly in control over the productive resources for aquaculture.
  - ⇢ Y3= Likelihood of women's involvement either solely or jointly in ownership of land for fishpond construction.
  - ⇢ Y4= Likelihood of women's involvement either solely or jointly in access to information on aquaculture.

HYPOTHESIS 3:

- → **that there is gender equality in climate resilient practices (knowledge and adoption of CSA aquaculture practices)**
  - ⇢ Y5= Intra-household gender difference in awareness of climate-smart practices
  - ⇢ Y6= Intra-household gender difference in knowledge of climate-smart practices
  - ⇢ Y7= Intra-household gender difference in adoption of climate-smart practices

HYPOTHESIS 4:

- → **that women's empowerment is enhanced**
  - ⇢ Y8= Likelihood of women's involvement either solely or jointly in aquaculture decision-making
  - ⇢ Y9= Likelihood of women to control the income from aquaculture activities
  - ⇢ Y10= Women empowerment using pro-WEAI

[7] See Gertler, P.J., Martinez, S., Premand, P., Rawlings, L.B., Vermeersch, C.M.J., 2011. Impact Evaluation in Practice. The International Bank for Reconstruction and Development/, The World Bank Publications.

HYPOTHESIS 5:

→ **that there is enhanced gender equality in terms of benefits from the food system**

- Y11= Intra-household Diet Diversity Scale (IDDS): - the difference between husband and wife
- Y12= Intra-household Food Insecurity Access Scale (IFIAS): - the difference between husband and wife

For each hypothesis, the treatment variable took the value (1) for farmers in the treatment districts participating in the WorldFish intervention and (0) for farmers in the control districts.

Employing a propensity score matching

The control or matching variables that were used to test the hypotheses are;

- Land size,
- Age of head of the household,
- Proportion of females in the household,
- Age difference between men and women in the household,
- Average income of the household,
- Distance to market and number of children under-five years in the household,
- Ownership of large livestock (cows, buffalos),
- Ownership of small livestock (cows, buffalos),
- Ownership of poultry,
- Ownership of cell phone,
- Ownership of non-mechanized farm equipment,
- Ownership of non-farm business equipment (house or building, large consumer durables, small consumer durables, means of transport).

Computation of the Pro-WEAI index

Pro-Women Empowerment in Agriculture Index (WEAI) is calculated as the weighted mean of two sub-indices: the Three Domains of Empowerment Index (3DE) and the Gender Parity Index (GPI) score (Malapit et al., 2019). The 3DE measures women's empowerment across three domains: intrinsic agency, instrumental agency and collective agency. The GPI is a relative inequality measure that reflects the inequality in 3DE profiles of the primary adult female in a household with that of the primary adult male. Typically, the primary adult female and male are the husband and wife, but the relationship between the two does not necessarily matter. The GPI shows the share of women who are as empowered as their male counterparts. Improvements in either the 3DE or GPI will increase pro-WEAI scores. The computation of the pro-WEAI in this study follows the methodology of the original WEAI by Alkire et al. (2013).

3.5.2. Qualitative data

Data, in the form of notes derived through edited transcription, was collected through FGDs with fish farmers (four with women only, two with only men and three with three mixed) and interviews with Small and Medium-sized Enterprise Owners8 (SMEOs). In total, nine FGDs were conducted, and seven IBEMs were interviewed. This data was collected using Focus Group Discussions with Fish Farmers and Key Informant Interviews with SME Owners (see Annex, Qualitative Data Collection Tools).

[8] These are enterprise owners that were targeted by the Inclusive Business and Entrepreneurial Models (IBEMs) project.

Notes from the FGDs and KIIs were uploaded to ATLAS.ti and MAXQDA qualitative software as one project for analysis. The coding scheme for analysis was based on three themes that correspond with the study's objectives: WorldFish enhancing women's access to and control of resources; WorldFish encouraging women to participate in fish farming; and WorldFish encouraging climate change resilience among IBEMs and fish farmers. Data coding involved exploring the data for relevant responses provided in the FGDs and by SMEOs to questions in the tools relating to the themes. Therefore, coding followed an inductive (ground-up) approach that allowed a narrative to emerge from the data with no preconceived notions. This approach captured the variety of responses provided in FGDs and by SMEOs to the questions relevant to the themes. Further, the data from the women and men FGDs were disaggregated using code-document tables to compare how men and women responded to key questions. Similarly, data was disaggregated by farmers and SMEOs for the same purposes.

3.6. Risks and Challenges

A major challenge for this evaluation was the choice between achieving the statistical sample size and the reality of reaching the targeted sample size on the ground. The districts where the evaluation took place are widely dispersed and require the highest level of coordination to access farmers against the background of bad road networks. As a mitigating strategy, FIFE recruited 25 enumerators and hired five vehicles to access as many farmer households as possible.

Especially in this case where the evaluation design requires access to fish farmer households with two adults, it meant the mobilisation of fish farmers had to consider having both adult household members for interviews. In almost all cases, farmers were mobilised to a central location for easy access. Many of these farmers travelled long distances to these locations. Some farmers were alone and without another adult member from their household but wanted to be interviewed. Some were without their spouses because either they were widows and had no older adults in their household or their spouses had travelled. Such farmers were added to FGDs and contributed to the qualitative data.

Within the treatment district, the mobilisation of farmers was easier than in the control districts. This was because of the familiarity with the farmers due to WorldFish interventions. It was also because the WorldFish officers with us on the field were familiar with some of the areas the evaluation team visited. The situation was different in the control district. The evaluation team had to rely on some officials from the Fisheries Department to help mobilise fish farmers in their districts. There were instances where some of the officers who were coordinating the study at the control districts were unaware of the sampling criteria for mobilising the farmers. Also, since the WorldFish officials who accompanied the team were not familiar with the control districts, there were few mobilisations that they could do. Ultimately, the lack of accessibility to farmers due to low coordination accounted for fewer responses in the control district.

PART 4

EVALUATION FINDINGS

Data was collected from 322 households from the treatment group in districts with WF interventions. In each household, both male and female members were interviewed separately/individually (intrahousehold gender-disaggregated data).

Data were collected from 178 households from the control group in districts without WF interventions. In each of those households, both male and female members were interviewed separately/individually (intrahousehold gender-disaggregated data)

For the qualitative data, nine focus group discussions and seven key informant interviews were conducted with fish farmers and feed and hatchery operators.

	Province	District	Individual	Household
Treatment	Northern	Mungwi	120	60
	Northern	Luwingu	174	87
	Northern	Mbala	68	34
	Northern	Mporokoso	84	42
	Northern	Kasama	40	20
	Luapula	Mansa	64	32
	Luapula	Kawambwa	94	47
		Total	**644**	**322**
Control	Northern	Kaputa	68	34
	Luapula	Chembe	22	11
	Luapula	Mwense	64	32
	Luapula	Mwansabombwe	32	16
	Luapula	Nchelenge	170	85
		Total	**356**	**178**

Figure 1: Achieved Samples and the Respective Respondents in the Targeted Districts

Figure 2: Number of Respondents for the Qualitative Data

4.1. Demographic Characteristics

The number of female and male household respondents in the impact evaluation survey was equal for farmers in both controls (178 female, 178 male) and treatment (322 female, 322 male) districts. It was because of the study design, which targeted both female and male adults in fish farmer households.

Table 2: Demographic results

Variable	Category	Control					Treatment				
		Female	Male	%Female	%Male	total	Female	Male	%Female	%Male	total
Age	≤ 35	69	47	39%	26%	116	124	97	39%	30%	221
	36 to 64	105	109	59%	61%	214	188	191	58%	59%	379
	≥ 65	4	22	2%	12%	26	10	34	3%	11%	44
	Total	**178**	**178**	**100%**	**100%**	**356**	**322**	**322**	**100%**	**100%**	**644**
Marital status	Cohabiting	1	0	1%	0%	1	0	1	0%	0%	1
	Divorced	2	1	1%	1%	3	2	1	1%	0%	3
	Married	160	165	90%	93%	325	291	293	90%	91%	584
	Separated	1	0	1%	0%	1	2	0	1%	0%	2
	Single	11	10	6%	6%	21	12	16	4%	5%	28
	Widowed	3	1	2%	1%	4	9	4	3%	1%	13
	Other	0	1	0%	1%	1	6	7	2%	2%	13
	Total	**178**	**178**	**100%**	**100%**	**356**	**322**	**322**	**100%**	**100%**	**644**
Years in School	0	9	2	5%	1%	11	9	2	3%	1%	11
	1-5	56	12	31%	7%	68	73	20	23%	6%	93
	6-10	98	121	55%	68%	219	199	206	62%	64%	405
	11-15	13	41	7%	23%	54	41	89	13%	28%	130
	> 15	2	2	1%	1%	4	0	5	0%	2%	5
	Total	**178**	**178**	**100%**	**100%**	**356**	**322**	**322**	**100%**	**100%**	**644**
Household Members	< 3	2	3	1%	2%	5	10	12	3%	4%	22
	3-5	40	34	22%	19%	74	104	100	32%	31%	204
	5-7	52	60	29%	34%	112	96	104	30%	32%	200
	7-10	60	59	34%	33%	119	89	85	28%	26%	174
	> 10	24	22	13%	12%	46	23	21	7%	7%	44
	Total	**178**	**178**	**100%**	**100%**	**356**	**322**	**322**	**100%**	**100%**	**644**

In both the control and treatment districts, most farmers were between the ages of 36 and 64 years for both male and female respondents, suggesting that most respondents are in their active working age group.

The majority of farmers in both groups (control=219/365 out of the 178 households; treatment = 405/644 out of the 322 households) have had between six and 10 years of school, with only a few (control=11/365 out of 178 households; treatment 11/644 out of the 322 households), who have never attended school. Overall, in both control and treatment groups, male household members scored higher in the number of years in school compared to female household members. Interpreting the results indicates that most fish farmers in the two provinces have received a basic level of education. It further suggests that some of the farmers could read and write.

Most of the two adult respondents in the households were married (control group = 325/365 out of the 178 households; treatment = 584/644 out of the 322 households).

PART 4A

DESCRIPTIVE ANALYSIS OF ACCESS TO AQUACULTURE RESOURCES INFORMATION

5. FARMERS' RESPONSES ON ACCESS TO RESOURCES AND TRAINING.

This section presents findings of the descriptive analysis of responses from smallholder fish farmers in the control and treatment districts and small and medium-sized enterprise owners from the treatment districts. The section presents findings relating to i) smallholder farmers' gender-equal access and control over resources, technology, and aquaculture information, ii) climate resilience and productivity of smallholder farmers, and iii) climate and business adaptation of SME owners. The results are the triangulation of qualitative and qualitative analysis results, which answer the 1.3. Evaluation Questions. The results are disaggregated by treatment and control districts and respondents' sex in both districts. Results from the descriptive analysis drew comparisons of simple differences in farmers' responses within the treatment and control districts.

5.1. Gender-equal Access and Control over Resources, Technology and Aquaculture Information

Evaluation question: *How have WorldFish interventions enhanced gender-equal access and control over resources, technology, and information among smallholder farmers?*

In assessing the access and control over resources, technology and aquaculture information of farmers, we focused on two key outcomes expressed in WorldFish's intervention logic (
Table 3), which included a) facilitating access to input and output aquaculture resources and services and

Intervention	Intervention outcome (indicators)
Access to Input and Output Resources and Services	→ Access to quality fingerlings →Access to commercial feed →Access to extension services →Access to fish offtake (market and sales) →Access to climate information services
Knowledge of Aquaculture Practices	→Training on gender and social inclusion →Training on pond construction →Training on biosecurity →Training on managing your farm as a business → Training on integrated aquaculture/climate smart aquaculture

b) providing training on aquaculture practices.

Table 3: Indicators for Access and Training

Intervention	Intervention outcome (indicators)
Access to Input and Output Resources and Services	→ Access to quality fingerlings →Access to commercial feed →Access to extension services →Access to fish offtake (market and sales) →Access to climate information services
Knowledge of Aquaculture Practices	→Training on gender and social inclusion →Training on pond construction →Training on biosecurity →Training on managing your farm as a business → Training on integrated aquaculture/climate smart aquaculture

The indicators above mirror the direct interventions implemented by WorldFish. Using these indicators as a point of departure, the results reflect the differences between the farmers in the treatment and control districts on their access to input and output resources/services and whether they have received training on best aquaculture practices.

5.1.1. Accessing Input and Output Resources and Services

WorldFish interventions in the Luapula and Northern provinces focused on opening up the value chain system surrounding aquaculture. It included providing farmers with access to input and output services such as access to quality fingerlings, access commercial feed, access extension services and access to the off-takers market. It also included providing farmers with access to climate information services. The results presented below (Table 4) show how farmers in both control and treatment districts responded to whether these services and information are accessible for their aquaculture activities.

Table 4: Access to input and output resources and climate information

Indicator	Yes responses for Control (of 178 HH)					Yes responses for Treatment (322 HH)				
	Female	Male	% Female	% Male	Total	Female	Male	% Female	% Male	Total
Famers with access to quality fingerlings	60	38	34%	21%	98	214	226	66%	70%	440
Famers with access to commercial feed	46	31	26%	17%	77	191	190	59%	59%	381
Famers with access to fish offtake market and sales	46	33	26%	19%	79	208	194	65%	60%	402
Famers with access to on-the-farm extension services	57	44	32%	25%	101	196	199	61%	62%	395
Famers with access to climate information services	53	45	30%	25%	98	219	201	68%	62%	420

5.1.1.1. Accessing Quality Fingerlings

The evaluation results show fish farmers from the treatment districts responding positively to having access to quality fingerlings (see Figure 3). In gender terms, 66% of female farmers in the treatment districts mentioned having access to quality fingerlings compared to female farmers in control districts (34%).

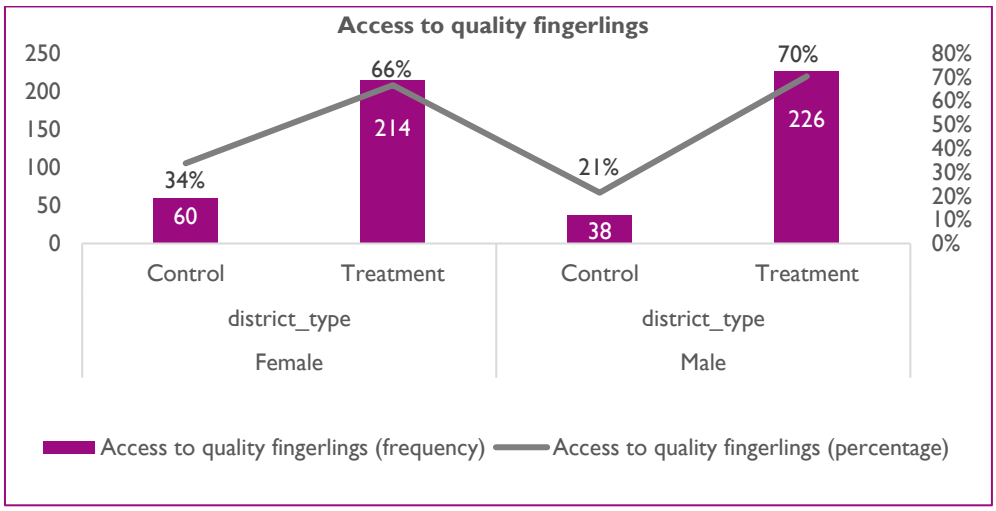

Figure 3: Accessing quality fingerlings

Within the treatment districts, the results indicate that more males (70% of 322) have access to quality fingerlings compared to female fish farmers (66% of 322).

The result points to more farmers in the treatment districts having access to quality fingerlings than fish farmers in control districts. According to farmers during focus group discussions, this result is due to the increased number of hatchery operators in the treatment districts who offer quality fingerlings to farmers. These hatchery operators in the treatment districts were established through the support of WorldFish interventions. Another reason found by the study (through focus group discussion) was that several farmers in the treatment districts, through WorldFish training, could nurse and produce quality fingerlings for their ponds. Based on these findings, the improvements found in the treatment districts can be directly attributed to WorldFish interventions in these areas.

5.1.1.2. Accessing Commercial Feed

One of the several challenges identified in a 2020 small-scale fish farmer's census in the two provinces was fish farmers' lack of access to commercial fish feed. The reason was that while fish feed producers were mainly located in the southern part of the country, these firms had not expanded to northern Zambia. A previous evaluation result of WorldFish's intervention in the two provinces revealed that WorldFish intervention facilitates the extension of feed operators to the Luapula and Northern provinces starting in 2020. Thus, when asked whether they could access commercial feed in their various districts, farmers in the treatment districts (average 59%) mentioned having more access to commercial feed than farmers in the control districts (average 22%) (See Figure 4).

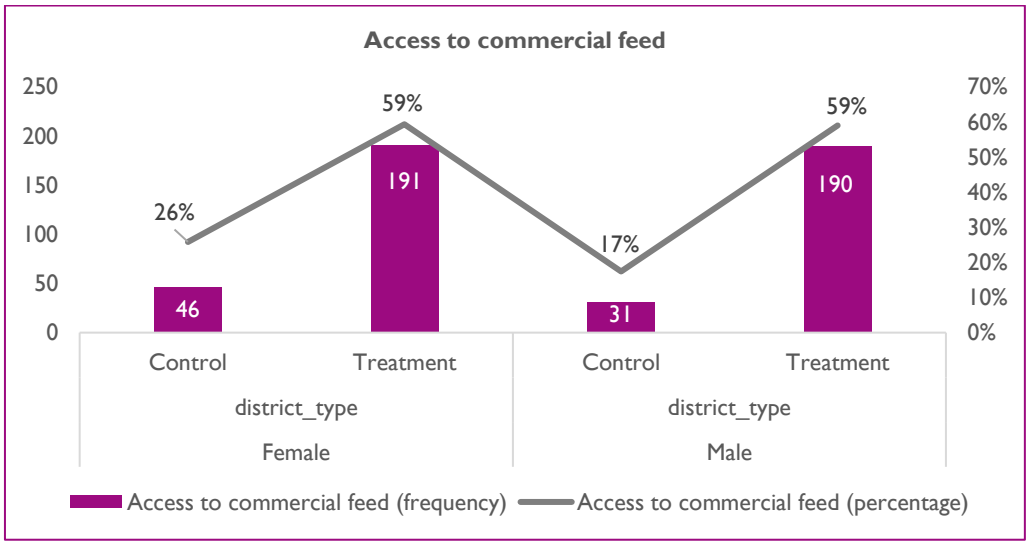

Figure 4: Accessing commercial feed

Compared to female farmers in the control districts (26% of 178), most female farmers (59% of 322) in the treatment districts have more access to commercial feed. Therefore, the difference in access to commercial feed between farmers in the control and treatment districts can be attributed to the specific WorldFish intervention of supporting feed operators (or feed sellers) to access feed from feed-producing companies. Thus, WorldFish interventions promoted the retail of commercial feed by linking feed operators directly to feed producers.

5.1.1.3. Accessing Fish Off-taker Markets

The study also revealed (in Figure 5) that more farmers (62% of the 644 farmers) in the treatment districts (female=208/322; male =194/322) had access to fish off-takers markets compared to their colleagues in the control districts where only 22% of the 356 farmers surveyed have access to off-taker markets (female=46/178; male = 33/178).

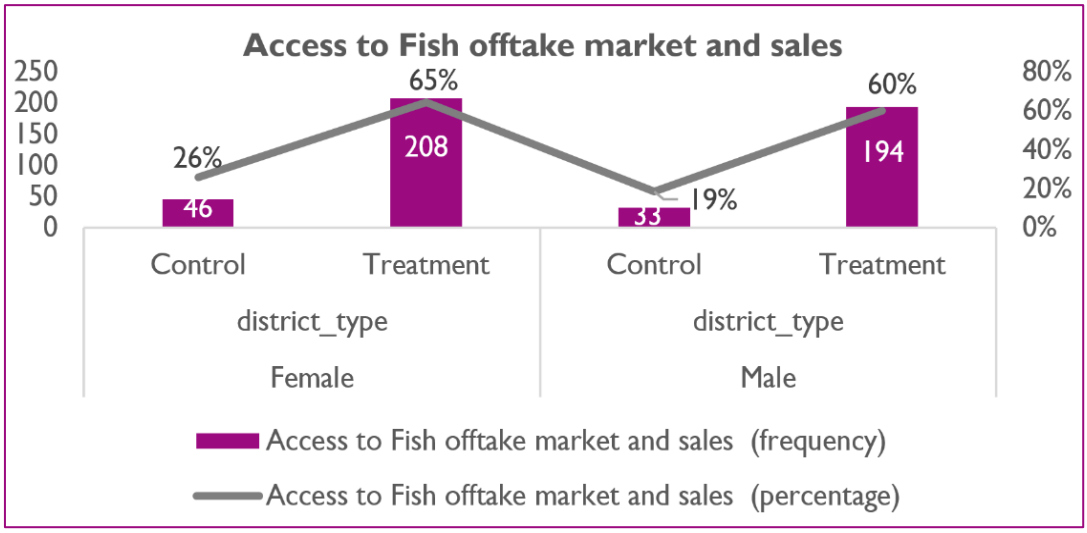

Figure 5: Accessing fish offtake markets

In gender terms, more female farmers responded positively to accessing off-taker markets than male farmers in control and treatment districts. The reason points to gender roles where women are often the ones who take care of sales of fish in households. It, however, does not necessarily mean women have control over the income from such sales as men often tend to still have more control over income from the sale of fish, according to focus group discussions with the farmers. Off-takers are individuals or businesses buying harvested fish directly from smallholder farmers. Access here means farmers are aware of the existence of these off-takers and sell directly to them without having to sell their harvests only in local markets. The result that more farmers in the treatment districts have access to off-takers points to the likelihood that these outlets result from WorldFish interventions in the treatment districts. The study found that most of these outlets in the treatment districts were introduced to farmers through WorldFish negotiations. Also, some off-takers are feed/hatchery operators supported by WorldFish interventions in the provinces. It explains the results from the control districts that still lack the linkages between farmers and off-takers, a situation identified in the census report.

5.1.1.4. Accessing (on the farm) Extension Services

Fish farmers' access to extension services in the treatment districts has increased since 2020 compared to control districts. About 61% (representing 396 out of 644) of farmers in the treatment districts (female = 196 (61%), male = 199(62%)) mentioned having sustained access to on-the-farm extension services compared to the only 28% (representing 101 out of 356) of farmers in the control districts (female = 57(32%), male = 44 (25%) who can access extension services (see Figure 6).

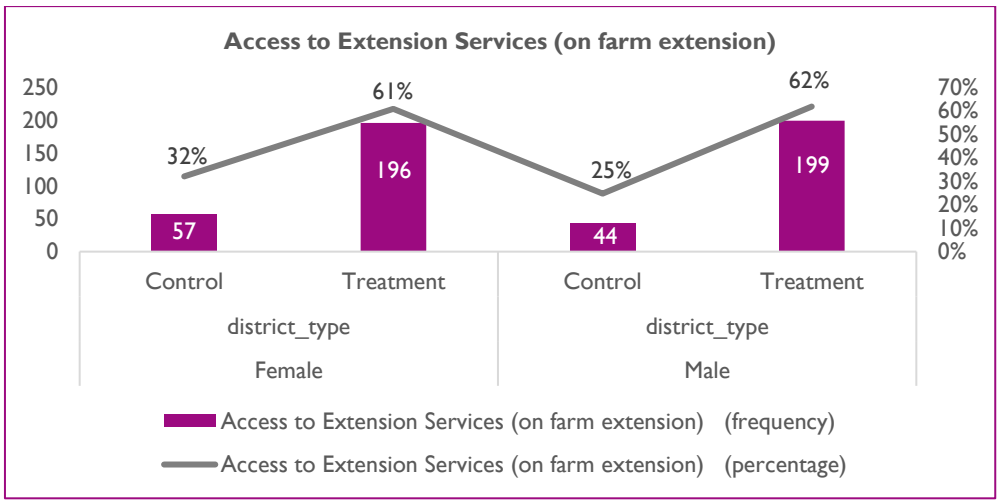

Figure 6: Accessing extension services

The results show a significant improvement in the treatment district. Farmers in the treatment districts directly attributed (during focus group discussions) the increase in on-the-farm extension services to the small and medium enterprise owners, including hatchery and feed operators who offer these services to their clients. Most of the farmers in this study are clients of these SMEs. The operators of these SMEs were supported and or helped established by WorldFish and were trained through WorldFish interventions on aquaculture to equip them in providing extension services to farmers within their reach. Indirectly, WorldFish interventions also facilitated internship positions for aquaculture graduates with SMEs who, in return, offered on-the-farm extension services to farmers. During focus group discussions with farmers in the control districts, the few who mentioned having access to extension services named government officers (from the fisheries department) and GIZ projects in their districts as the sources of extension services they have accessed.

5.1.1.5. Accessing Climate Information Services

A basic issue about climate challenges in the aquaculture sector centres on enhancing access to climate-related information services. Here, approximately 65% (420 {female=219, male=201} out of 644) of the fish farmers in the treatment districts confirmed having access to information on climate. In the control districts, only 28% of farmers mentioned having access to information on climate (see Figure 7).

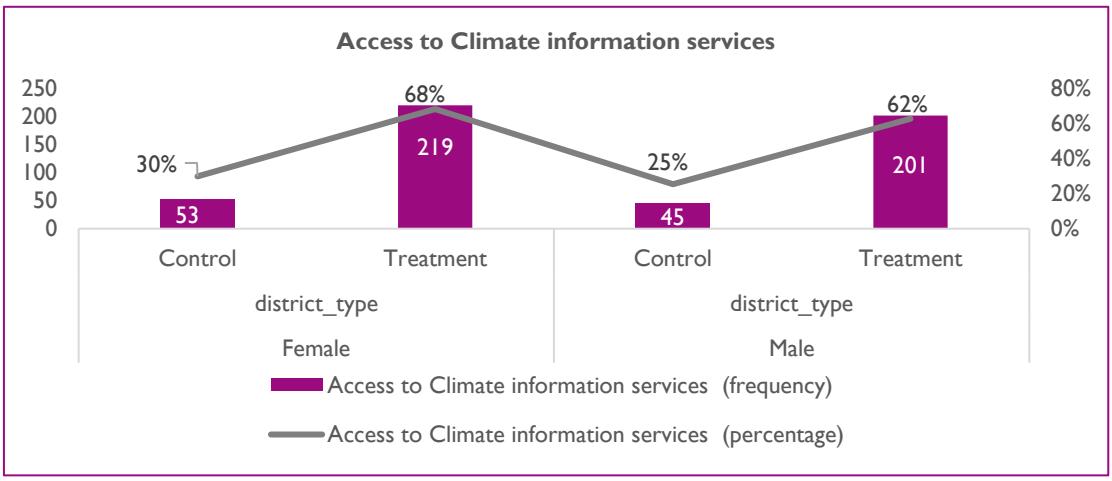

Figure 7: Accessing climate information services

The difference between the control and treatment districts regarding access to climate information services could be attributed to the WorldFish projects. According to farmers in the treatment districts, WorldFish staff have provided access to climate information platforms where they receive weather and other climate-related aquaculture information on their mobile phones. Some farmers also mentioned getting climate-related information on aquaculture practices through WorldFish-sponsored radio programmes from their local FM stations.

5.1.2. Acquiring Knowledge of Aquaculture Practices

Besides access to input and output resources and services, the evaluation sought to examine whether farmers have received training on five activities that are critical for the aquaculture value chain system (

Table 5). Access to such training for this study contributes to farmers having gained knowledge on such activities.

Table 5: Access to Training on Aquaculture

Indicator (Training)	Control (of 178 HH)					Treatment (322 HH)				
	Female	Male	% Female	% Male	Total	Female	Male	% Female	% Male	Total
Gender and social inclusion	57	42	32.0%	23.6%	99	211	208	65.5%	64.6%	419
Pond construction	65	44	36.5%	24.7%	109	221	227	68.6%	70.5%	448
Biosecurity	39	28	21.9%	15.7%	67	201	199	62.4%	61.8%	400
managing your farms as a business	54	37	30.3%	20.8%	91	223	219	69.3%	68.0%	442
Integrated aquaculture/climate smart aquaculture	49	35	27.5%	19.7%	84	222	203	68.9%	63.0%	425

5.1.2.1. Training on Gender and Social Inclusion

Including women in aquaculture is critical to the fish farming value chain system. It speaks to gender equality in aquaculture. The results show that approximately 211 out of 322 (66%) female and 208 out of 322 (65%) male fish farmers in the treatment districts have gained knowledge in gender and social inclusion through training (see Figure 8). The number of women in the treatment districts is twice that in the control districts (57/178 representing 32%) that mentioned having been trained in this topic. This outcome is almost tripled compared to male fish farmers in the treatment and control districts (42 out of 178, representing 24%). It could be interpreted that the increase in knowledge in the treatment district is credited to training on gender and social inclusion conducted through WorldFish interventions in these districts.

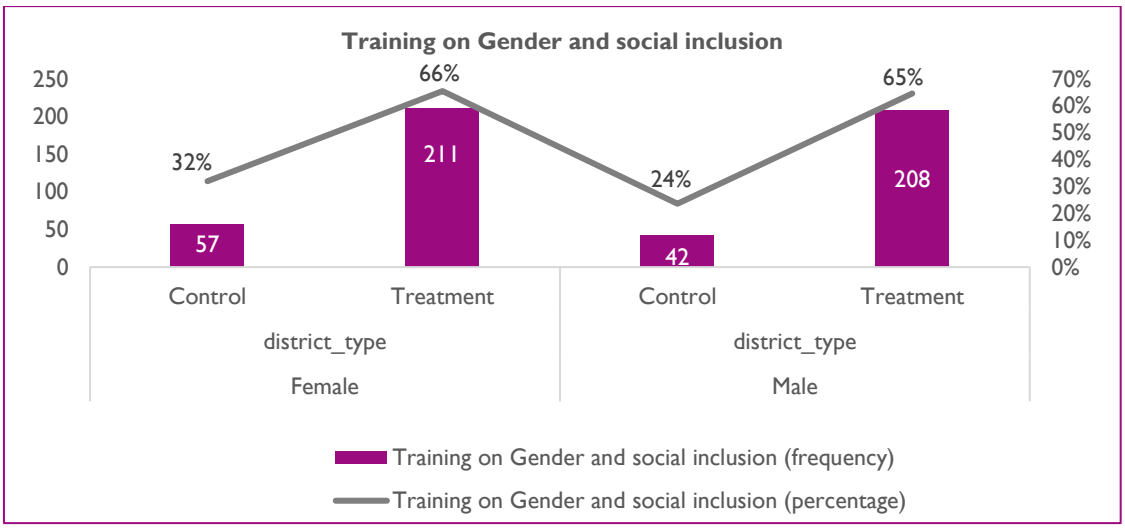

Figure 8: Accessing training on gender and social inclusion

5.1.2.2. Training on Pond Construction

Most of the fish farmers (female = 221/322 (69%); male 227/322 (70%)) in the treatment districts have received training in how to construct improved fishponds (see Figure 9). This, compared to farmers in the control districts (female = 65/178 (37%); male 44/178 (25%)), shows a significant increase compared to the 2020 census, where most farmers did not know about constructing improved fishponds.

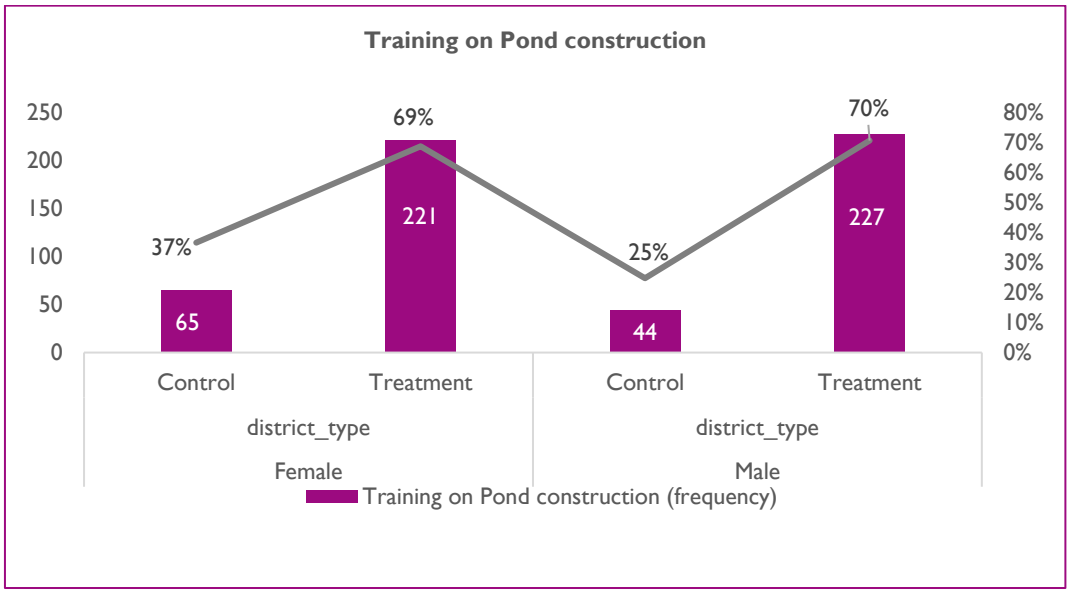

Figure 9: Accessing training on pond construction

5.1.2.3. Training on Biosecurity

Also, on biosecurity (Figure 10), more female farmers {201/322 = 62%} in the treatment districts have been trained compared to the few female farmers in the control district {39/178 = 22%}. The result shows a similar trend among male farmers in the two district types of the study. It is, however, interesting to note that between the male and female farmers in the treatment districts, the number of responses was the same for both sexes (62%), indicating equal access to training in biosecurity.

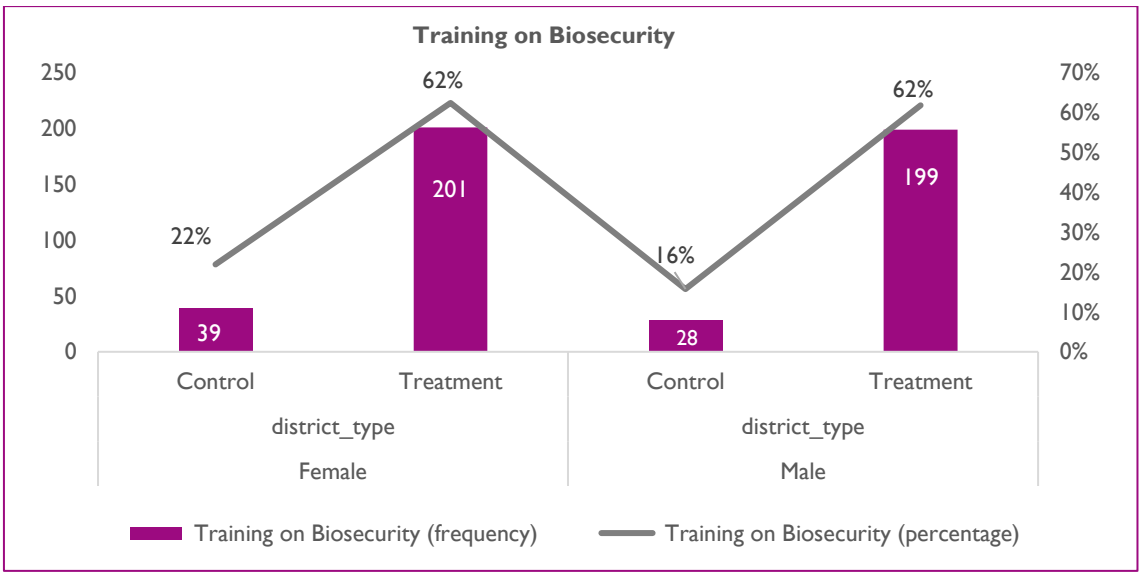

Figure 10: Accessing training on biosecurity

5.1.2.4. Training on Farm Management as a Business

Aquaculture management is another area of increased access due to training provided by WorldFish interventions. On this, the result was not different from other responses. Thus, more farmers in the treatment districts responded positively {female=223/322 (69%); male=219/322 (68%)} to receiving training on how to manage their farms as a business (see Figure 11). On the other hand, few farmers in the control districts acknowledged receiving training on managing farms as a business {female=54/178 (30%); male=37/178 (21%)}.

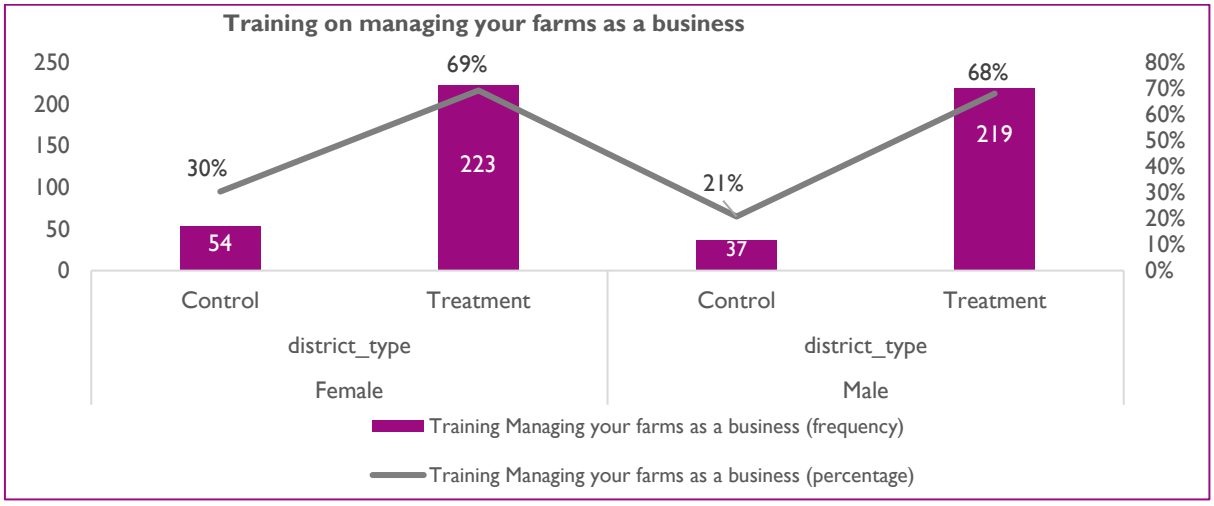

Figure 11: Accessing training on managing your farms as a business

5.1.2.5. Training on Integrated Aquaculture/Climate Smart Aquaculture

On integrated aquaculture/climate smart aquaculture (see

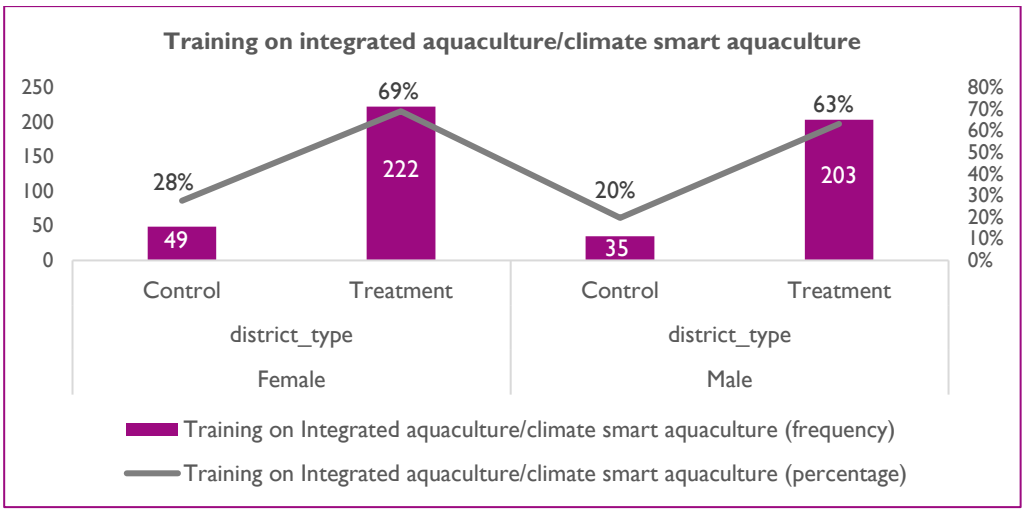

Figure 12), more female farmers {222/322 (69%)} in the treatment districts responded "yes" to receiving such training compared to their male colleagues {203/322 (63%)}. This trend (more female farmers trained) was also observed among farmers in the control districts, even though the number of respondents was over two times less than the results from the control district {female=49/178 (28%); male=35/178 (20%)}.

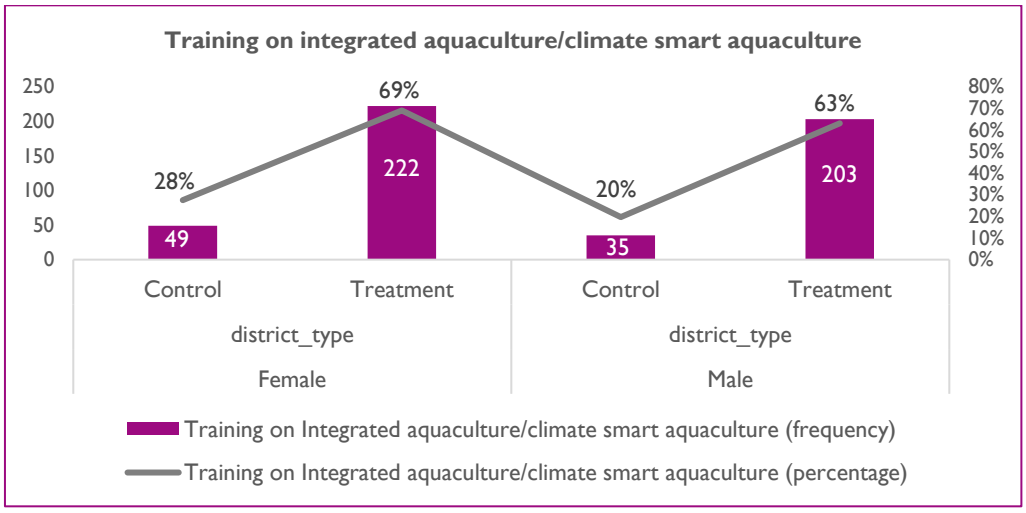

Figure 12: Accessing training on integrated aquaculture/climate smart aquaculture

5.1.3. Discussion

The results depict changes in farmers in the treatment districts regarding access to input and output resources and services and acquisition of knowledge on aquaculture practices through training. With these two broad indicators (access to input and output resources and services and knowledge in aquaculture practices), more farmers in the treatment than control districts indicated favourable responses. Considering that the 2020 census puts these farmers on the same level of performance in the aquaculture sector in the two provinces, the results highlight significant differences between these two groups of farmers. It could be interpreted that the recorded difference is due to the activities of these interventions. On gender, the results show a significant increase in the number of women who have access to input and output resources, services and training in the treatment district. The difference is significant, indicating an impact of the interventions on women fish farmers. Within the treatment districts, the study also shows an average of more than 65% for males and females who responded positively to all these indicator variables.

According to the findings above, this section shows that WorldFish's interventions have enhanced access to resources and information on aquaculture for improving fish farming in treatment districts. The results show that more women in the treatment than the control districts have access to input and output resources and information on climate aquaculture practices. These findings could be attributed to WorldFish interventions, which also promoted female participation concerning mobilization, training and providing information on climate change adaptation and facilitating market linkages. In the position of this evaluation, WorldFish's adoption of inclusive approaches with regards to these interventions significantly contributed to women in the treatment districts 1) having better access to inputs and out resources (2) having acquired more training on aquaculture production and climate change adaptation strategies, compared to women farmers in the control districts.

However, the qualitative data on gendered access to resources, decision making and roles in aquaculture practices in the household show no different results for farmers in treatment and control districts.

In terms of female and male farmers taking equal advantage of the opportunities to access resources, both genders face similar challenges of lack of funding. However, despite both men and women lacking capital to effectively engage in fish farming, women's challenges in this area are more profound – judging from all the female FGDs referring to this issue. For women, the fear of societal shame if they defaulted on a loan, partly due to their perspective that they lack the same drive and capacity of men to repay a (sizeable) loan, hindered them from considering credit as a source of capital. When they did get loans, they often acquired small loans from informal credit providers – specifically village savings groups.

Further, even though both men and women lacked the financial resources to purchase inputs or engage in climate change adaptation strategies (e.g., livelihood diversification), and women could participate in training sessions, there are social norms hindering women's capacity to engage with off-takers. The interviews showed that in joint/family enterprises, female farmers were less likely to have decision-making jurisdiction concerning all the value chain nodes (production, harvesting, marketing). This is the case regardless of farmers intimating that women and men have different responsibilities concerning fish farming – notably, men take on the more capital-intensive, physically involving and periodic tasks. In contrast, women engage in daily, time-consuming chores with a nurturing disposition (see Table 6 below). Women's limited decision jurisdiction is due to social norms that identify men as the head of a household. Therefore, despite women and men alluding to a collaborative decision-making approach in their households or enterprises, they agreed that men had more influence in decision-making on how or when activities related to the family/joint fish farming enterprise proceed. According to farmers, men's influence in decision-making is to the extent that women only make decisions when they are off the farm (far away) and when women solely own a pond. Based on this situation, men and women agreed that marketing decisions, such as which off-takers to engage with, the sale prices, and decisions on how the income from fish sales is spent, are largely influenced by men.

Table 6: Men's and women's ascribed responsibilities in fish farming

Fish farming activities	Women responsible		Men responsible	
	Women FGD	Men FGD	Women FGD	Men FGD
Fish farm expansion			x	
Fencing pond				x
Stocking/buying fingerlings				x
Water management			x	x
Feeding	x	x		

Pond maintenance	x	x		
Fish health monitoring	x	x		
Harvesting		x	x	
Sales price			x	x

The challenge women face in fish farming about decision-making power based on social norms is specific to joint/family enterprises. This is because, in a situation where women solely own the enterprise or they operate as part of a women's group, they have (more) control of all fish farming resources related to this jurisdiction to make decisions at all value chain nodes, including decisions on how the income accrued from the venture is used. However, it is important to note that often, when women own ponds, it does not exclude them from labouring on the family enterprise – meaning that in certain cases, women and their children's labour burden increases. Further, it is noteworthy that despite women having limited control of land, a critical resource to pond ownership, farmers indicated that male spouses and traditional leaders are willing to grant women and women groups' access to land, respectively, to engage in fish production as well as provide labour to assist women in digging ponds. To such an activity, female and male farmers stated that it is difficult for them to dig due to physical limitations. This situation regarding women's access to land reflects that women may not own land and are likely to only inherit it on behalf of their children when their spouse passes on, but that they are in a position to own a pond through the support of their spouses or traditional leaders.

5.2. Climate Resilience and Productivity of Smallholder Farmers

Evaluation question: How have WorldFish interventions promoted climate resilience and productivity of smallholders (especially women)?

Following the evaluation question, two core indicators were observed: Climate Resilience and Productivity. On the one hand, the evaluation assessed the awareness, knowledge, and adoption of climate-smart aquaculture. On the other hand, factors relating to productivity, such as the number of active ponds, number of fingerlings stocked, kilograms of fish and sale of a kilogram of fish harvested last season, and monthly estimated household income, were measured.

5.2.1. Climate Resilience

Farmers and operators in the two provinces continue to experience the effect of climate change on their fish farming activities. The qualitative interviews and focus group discussions revealed challenges such as drought, prolonged rainfall, flooding, and low temperatures during the cold season as among the effects of climate change in the districts. Thus, the evaluation assessed WorldFish interventions' impact on climate resilience by examining farmers' awareness and adoption of Climate-Smart Aquaculture strategies (CSAS).

5.2.1.1. Awareness of Climate Smart Aquaculture Strategies

Farmers' awareness of climate-smart aquaculture strategies was measured against awareness of integrated aquaculture (crop and livestock), improved pond construction, water harvesting and improved grain storage. The results show that most farmers in the treatment area are responding to awareness of such climate resilience strategies. Except for awareness of water harvesting and improved grain storage, responses from farmers in the treatment district on all the assessed strategies were over 72%, indicating a significant level of awareness compared to farmers in the control districts, with an average "yes" response of over 55%.

Among male and female farmers in the treatment districts, the average positive response of female farmers to climate resilience strategies was 73% compared to male farmers' average of 71% awareness. The results

indicated gender equality regarding awareness of climate resilience strategies among male and female farmers in the treatment district.

Table 7: Awareness of Climate-Smart Aquaculture Strategies

Indicator = Awareness of climate resilience strategies	**Yes responses for Control (of 178 HH)**					**Yes responses for Treatment (322 HH)**				
	Female	Male	% Female	% Male	Total	Female	Male	% Female	% Male	Total
Integrated aquaculture with crops?	133	135	75%	76%	268	289	276	90%	86%	565
Integrated aquaculture with livestock?	105	100	59%	56%	205	248	231	77%	72%	479
Improved pond construction?	98	91	55%	51%	189	266	266	83%	83%	532
Water harvesting?	44	43	25%	24%	87	146	141	45%	44%	287
Improved grain storage?	114	112	64%	63%	226	201	201	62%	62%	402

The high awareness of the measured climate resilience strategies among farmers in the treatment districts was attributed to WorldFish and IBEM training, which encouraged fish farmers in the treatment districts to adopt these strategies. The findings are consistent with the percentage of farmers in the treatment district who admitted to having access to climate information systems and being trained in climate-smart aquaculture.

5.2.1.2. Adoption of Climate-Smart Aquaculture Strategies

On the use of CSA strategies, the result (in Table 8 below) shows that more fish farmers (average of 52%) in the treatment districts are practising the tested strategies than fish farmers in the control districts (average of 38%). It was also evident that female fish farmers in the treatment districts scored higher (average 52%) on all the evaluated strategies than their male partners (average 51%)

Table 8: Adoption of Climate-Smart Aquaculture Strategies

Indicator = Use of climate resilience strategies in the last 12 months	**Yes responses for Control (178 HH)**					**Yes responses for Treatment (322 HH)**				
	Female	Male	% Female	% Male	Total	Female	Male	% Female	% Male	Total
Integrated aquaculture with crops on the plots that you manage?	123	126	69%	71%	249	260	256	81%	80%	516
Integrated aquaculture with livestock?	84	85	47%	48%	169	193	193	60%	60%	386
Improved pond construction?	68	70	38%	39%	138	197	186	61%	58%	383
Water harvesting?	34	35	19%	20%	69	111	104	34%	32%	215
Improved grain storage?	29	20	16%	11%	49	85	82	26%	25%	167

Among all the farmers, the most practised climate strategy is integrated aquaculture with crops, while the least used strategy is improved grain storage. Like the above findings, more than 50% of the total 644 farmers from the treatment districts are practising more climate resilience strategies (integrated aquaculture with crops/livestock, improved pond construction).

On gender, there was a difference between female (average 51% of 322) and male (average 49% of 322) farmers in the treatment districts practising all the evaluated climate resilience aquaculture strategies. The results indicate the equal application of these strategies among male and female fish farmers in the treatment districts and attributed to the gender focus of WorldFish interventions that prioritise providing information equally to female and male farmers. Importantly, WorldFish's provision of training manuals and books was found to have played a critical role in sustaining these adopted practices as farmers use these materials.

In discussions with farmers and IBEMs, several climate change effects were identified. Both men and women mentioned drought as the major climate change effect they experienced, followed by floods. Drought was alluded to as a climate change effect in all the FGDs. The former is detrimental to farmers as it impacts fish mortality due to ponds drying up, and the latter leads to fish losses as a result of fish being washed away. Additionally, men mentioned that the reduction in water temperatures due to climate change caused fish stress, contributing to fish mortality. Responses of farmers regarding the effects of climate change on their activities and sales were similar to those mentioned by IBEMs. However, IBEMs specifically alluded to fish mortality or loss, translating into farmers buying less feed.

Concerning the climate change effects that impact farmers' enterprises and IBEMs, both entities alluded to droughts, floods and changes in temperature affecting their businesses. As already mentioned, climate change effects on farmers also impact IBEM's sales. Further, regarding farmers' mitigation measures for these effects, they mentioned several instances (see Table 9).

Table 9: Farmers' mitigation measures for climate change effects

Mitigation measure	Farmer FGD	IBEMs KII
Drought		
Improve furrows	x	
Integrated farming	x	x
Livelihood diversification		x
Dig new pond in alternative/appropriate location	x	
Good site selection	x	
Dig a well	x	
Drilling borehole		x
Afforestation		x
Plant drought-resistant crop varieties and fish species		x
Floods		
Construct a pond with a drainage pipe	x	
Pump out water	x	x
Temperatures		
Reduce water level to warm water.		x

Furthermore, concerning WorldFish's support in responding to these effects or taking steps towards climate change resilience, farmers and IBEMs alluded to two avenues. Both farmers and IBEMs alluded to WorldFish providing them with access to climate information (e.g., via radio) and engaging them in climate change adaptation training in specific areas, as presented in Table 10.

Table 10: Training of climate change adaptation strategies

Type or training	Farmers	IBEMs
General training on climate change	x	
Proper site selection	x	
Livelihood diversification	x	x
Integrated farming	x	

5.2.2. Small Holder Fish Farmers' Productivity

5.2.2.1. Number of Fingerlings Stocked Last Season

In aquaculture, the number of fingerings a farmer stocks can be critical for determining the productivity levels of that farmer for a particular season. Among farmers in the control districts, many (female=85/178 (48%); male=87/178 (49%) stocked less than 500 fingerlings in their last fish season (see Table 11).

Table 11: Number of Fingerlings Stocked Last Season

How many fingerlings did you stock?							
Sex/ District	**N**	**< 500**	**500 - 2000**	**2001 - 4000**	**4001 - 6000**	**> 6000**	**None**
Female Control	178	48%	27%	6%	2%	2%	15%
Female Treatment	322	44%	30%	8%	5%	3%	10%
Male Control	178	49%	29%	5%	2%	1%	14%
Male Treatment	322	44%	34%	7%	4%	2%	9%

On average, farmers in the treatment districts stocked above 500 fingerlings more than farmers in the control district. The results suggest that farmers in the two provinces stock between 501 and 2000 fingerlings per harvest season. Between the farmers in the treatment district, more female farmers mentioned stocking 2000 fingerlings and above compared to male farmers in the same district type. There is no evidence to suggest that female fish farmers have more fingerlings than men, as many of the female fish farmers in this study are married and, therefore, do their activities with their partners. Also, the indication that farmers in the treatment districts stock more fingers than farmers in the control district could result from several factors. It may be that farmers in the treatment district are less worried about finding markets for their harvest, having access to quality fingerlings and feed, or even having improved their ponds and holding more fish. None of these reasons justifies the results, but it could also be that farmers in the treatment districts are more willing to take on the risk of stocking more fingerlings. Considering that fingerlings can cost between K1-K3, another interpretation is that farmers in the treatment districts invest more in their farms, possibly because of the realised profitability in aquaculture.

5.2.2.2. Kilograms of Fish Harvested

In their last harvesting season, most farmers in the control and treatment districts harvested less than 500 kilograms of fish (see Table 12). Compared to the control districts, more female farmers (female=60/322 (19%); male 57/322 (18%)) in the treatment districts harvested between 100 and 300 Kg of fish. The percentage is the same for male and female farmers in control and treatment districts for fish harvests between 300 and 600 kg. Few farmers in the treatment districts harvested between 300 and 1000 Kg of fish. For some farmers, these measurements are guesses of estimations.

Table 12: Kilograms of Fish Harvested

How many kilograms of fish did you harvest?							
Sex/ District	**N**	**< 100**	**100 - 300**	**301 - 600**	**601 - 1000**	**> 1000**	**None**
Female Control	178	51%	15%	2%	1%	1%	30%
Female Treatment	322	46%	19%	2%	2%	0%	31%
Male Control	178	50%	13%	2%	3%	1%	31%
Male Treatment	322	48%	18%	2%	2%	0%	30%

Reflections from enumerators confirmed that many farmers in the treatment districts recorded their last harvest in kilograms using buckets to measure their harvests. Even though some farmers in the control districts also mentioned the number of buckets (in kg) of fish they harvested, only a handful recorded their

harvests. The high harvest recorded within the treatment districts could be credited to the WorldFish interventions, especially training on managing farms as a business.

5.2.2.3. Sales of Fish (in Kilograms)

As the kilograms of fish were harvested, most farmers in the control and treatment districts sold less than 100 Kg of fish from their last harvest. Interestingly, farmers in both the control and treatment districts sold between 100-300 Kg of fish from their last harvest (see Table 13).

Table 13: Sales of Fish (in Kilograms)

How many kilograms did you sell from the harvest?							
Sex/ District	**N**	**< 100**	**100 - 300**	**301 - 600**	**601 - 1000**	**> 1000**	**None**
Female Control	178	48%	15%	1%	1%	1%	34%
Female Treatment	322	49%	14%	3%	1%	0%	33%
Male Control	178	51%	11%	1%	3%	1%	34%
Male Treatment	322	48%	15%	2%	2%	0%	33%

The study compared male and female farmers in the treatment districts and found no significant difference in the kilograms of fish sold. The result could be interpreted to mean that more farmers continue to do partial harvest than full harvest. Farmers harvest their fish in stages rather than harvesting them at once, a situation also observed in the baseline census study. If so, it suggests that WorldFish interventions have not necessarily impacted farmers' behaviour in this regard. Nevertheless, it could also mean that farmers only harvest when they feel there is a market or need to raise income. Another interpretation from the result is that although there are off-taker markets accessible to farmers in the treatment districts, some farmers are yet to utilise this market and rather still sell fish in nearby markets as and when there is a demand for fish or a need for household income.

5.2.2.4. Sale of Fish (Kwacha per kilogram)

Most control and treatment district farmers mentioned that they did not sell their harvest from the last season. This result echoes the 2020 census findings that many fish farmers in the Luapula and Northern provinces often farm fish for consumption. Nevertheless, most farmers in the control districts who sold their harvest from last season sold a kilo of fish for less than ZK30, compared to farmers in the control districts, more farmers in the treatment districts sold 1 kg of fish above ZK31 (see Table 14).

Table 14: Sale of Fish (Zambian Kwacha per kilogram)

For how much did you sell 1 kg of fish from your last season's harvest?							
Sex/ District	**N**	**< ZK20**	**ZK21-K30**	**ZK31 – K50**	**> ZK50**	**I didn't sell**	**N/A**
Female Control	178	11%	24%	22%	2%	37%	3%
Female Treatment	322	4%	15%	29%	19%	30%	4%
Male Control	178	13%	21%	22%	4%	37%	4%
Male Treatment	322	3%	19%	30%	15%	29%	4%

The results also exhibit that farmers in the treatment district sell a kg of fish at a higher price than farmers in the control districts. It is, however, important to note that several factors account for the per kilo sale of fish. For example, the markets where farmers sell their fish, to whom they sell the fish (family and friends), and the availability of competitors (other fish farmers selling them in the same market) all determine the per kg of fish in kwacha. The one possible explanation for the result of more treatment district farmers selling a kilogram of fish at higher prices could be the existence of off-takers market linkages established

through WorldFish intervention in these areas. The study also found that most farmers in the control district practice early harvesting, which means they harvest their fish early without waiting for the fish to grow bigger. They also harvest several times within a season. This makes it easier for the farmers to sell their fish in the local markets at prices affordable to buyers. This practice helps the farmers to avoid raising bigger fish. This is because bigger fish often do not get buyers in local markets. After all, not all people can afford them. However, the treatment district situation may differ since farmers can access off-takers who often prefer to buy bigger fish.

5.2.2.5. Fish Farmers' Monthly Income

In both treatment and control districts, more female respondents mentioned higher household monthly incomes than men. The majority of respondents in the control districts (female=83%, male=81%) estimated a monthly household income of up to ZK1000 compared to farmers in treatment districts (female=75%; male=74%) who estimated the same income levels (see Table 15). However, more farmers in the treatment districts (female=25%; male=24%) received the highest percentages of household income above ZK1000 per month.

Table 15: Fish Farmers' Monthly Income

What is your estimated household income per month?							
Sex/ District	**N**	**< ZK500**	**ZK500 - ZK1000**	**ZK1001 – 3000**	**ZK3001 – K5000**	**> ZK5000**	**None**
Female Control	178	50%	33%	11%	4%	2%	1%
Female Treatment	322	43%	32%	14%	5%	6%	1%
Male Control	178	51%	30%	12%	3%	2%	1%
Male Treatment	322	43%	31%	14%	4%	6%	2%

The results show no huge difference in farmers' incomes in the treatment and control districts, only that a few farmer households in the treatment districts receive higher monthly incomes than those in the control districts. Overall, the evaluation found that farmers in the treatment districts are ahead of their colleague farmers in the control district regarding the number of stocked fingerlings and monthly incomes

5.2.2.6. SME's Businesses and Operations

Another group of stakeholders involved in this evaluation are Small and Medium Enterprises (SMEs) owners who were part of the IBEM project. These SME owners include hatchery and feed operators (including agro-dealers). Key informant interviews with the IBEM-targeted SMEs highlighted observed impacts.

In all seven interviews with hatchery and feed operators, they indicated growth in their business. For many of these business owners, the linkages between them and more prominent companies by WorldFish have facilitated easy and direct access to aquaculture inputs such as feed. It has also led to these operators expanding their customer base by mobilising farmers in their districts, ultimately expanding their businesses.

> *"It has grown since 1996. We have more partners now (Musika, WF) for technical assistance and business linkages [for inputs], and we have also upgraded to limited company,"*
> *– Seketani ADSEK Enterprises (agro-dealer), Mansa*

Also, the results found that WorldFish interventions have directly impacted the businesses of the targeted feed and hatchery operators concerning increased products. For instance, the hatchery operators were provided support in the form of brooder stocks, which these operators then used to raise fingerlings for

farmers within their catchment areas. Such support, as the evaluation found, has led to expansion in the production and operations of hatchery operators. In the words of a hatchery operator;

> *"We have expanded on the number of ponds we have: in 2017 (1 pond), 2018 (3 ponds), 2019 (5 ponds), 2020 (7 ponds) and 2021 (8 Ponds) though 1 pond is dry. We are also stocking different species like mpendwe and pale. We offer more variety, meaning we have more chances to capture sales," - Zulu Silken enterprise (hatchery operator), Samfya.*

Again, for all these operators targeted through interventions in the treatment districts, WorldFish provided them with training on several aspects of their businesses and aquaculture. These pieces of training have exposed these business operators to basic business management practices, which have become valuable for sustaining and expanding their businesses.

> *"Before I was doing business without feasibility studies. But with training, now I do feasibility before I do any business. This helps me to make a profit," Mulenga Kasakalabwe (agro dealer), Kasama*

The quotation above exemplifies the impacts that these operators have witnessed since engaging with WorldFish. Most importantly, it highlights operators' increased knowledge on diversifying their businesses to only productive aquaculture ventures.

5.2.2.7. SME Owners' Gender Attitudes

Another area where this evaluation recorded impact was feed and hatchery operators' attitudes toward gender. First, the business operators, especially the female operators, mentioned that they had become mentors for female farmers in their districts of operation. Despite the increase and acceptance of fish farming in these two provinces, some women are still reluctant to participate in fish farming. For these women, seeing their fellow women engaging in aquaculture ventures becomes visible evidence of the benefits that can be derived from fish farming.

> *"As for women, I encourage them more. I tell them I am a woman, and I am doing this business so they should also get active," Agro-deale, Mporokoso.*

Furthermore, SMEs mentioned the changes in their operations due to the training. One area of attitudinal change is where they intentionally include more women in their client base. The results showed that WorldFish had trained the operators to encourage more women and women groups in fish farming. They do this by forming women fish farmer groups, engaging with customers as a couple for women to benefit from training and information sharing, and dismantling the gender role myth surrounding fish farming.

> *"We are providing women with more knowledge through Women's groups formation," Musonda Smart-agro (agro-dealer), Kawambwa*

The hatchery and feed operators involved in this evaluation were also asked to assess the extent to which WorldFish interventions have contributed to the changes they have observed in their operations. The results revealed that 5 out of the seven respondents attributed an average of over 75% of their perceived changes in their business operations to WorldFish interventions. The major impacting factors mentioned were knowledge acquisition and linkages that the interventions provided.

5.2.3. Discussion

WorldFish targeted women directly, and through IBEMs, this has improved female access to certain productive resources and fostered more female participation in fish farming. IBEMs have been motivated to engage with female fish farmers more strategically through the WorldFish interventions. The IBEMs intimated that their approach to female farmer engagement changed along these lines: (1) taking more time to explain products to women who are often less informed; (2) encouraging the formation of women's groups; (3) actively engaging with women's groups during sales activities; (4) engaging with customers as a couple considering men have more control over household/family enterprises income; and for female IBEMs in particular (5) presenting themselves as role models to encourage and motivate other women to engage in or expand their fish -related businesses (farming, hatchery operation etc.). Five of the seven IBEMs interviewed attributed 75% of their observed changes to WorldFish interventions. More importantly, the strategic changes indirectly, excluding points '2' and '5', impact the increase in female participation or productivity in fish farming.

Additionally, WorldFish's gender inclusion model sought to enable the cultivation of female role models in the aquaculture value chain system in rural communities. Women who gained access to ponds stocked them and acquired feed. They emerged as role models in their community. Some women were cited as encouraging other women and even men to engage in fish farming. According to farmers, it is through these women that community members see that women can engage in what is considered a man's domain, and they have also seen the financial and other (nutritional) benefits of fish farming. Although female and male community members are encouraged by these role models, men are motivated by the perspective that women could not do better than them, while women are encouraged to accrue the same financial and other benefits of fish farming as these exemplary farmers.

It also emerged from the FGDs that negative perspectives are associated with women in the position of female role models who were financially stable (high-earning) in the community. Women strongly expressed this negative association. The role models were perceived as proud, boastful, pompous and disrespectful. Men, specifically, intimated that men married to these role models were seen as useless and failing to head their households. To most of these discussants, "successful" women still have to submit to their partners per cultural dictates. Thus, both men and women mentioned that there were likely conflicts in households where women were (more) financially successful. The study found that the idea of a successful woman who becomes a role model to other women (empowered) is not frowned upon or disregarded as long as the person shows additional qualities such as respect and humility and is not boastful in her household and relationship.

Overall, regarding climate resilience and productivity, the findings indicate some degree of influence of WorldFish interventions on fish farming among farmers in districts where these interventions were implemented. On climate resilience, the study showed that most farmers in the treatment districts are aware of different resilience strategies compared to farmers in districts where no WorldFish interventions have been implemented, especially regarding integrated aquaculture and improved pond construction. On gender, no significant difference was observed between male and female farmers in the treatment districts regarding the level of awareness and practice of climate resilience strategies. These findings suggest gender equality among farmers in the treatment districts regarding accessing and practising climate resilience information and strategies. Farmers in the treatment districts recorded a relatively higher productivity level than farmers in the control districts. It also showed that farmers in the treatment district

harvested and sold higher kilograms of fish in the last season. Meanwhile, despite having access to offtake markets, the study found that many farmers are yet to fully utilise offtake markets as they still sell in local markets. However, 1kg of most fish from the treatment districts was sold for higher prices (above ZK31) than most fish harvested in the control district (less than ZK30). Also, the study did not find significant income differences between farmers in the control and treatment districts.

The study also shows WorldFish interventions had influenced feed and hatchery operators' behaviour, businesses and activities in the treatment district. Besides increasing the number of these operators in the targeted districts, linking these farmers to larger firms, providing training, and supporting them with product subsidies have improved these businesses. The findings show increased businesses and products, the inclusion of more female farmers and a change in mind-set on gender roles in aquaculture. It is thus the position of this evaluation that by targeting couples for training, encouraging women to form farmer groups and enabling women to serve as role models for women and men in aquaculture.

5.2.4. Fish Farmer Life Story

Sylen Mwelwa - 37 years
(Fish farmer, trader and treasurer of Yasakwa Fish Farmers Group in Kawambwa District)

Sylen grew up in the Kwakele community, where she still lives today. She grew up in a household where her male siblings were also involved in cooking and cleaning because she was the only female and the youngest. She is of the view that nowadays, things have changed. Both her female and male children (three in total) need to be involved in all kinds of domestic chores or roles in the family, whether they are traditionally assigned to women or men. She takes this perspective with the view that marriage does not secure a woman's future – considering the future is uncertain, and a woman can end up widowed.

Regarding her business, Sylen says she has always wanted to be independent and have the means to support her family. She started her business at a very young age. More specifically, she had a small garden growing up to make some money to contribute to her school requirements. As part of her business interests, she always wanted to be a farmer, and this was because farmers always had money. Unlike employed people, they do not have to wait for payday to access money and are, thus, never broke. Though Sylen only has a Grade 12 level of education, as a result of limited finances, she runs a lucrative business. She is not only a fish farmer but also a trader. She trades in dried fish, tomatoes, maize and rice aside from selling fresh fish from her pond even when there is a fish ban. She believes that fish farming has improved her family's cash flow as she always has fish in stock for sale aside for nourishing her family. The income she and her husband earn from fish farming is used to pay school fees and is invested in farming beyond aquaculture. She hopes to use the funds from all her business ventures to build a house and buy quality chairs for her lounge.

Even though she intimates her fish farming business is doing well, she points out that pond digging and lack of capital hinder women from participating in fish farming. Therefore, they need to be empowered in this manner to take on income-generating activities and livelihood. She further states that women are often less likely to get a loan as they are unsure how they will pay back, unlike their male contemporaries.

Aside from being a business person, Sylen is also the treasurer of a fish farmers' group. She does not believe she was chosen for this position because she is a woman. Still, she does put across that there are notions that women are considered more trustworthy in society.

PART 4B

TESTING GENDERED IMPACT HYPOTHESIS

6. AVERAGE TREATMENT EFFECT (ATE) PROPENSITY SCORE MATCHING

In section 1, the results showed enhanced gender equality among fish farmers in the treatment districts. Yet, the previous section did not answer whether WorldFish interventions have impacted women's access and control over resources and women's empowerment. In this section, the results from testing the1.4. Evaluation Hypothesis are presented.

The study used the nearest neighbourhood propensity score matching to test twelve hypotheses. The study used one-to-one and two-to-one nearest neighbourhood matching and compared it with Inverse Probability Weighting (IPW) propensity score matching results. The average treatment effects indicate the amount of change (either negative or positive) that an intervention impacts on those who received the intervention compared with those with similar background characteristics who did not participate. The control or matching variables selected for the hypotheses were land size, age of head of the household, proportion of females in the household, age difference between men and women in the household, average income of the household, distance to market, and number of children under-five years in the household. It also included household ownership of the following assets: large livestock (cows, buffalos), small livestock (sheep, goats, pigs), poultry, cell phone, non-mechanized farm equipment, non-farm business equipment, house or building, large consumer durables, small consumer durables, means of transport. The treatment variable showed whether or not a person received the intervention. The result of the tests is summarized in Table 16, Table 17, and Table 18.

Table 16: Nearest Neighbourhood Matching 1:1 (ATE) Test Results

Hypothesis (treatment versus control)		Coeffi cient	AI robust std. err.	z	P>|z|	[95% conf. interval]	
Likelihood that wife is involved in aquaculture (has fish-pond of her own or owns it jointly with husband) and is also involved in decision-making	Y1	0.003	0.047	0.070	0.946	-0.090	0.096
Likelihood of women's involvement either solely or jointly in control over the productive resources for aquaculture	Y2	-0.054	0.025	-2.130	0.034	-0.104	-0.004
Likelihood of women's involvement either solely or jointly in ownership of land for fish pond construction.	Y3	-0.071	0.056	-1.270	0.204	-0.181	0.039
Likelihood of women's involvement either solely or jointly in access to information on aquaculture.	Y4	0.381	0.036	10.600	0.001	0.310	0.451
Intra-household gender difference in awareness of climate-smart practices	Y5	0.028	0.043	0.660	0.512	-0.056	0.113
Intra-household gender difference in knowledge of climate-smart practices	Y6	0.185	0.035	5.240	0.001	0.116	0.254
Intra-household gender difference in adoption of climate-smart practices technology climate resilient practices	Y7	0.050	0.042	1.180	0.236	-0.033	0.132
Likelihood of women's involvement either solely or jointly in aquaculture decision-making	Y8	0.058	0.041	1.430	0.153	-0.022	0.138
Likelihood of women controlling income from aquaculture activities	Y9	-0.030	0.041	-0.730	0.466	-0.111	0.051
Women empowerment and change in men's attitudes as a result of the interventions.	Y10	-0.004	0.043	-0.090	0.930	-0.087	0.080
IDDS (difference between husband and wife)	Y11	-0.025	0.047	-0.540	0.586	-0.117	0.066
IFIAS (difference between husband and wife)	Y12	-0.098	0.050	-1.940	0.053	-0.197	0.001

6.1. Gender Impact Assessment of WorldFish Interventions

1. Given the control variables and the intervention, the hypothesis that wives have gotten involved in aquaculture and decision-making is false. This implies that compared with those who did not receive the intervention, the intervention has not made a significant effect in making more wives own fish-pond of their own or jointly own fish-pond with their husbands. The coefficient of 0.003 indicates that wives are more involved in aquaculture from the intervention than the women not participating.
2. The test results in Table 16 showed that 0.054 fewer women participating in the intervention than those not participating were likely to control productive resources solely or jointly for aquaculture.
3. Regarding the likelihood of women's involvement either solely or jointly in land ownership for fish-pond construction, the results from the hypothesis test indicated that 0.071 less of the women participating in the intervention relative to those not participating were likely to solely or jointly own land for fish-pond construction. However, this number does not statistically show a significant difference between the women in the intervention and those not participating in the intervention.
4. The test results from Table 16 showed that 0.381 more women participating in the intervention either solely or jointly have access to information on aquaculture than their counterparts who are not participating in the intervention. This implies that the intervention significantly impacts women's access to information on aquaculture.
5. On the intra-household gender difference in awareness of climate-smart practices, the test results showed no significant gender differences in the households where women participated in the intervention and the other households where women did not participate. However, there were 0.028 more women in the intervention than those not participating, showing gender differences in their households on awareness of climate-smart practices.
6. Considering the intra-household gender difference in knowledge of climate-smart practices, the test results indicated that there are no significant gender differences in the households where women are participating in the intervention and households where women do not take part in the intervention.
7. Table 16 again showed no significant intra-household gender differences in adopting climate-smart practices and technology, and climate-resilient practices between households with women participating in the intervention and those with women not participating.
8. The hypothesis test for the likelihood of women's involvement either solely or jointly in aquaculture decision-making shows no significant difference between women involved in the intervention and their counterparts who are not involved in the intervention. The results indicated that 0.058 more women in the intervention are involved either solely or jointly in aquaculture decision-making.
9. The hypothesis results on the likelihood of women controlling income from aquaculture activities indicated no significant difference between women involved in the intervention and their counterparts. There are 0.03 fewer women in the intervention to control income from aquaculture than those who are not in the intervention.
10. Considering women's empowerment and change in men's attitudes as a result of the intervention, the hypothesis test results showed no significant change in women's empowerment and change in men's attitudes given the control variables and the intervention.
11. According to the results in Table 16, there was no significant difference between husbands and wives regarding the Intra-household Diet Diversity Scale (IDDS) and the Intra-household Food Insecurity Access Scale (IFIAS) households with wives involved in the intervention and the households with wives not participating in the intervention.

These results in Table 16 were obtained from the propensity score matching tests of the Average Treatment Effect on the entire population using a 1:1 nearest neighbourhood match. From Table 16, three (3) out of twelve (12) hypotheses showed a significant difference between those participating in the intervention and

their other counterparts. These are the likelihood of women's involvement either solely or jointly in control over the productive resources for aquaculture, the likelihood of women's involvement either solely or jointly in access to information on aquaculture and the intra-household gender difference in knowledge of climate-smart practices.

Furthermore, we conducted a 2:1 nearest neighbourhood propensity score match of the Average Treatment Effect on the entire population. The results from using a 2:1 nearest neighbourhood propensity score match are presented in Table 17 below.

Table 17: Nearest Neighbourhood Matching 2:1 (ATE) Test Results

Hypothesis (treatment versus control)		Coefficient	AI robust std. err.	z	P>|z|	[95% conf. interval]	
Likelihood that wife is involved in aquaculture (has fishpond of her own or owns it jointly with husband) and is also involved in decision-making	Y1	0.013	0.046	0.270	0.786	-0.078	0.104
Likelihood of women's involvement either solely or jointly in control over the productive resources for aquaculture	Y2	-0.042	0.027	-1.530	0.125	-0.096	0.012
Likelihood of women's involvement either solely or jointly in ownership of land for fish pond construction.	Y3	-0.033	0.049	-0.670	0.502	-0.129	0.063
Likelihood of women's involvement either solely or jointly in access to information on aquaculture.	Y4	0.401	0.034	11.790	0.001	0.334	0.468
Intra-household gender difference in awareness of climate-smart practices	Y5	0.011	0.042	0.270	0.788	-0.071	0.093
Intra-household gender difference in knowledge of climate-smart practices	Y6	0.183	0.033	5.610	0.001	0.119	0.247
Intra-household gender difference in adoption of climate-smart practices technology climate resilient practices	Y7	0.045	0.040	1.110	0.266	-0.034	0.123
Likelihood of women's involvement either solely or jointly in aquaculture decision-making	Y8	0.041	0.038	1.070	0.284	-0.034	0.115
Likelihood of women controlling income from aquaculture activities	Y9	-0.013	0.039	-0.330	0.745	-0.089	0.064
Women empowerment and change in men's attitudes as a result of the interventions.	Y10	-0.021	0.041	-0.520	0.600	-0.101	0.059
IDDS (difference between husband and wife)	Y11	-0.036	0.045	-0.800	0.427	-0.125	0.053
IFIAS (difference between husband and wife)	Y12	-0.057	0.044	-1.290	0.197	-0.143	0.030

The results from Table 17 shows that two (2) out of twelve (12) of the hypothesis tested indicated a significant difference between the farmers in the treatment districts and farmers in the control districts. These two hypotheses are among the three hypotheses that showed significant differences using the 1:1 nearest neighbourhood propensity score matching of the average treatment effect on the entire population. The two hypotheses are the likelihood of women's involvement either solely or jointly in access to information on aquaculture and the intra-household gender difference in knowledge of climate-smart practices.

Apart from the two nearest neighbourhood propensity score matching methods used to test for the various hypotheses, the study considered using the Inverse Probability Weight (IPW) Probit Model propensity score matching (non-constant) method to compare the results. The IPW method also used the Average Treatment Effect (ATE) on the entire population. The results obtained from this method are presented in Table 18.

Table 18: Inverse Probability Weight (Probit Non-constant) Model Results (ATE)

Hypothesis (treatment versus control)		Coefficient	AI robust std. err.	z	P>|z|	[95% conf. interval]	
Likelihood that wife is involved in aquaculture (has fish-pond of her own or owns it jointly with husband) and is also involved in decision-making	Y1	-0.021	0.041	-0.520	0.604	-0.101	0.059
Likelihood of women's involvement either solely or jointly in control over the productive resources for aquaculture	Y2	-0.037	0.024	-1.550	0.122	-0.083	0.010
Likelihood of women's involvement either solely or jointly in ownership of land for fish pond construction.	Y3	-0.039	0.041	-0.950	0.344	-0.119	0.041
Likelihood of women's involvement either solely or jointly in access to information on aquaculture.	Y4	0.387	0.035	10.990	0.000	0.318	0.456
Intra-household gender difference in awareness of climate-smart practices	Y5	0.012	0.038	0.320	0.751	-0.062	0.086
Intra-household gender difference in knowledge of climate-smart practices	Y6	0.192	0.032	5.920	0.000	0.128	0.255
Intra-household gender difference in adoption of climate-smart practices technology climate resilient practices	Y7	0.046	0.037	1.230	0.218	-0.027	0.119
Likelihood of women's involvement either solely or jointly in aquaculture decision-making	Y8	0.049	0.036	1.340	0.180	-0.022	0.120
Likelihood of women controlling income from aquaculture activities	Y9	-0.012	0.038	-0.310	0.759	-0.086	0.062
Women empowerment and change in men's attitudes as a result of the interventions.	Y10	-0.020	0.038	-0.520	0.605	-0.094	0.055
IDDS (difference between husband and wife)	Y11	-0.022	0.040	-0.550	0.580	-0.101	0.057
IFIAS (difference between husband and wife)	Y12	-0.038	0.043	-0.890	0.374	-0.123	0.046

The results obtained from the IPW Model propensity score matching, as presented in Table 18, also indicate that two (2) out of the twelve hypotheses showed a significant difference between those receiving the intervention and those not participating in the intervention.
These two hypotheses (likelihood of women's involvement either solely or jointly in access to information on aquaculture and intra-household gender difference in knowledge of climate-smart practices) are the same as those that showed significant differences between the two groups of the population using the nearest neighbourhood propensity score matching methods.

Overall, the results from the analysis indicated significant differences between farmers in the treatment district and those in the control district regarding women's involvement either solely or jointly in access to information on aquaculture, women's involvement either solely or jointly in control over the productive resources for aquaculture and the intra-household gender difference in knowledge of climate-smart practices.

PART 4C

GENDER IMPACT ANALYSIS ON EMPOWERMENT

This section of the report presents the results of the extensive analysis of the evaluation data against the Pro-WEAI indicators (Table 19) and their corresponding effects on farmers in the treatment and control districts.

7.1. Pro-WEAI indicators

7.1.1 Input in livelihood decisions

The indicator *Input in livelihood decisions* is constructed based on questions related to the participation of respondents in certain types of work activities and in making decisions on various aspects of household life. An example of the activity is staple grain farming and processing of the harvest, which refers to grains grown primarily for food consumption (rice, maize, wheat, millet).

7.1.2. Ownership of land and other assets

The indicator *Ownership of land and other assets* measures the possession of land cultivated by households and other assets such as large livestock (cattle, buffaloes) and small livestock (sheep, goats, pigs).

7.1.3. Access to and decisions on credit

The indicator *Access to and decisions on credit* measures the household's experience with borrowing money or other items (in-kind) in the past 12 months from a formal lender (bank/financial institution), etc.

7.1.4. Control over use of income

The indicator *Control over use of income* measures how much input the respondents have in decisions about how much of the output to keep for consumption at home rather than selling.

7.1.5. Autonomy in income

The indicator *Autonomy in income* measures the autonomy in decision-making regarding the use of income generated from agricultural and non-agricultural activities.

7.1.6. Group membership

The indicator *Group membership* measures the participation of the respondents in group activities in the community. These can be either formal or informal and customary groups.

7.1.7. Visiting important locations

The indicator *Visiting important location*s measures how often the respondents go to a public village gathering/community meeting/training for NGOs or programs.

7.1.8. Attitudes towards domestic violence

The indicator *Attitudes towards domestic violence* measures the respondent's opinion on domestic violence issues. For example, in your opinion, is a husband justified in hitting or beating his wife in the following situations if she goes out without telling him?

7.1.9. Self-efficacy

Self-efficacy indicates the respondent's self-efficacy on certain issues, for example, when facing difficult tasks.

7.1.10. Work balance

The indicator *Work balance* measures the respondent's time spent on activities and childcare.

Table 19: Pro-WEAI indicators by intervention groups

PRO-WEAI INDICATORS			
Indicators	**Treatment**	**Control**	**Z**
Indicator 1: Input in livelihood decisions			
% of participants reporting that they have an input in the livelihood decisions	86%	70%	6.1822***
Indicator 2: Ownership of land and other assets			
% of participants reporting that they own land or other assets	95%	92%	1.9047**
Indicator 3: Access to and decisions on credit			
% of participants reporting that they have access to and decision on credit	87%	88%	-0.31
Indicator 4: Control over the use of income			
% of participants reporting that they have control over the use of income	78%	59%	6.4884***
Indicator 5: Autonomy in income			
% of participants reporting autonomy in income	60%	59%	0.09
Indicator 6: Group membership			
% of participants reporting that they belong and are active members of a group	75%	71%	1.2269*
Indicator 7: Visiting important locations			
% of participants reporting visiting important locations	82%	78%	1.2518*
Indicator 8: Attitudes about domestic violence			
% of participants reporting a positive attitude toward domestic violence	72%	70%	0.94
Indicator 9: Self-efficacy			
% of participants reporting having a positive attitude about self-efficacity.	81%	77%	1.5246*
Indicator 10: Work balance			
% of participants reported having spent time on activities and child care.	92%	96%	-2.4486**

*Note: *p**p***p<0.001*

7.2. Model: Propensity score matching (PSM)

The PSM is a widely used approach to estimate the causal effect of public policies in various settings. This method is particularly useful in the absence of appropriate instrumental variables. The PMS technique's general idea is to determine a comparison group from a sample of non-participants that 'resembles' the participants based on the observable characteristics. The large sample size of our data supports the use of this approach (Rosenbaum & Rubin 1985). The PMS technique depends on the conditional independence hypothesis, according to which the observed results are independent of the participation in treatment, participation conditional on certain observable characteristics. We then reduce the impact of the treatment on the processes:

$$\mathbf{E\,(Y1\,|D\,=\,1)\,-\,E\,(Y0\,|D\,=\,0)\,=\,ATT}$$

Rosenbaum and Rubin (1985) clearly show that if the assumption of conditional independence is valid, then rather than conditioning on the observable characteristics, it is preferable to condition on the propensity score Prob(X) with:

$$\mathbf{Prob(X)\,=\,Prob\,\{D\,=\,1|X\}}$$

Prob(X) represents the probability of receiving the treatment. The probability is conditional on a set of observable characteristics X. The propensity score is the one-dimensional summary of all the observed characteristics. In practice, propensity scores are obtained by the probabilities provided by a quantitative model with a binary choice (Logit or Probit), explaining the outcome of participating in a program with a large number of observable features. In our case, this is a binary probit model, with a binary variable equal to one (1) if the respondents participated in the programme and zero (0) if they did not. The quality of the propensity score technique depends on the robustness of the propensity scores, i.e., the capacity of the model to consider all the factors determining eligibility.

In our case, we use the PSM technique to measure the impact of the intervention on empowerment based on the pro-WEAI three indicators (Input in livelihood decisions, Ownership of land and other assets and Control over use of income). The variable representing our treatment variable takes the values '1' if the respondent participates in the intervention and '0' if not. Those three indicators taken separately are our outcome variable. The general rationale is that PSM finds people with similar properties in a treatment and non-treatment group and computes their difference in outcome to measure the effect. We computed the propensity score using the following covariates: Age, Gender, Distance to market, Proportion of HH members who are female, Number of children, Own large livestock (cows, buffalos), Own small-large livestock (cows, buffalos), Own poultry, Cell phone, Non-farm business equipment, House or building, Large consumer durables (refrigerator, TV, sofa), Small consumer durables (radio, cookware), Means of transport (motorbike, bicycle or motorcar). The result shows a significant and positive treatment effect on the two different outcomes (Input in livelihood decisions, Control over use of income) on the treated group and no significant impact on the Ownership of land and other assets. This implies that WorldFish intervention increases empowerment indicators Input in livelihood decisions and control over the use of income by .15 and .18 units, respectively, in Table 20, Table 21 and Table 22.

Table 20: Impact of the Intervention on Input in Livelihood Decisions

		AI Robust				
ATT	**Coef.**	**Std. Err.**	**z**	**P>z**	**[95 Conf.**	**Interval]**
Intervention						
(1 vs 0)	.150079	.0364465	4.12	0.000	.0786451	.2215129

Table 21: Impact of the Intervention on Ownership of Land and Other Assets

		AI Robust				
ATT	**Coef.**	**Std. Err.**	**z**	**P>z**	**[95 Conf.**	**Interval]**
Intervention						
(1 vs 0)	.033437	.0216004	1.55	0.122	-.0088989	.0757729

Table 22: Impact of the Intervention on Control over the Use of Income

		AI Robust				
ATT	**Coef.**	**Std. Err.**	**z**	**P>z**	**[95 Conf.**	**Interval]**
Intervention						
(1 vs 0)	.1808847	.0421163	4.29	0.000	.0983383	.2634311

7.3. Gender Equality and Empowerment Based on Pro-WEAI

7.3.1. Pro-WEAI and GPI Scores

The results show a higher aggregate pro-WEAI score among women in the treatment districts (0.88) compared to women fish farmers in the control district (0.83) – (see Table 23). The proportion of women who were "empowered" was also high (65%) among farmers in the treatment districts, which means 35% of women in the treatment district are disempowered. Comparatively, the results showed that 58% of women in the control districts were empowered and 42% disempowered. This result puts women in the treatment district ahead of their counterparts in the control districts by 7% on the empowerment level.

Another important parameter is the Gender Parity Index (GPI), which also showed a slightly higher score of 0.95 among women farmers in the treatment districts against a 0.93 score in the control districts. Women achieving gender parity was only slightly higher, with 73% within the treatment districts in comparison to 72% in the control districts. Meanwhile, the 3DE scores showed only a difference of 5% between women in the treatment (0.87) and their colleagues in the control districts (0.82). Despite the increase among the treatment group, these scores are less than the 90% preferred by the pro-WEAI.

The GPI is particularly important in measuring gender equality. Although Pro-WEAI analysis puts greater emphasis (90%) on the 3DE, which represents the achievements of women in the sample across the 10 indicators of empowerment in pro-WEAI, it still recognizes the importance of gender equality as an aspect of empowerment. Thus, improvements in either the 3DE or GPI (a measure of gender equality) will increase the Pro-WEAI score. The average empowerment gap between women who did not achieve gender parity with the men in their households was also lower within the treatment group (0.17) than those in the control group (0.24). Generally, this result shows improvement among women fish farmers in the treatment districts than in the control districts.

Table 23: Pro-WEAI and GPI results

Indicator	Treatment		Control	
	Women	Men	Women	Men
Number of observations	322	322	178	178
3DE score	0.87	0.9	0.82	0.82
Empowerment score	0.8	0.82	0.76	0.76
% achieving empowerment	0.65	0.71	0.58	0.56
Mean 3DE score for not yet empowered	0.62	0.64	0.57	0.6
Gender Parity Index (GPI)	0.95		0.93	
Number of dual-adult households	311		169	
% achieving gender parity	0.73		0.72	
Average intra-household inequality score	0.02		0	
Empowerment gap	0.17		0.24	
Pro-WEAI	**0.88**		**0.83**	

7.3.2. Contributions of different indicators to disempowerment

In the treatment district, the three top indicators contributing to disempowerment were Ownership of land and other assets, Access to and decision on credit, Work balance and Visiting important locations (see Figure 13). In the control group, the largest contributors to disempowerment for women were the same as the result from the treatment group: Ownership of land and other assets, Access to and decision on credit, Work balance and Visiting important locations (see Figure 14).

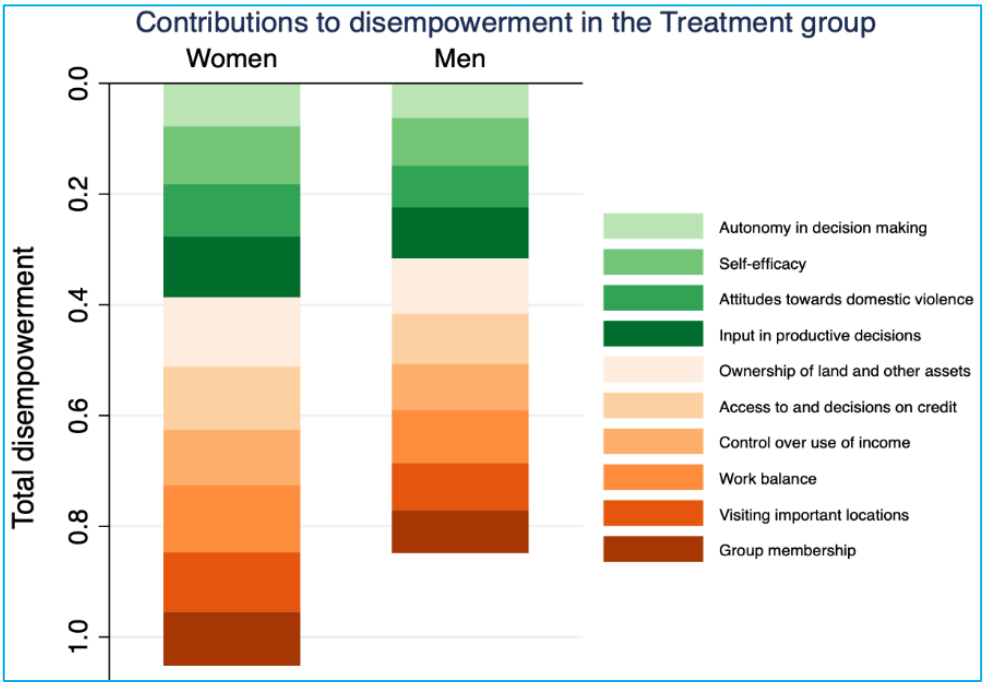

Figure 13: Contributors to women's disempowerment in the treatment group

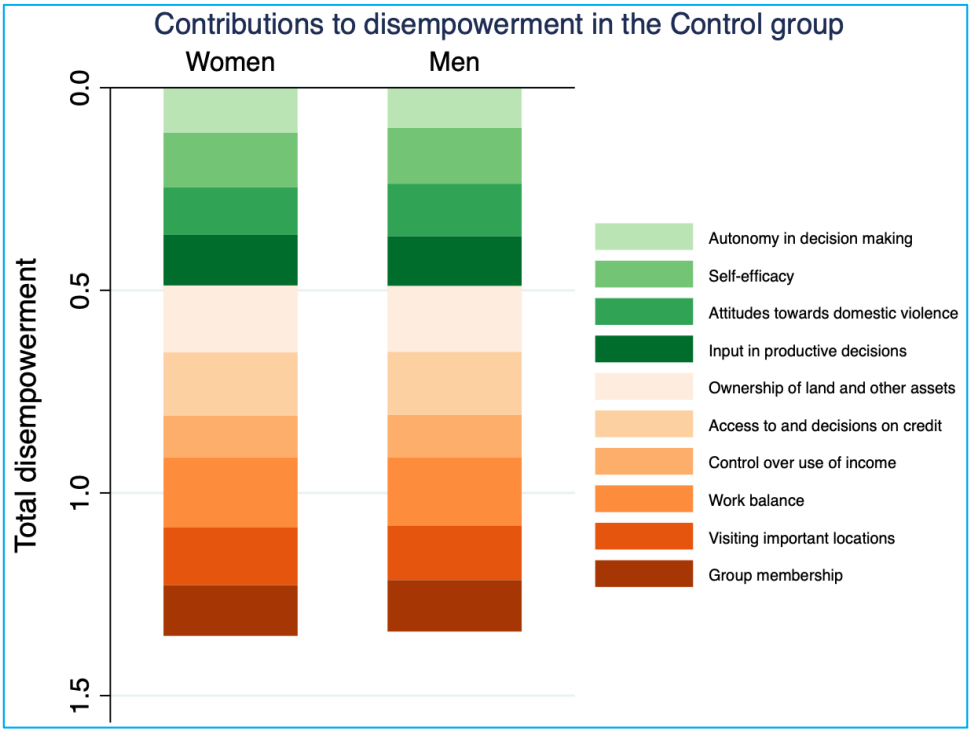

Figure 14: Contributors to women's disempowerment in the control group

8. CONCLUSION AND RECOMMENDATIONS

This impact evaluation examined the extent to which interventions implemented between 2018 and 2022 by WorldFish Zambia have enhanced the activities of fish farmers in seven targeted districts across Luapula and Northern provinces in Zambia. Specifically, the study assessed gender equality regarding access to information and resources for aquaculture, women empowerment, gendered access to climate information and practices among fish farmers and dietary intake within their households in the intervention districts. These results were then compared with fish farmers in districts where no WorldFish project was implemented. It also included small and medium size business owners supported in the treatment districts through WorldFish interventions. Two of the main projects implemented by WorldFish within the period under evaluation were the AQTEVET project and the IBEMs for smallholder fish farmers and poor value chain actors project.

A convergent mixed method design was used for data collection using quantitative (survey questionnaire) and qualitative (key informant interviews and focus group discussions) methods. Survey responses were collected separately and individually from a male and a female adult in each household. The evaluation data covers 322 households (made up of 644 respondents = 322 female and 322 male) in the districts where WorldFish interventions were implemented (treatment districts) and 178 households (made up of 356 respondents = 178 female and 178 male) from districts where no WorldFish intervention was implemented (control districts). Meanwhile, 9 focus group discussions were conducted among fish farmers in the treatment and control districts, and 7 key informant interviews were conducted with small and medium enterprise owners in the aquaculture industry within the treatment districts. In analysing the quantitative data, a descriptive analysis was drawn, followed by an impact analysis using Average Treatment Effect (Ate) Propensity Score Matching and a women empowerment analysis using the pro-Women in Agriculture Empowerment Index (pro-WEAI). The qualitative evaluation data were analysed using inductive coding approaches (ground-up), allowing narratives to emerge.

Over 70% of the farmers in those districts where WorldFish interventions were implemented (treatment districts) were found to have sustained access to critical input and output services due to the private sector-led Inclusive Business and Entrepreneurial Models (IBEMs) set up by the WorldFish projects.

Compared to farmers in districts where there were no WorldFish projects (control districts), farmers in the treatment districts have access to input and output resources such as quality fingerlings (female = 66%, male=70%), commercial feed (female = 59%, male=59%), on the farm extension services (female = 61%, male=62%), climate information services (female = 68%, male=62%) and off-take markets (female = 65%, male=60%) respectively. The findings show that for most households in both control and treatment districts, female farmers have the majority of access to these input and output services and resources. Specifically for the treatment districts, it was found that more female farmers mentioned having access to climate information (68%) and off-take markets (65%).

The types of training that were assessed included gender and social inclusion, pond construction, biosecurity, managing farms as a business, and integrated aquaculture and climate-smart aquaculture. The evaluation found that over 65% of the fish farmers in those districts where the WorldFish projects have been implemented have access to sustained training on aquaculture practices compared to the approximately 26% of the farmers in districts without WorldFish projects who mentioned ever having some training. The farmers in the treatment districts attributed their ability to access aquaculture training to

WorldFish, and WorldFish supported IBEMs, that continue to offer training to their clients/customers (fish farmers).

The evaluation found commendable training offered by WorldFish and IBEMs beneficiaries, targeting male and female adults in the same farmer households. Such activity contributed significantly to more women in the treatment districts accessing information and knowledge in integrated farming (69%), managing farms as businesses (69%), gender and social inclusion (66%), and biosecurity (62%) compared to their male colleagues. Farmers in the control districts who mentioned having received the above training indicated receiving it through radio programmes and some through GIZ projects in their districts. Based on these results, the evaluation concludes that the WorldFish projects in the treatment districts have enhanced gender-equal access and control over resources, technology, and information among smallholder farmers.

Five CSA strategies were accessed (integrated aquaculture with crops on the plots you manage, integrated aquaculture with livestock, improved pond construction, water harvesting, and improved grain storage). The results revealed that mong male and female farmers in the treatment districts, the average positive response of female farmers to awareness of climate resilience strategies was 73% compared to male farmers' average of 71% awareness. It means (2%) more female farmers in the treatment districts have received information and are aware of climate resilience strategies for aquaculture than male farmers.

On the use of CSA strategies, the result shows that more fish farmers (average of 52%) in the treatment districts are practising the tested strategies than fish farmers in the control districts (average of 38%). It was also evident that female fish farmers in the treatment districts scored higher (average 52%) on all the evaluated strategies than their male partners (average 51%).

The most practised climate strategy among the farmers is integrated aquaculture with crops. In contrast, the less used strategy was improved grain storage. More than 50% of the total 644 farmers from the treatment districts are practising more climate resilience strategies (integrated aquaculture with crops/livestock, improved pond construction). The evaluation found that the difference between farmers in the control and treatment districts on the adoption of climate strategies is that while many farmers in the control districts did not know they were practising climate strategies, farmers in the treatment districts were conscious of these strategies and had invested time and resources to adapt these approaches due to the training they have received. Notably, the provision of training manuals and books by WorldFish was found to have played a critical role in sustaining these adopted practices, as more female farmers mentioned using these materials even for those who could not attend the offered training. Likewise, the study found that the on-the-farm and home extension services promoted climate resilience strategy adaptation within the treatment districts.

WorldFish interventions of linking feed and hatchery operators to larger aquaculture firms, providing them with training, and supporting them with product subsidies were found to have contributed immensely to the improved operations of IBEMs beneficiaries in the targeted districts. The findings show increased agro-businesses that deal in aquaculture products, increased female entrepreneurs and farmers and a change in mindset on gender roles as significant impacts of WorldFish projects in aquaculture in the treatment districts. Still, drought, flooding, and lack of access to finance are challenges facing both farmers and SME operators.

On average, 46% of farmers in the treatment districts stocked above 500 fingerlings compared to the number of farmers (37%) who stocked 500 fingerlings and more in the control district. Most farmers in both district types stocked their ponds with less than 201 fingerlings.

Compared to the control districts, more farmers (female=60/322 (19%); male 57/322 (18%)) in the treatment districts harvested between 100 and 300 Kg of fish. The percentage is the same for male and female farmers in control and treatment districts for fish harvests between 300 and 600 kg. Few farmers in the treatment districts harvested between 300 and 1000 Kg of fish. For some farmers, these measurements are guesses of estimations.

The evaluation found that many farmers in both control (female = 37%, male = 30%) and treatment (female = 30%, male = 29%) districts do not sell their harvested fish from the previous season. When it came to the sale per kilogram of fish, most farmers in the control districts (female = 11%, male = 13%) sold a kilo of fish for less than ZK30, while more farmers (female = 48%, male 45%) in the treatment districts sold 1 kg of fish above ZK31.

In both treatment and control districts, female respondents mentioned higher household monthly incomes than men. The majority of the respondents in the control districts (female=83%, male=81%) estimated a monthly household income of up to ZK1000 compared to farmers in treatment districts (female=75%; male=74%) with the same income levels. In addition, farmers in the treatment districts (female=25%; male=24%) received the highest percentages of household income above ZK1000 per month.

Based on the results, the evaluation found that the WorldFish interventions have promoted climate resilience and productivity of smallholders (especially women) within the treatment district.

Using an Average Treatment Effect (ATE) Propensity Score Matching, this evaluation further assessed the impact of WorldFish interventions on fish farmers in the two provinces. In doing so, the study tested eleven indicators. Out of the 11 indicators, the evaluation found that 3 showed significant differences between farmers in the treatment district and those in the control district. That is, the results indicated that WorldFish interventions in the two provinces had impacted 1) women's involvement either solely or jointly in access to information on aquaculture, 2) women's involvement either solely or jointly in control over the productive resources for aquaculture and 3) intra-household gender difference in knowledge of climate-smart practices. Examining the factors leading to the results from the ATE propensity score matching, the results show that the formation of women fish farmers groups, inclusive training modules, the realisation of profit and female role models, and general culture are among those factors that contribute to women's participation in the aquaculture value chain in the targeted region. Yet, existing gender roles and norms, the physical labour intensity of fish farming, and the financing issue limit equal gender participation within the industry. Specifically for the Intra-household Diet Diversity Scale (IDDS) and the Intra-household Food Insecurity Access Scale (IFIAS), the study found no significant difference between husbands and wives in households within the treatment and control districts.

Another rigorous analysis of the evaluation data examined the impact of WorldFish interventions on women empowerment among farmers in the treatment and control districts. Overall, results from three pro-WEAI indicators that relate directly to aquaculture practices found that more farmers in the treatment districts reported that they have input in livelihood decisions (treatment =86%, control = 70%), ownership of land and other assets (treatment =95%, control = 92%), and control over the use of income (treatment =78%, control = 59%). It also revealed a higher aggregate pro-WEAI score among women in the treatment districts

(0.88) compared to women fish farmers in the control district (0.83), meaning that more women in the treatment district were empowered. The proportion of empowered women is higher (65%) among farmers in the treatment districts than women in the control districts (58%). The average empowerment gap between women who did not achieve gender parity with the men in their households was lower in the treatment group (0.17) than in the control group (0.24). The findings suggest that the gap between female and male farmers in the treatment district is less than between female and male farmers in the control district. Within the treatment district, the three top indicators contributing to disempowerment were Ownership of land and other assets, Access to and decision on credit, Work balance and Visiting important locations.

In conclusion, it is the position of this evaluation that the hypotheses that WorldFish interventions have enhanced involvement of women in aquaculture, improved gender equality in access and control over resources, technology and information on aquaculture, enhanced gender equality in climate resilient practices (knowledge and adoption of CSA practices), and enhanced women's empowerment are acceptable. However, there was less evidence to support the hypothesis that there is improved gender equality in terms of benefits from food systems. Overall, the results show signs of the impact of WorldFish intervention on women empowerment among fish farmers in the districts where WorldFish operates, even though the difference in the empowerment score was less substantial compared to scores from districts where WorldFish is not operational.

This evaluation concludes that the two WorldFish projects have collectively enhanced gender-equal access and control over resources, technology, and information among smallholder farmers. The projects promoted climate resilience and the productivity of smallholders (especially women). Even so, the evaluation found that women fish farmers in the areas where WorldFish projects were implemented are empowered. However, the evaluation also found that despite focusing some of the project's activities on gender inclusiveness in the targeted districts, the impact of WorldFish interventions on gender equality in the aquaculture value chain has been minimal. Also, these interventions were too general in their scope to elicit women's empowerment without intentional activities that focused on the equitable distribution of resources and activities for women.

Based on the findings above, the study recommends the following.

1. WorldFish can successfully scale up its project interventions in the treatment district and, likewise, in the control districts and should do so by utilizing the findings of this study and other lessons learned from the two projects. This is because, despite the improved results, the findings also point to the fact that farmers in the two provinces still need similar interventions.
2. In similar future projects, WorldFish should adopt more rigorous and intentional gender empowerment tools and approaches that are useful for the specific contexts of Northern Zambia.
3. WorldFish should consider integrating future gender-responsive projects with other women empowerment projects by collaborating with different stakeholders who can support women or women groups with direct support, such as small loans and aquaculture tools and equipment.
4. Future and similar projects should highlight and adopt advocacy tools and approaches in activities towards achieving women's empowerment in aquaculture.

9. ANNEXES

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List of Documents Received

#	Type	Name of Document	Date Received
1	Pdf	Annex 3 The Seed Innovation Platform Workshop Proceedings in Zambia	23/09/2022
2		Annex 14 Brood stock Distribution List for Hatchery Operator IBEMs in Zambia	23/09/2022
3	Pdf	Annex 8 Innovation Platform Concept Paper	23/09/2022
4	Pdf	Annex 12 Mentoring and Coaching of Feed operators in Zambia	23/09/2022
5	Pdf	Annex 15 Hatchery Operator On-Farm Training, Mentorship and Coaching Report in Zambia	23/09/2022
6	Pdf	Annex 17 Hatchery Operator Training and Mentorship Report in Zambia	23/09/2022
7	Pdf	Annex 23 Review of aquafeed business models and the feed value chain in Zambia and Malawi	23/09/2022
8	Pdf	GESI Training for SMEs and Smallholder Farmers	23/09/2022
9	Pdf	BMP_Zambia_300921	23/09/2022
10	Pdf	Gender Relay (energizer activity outline)	23/09/2022
11	Pdf	Monitoring and Evaluation Plan_IBEMS	23/09/2022
12	Pdf	Handout 1 - Gender Quiz Relay	23/09/2022
13	MS Word	Annex 1-Revised Logframe Matrix-WorldFish_Nov2018	21/09/2022
14	Ms Word	Developing Impact Assessment Methodology	23/09/2022
15	Pdf	Annex 12 TEVET Project Smallholder Fish Farmers' Population Census Report	21/09/2022
16	Ms Word	GIZ Revised Proposal-WorldFish_FINAL1072020 revised	21/09/2022
17	Ms Word	WorldFish_2018_FB3_81235254_Feedback_M+E_Response_20062022	21/09/2022

Fieldwork Schedule

Activity	Details	D 1	D 2	D 3	D4 – D13	D 14
Brainstorming and logistics session	The session with WorldFish staff will discuss the task and hand and finalised traveling and coordination arrangements	X				
Training of Enumerators	Training of Enumerators on sampling, the data collection, issues handling and data handling		X			
Allocation of sites and traveling to the project site	The enumerators will be assigned sites research authorisation documents and sample lists. The research team will travel to the project site			X		
Food and Accommodation	Daily lunch during data collection				X	
Transport and communication	Daily transport to and from the field				X	
Field visit 1-13	Data collection				X	
Data management	Uploading of offline data collected on server and recording number of daily entries per enumerator				X	
Error handling	Holding daily data collection briefs with enumerators on the progress and field experience				X	
Review and Closure	Review of data collection process and closure. Undertake administrative activities for enumerators and discuss transportation logistics					X
Transpiration to Lusaka	The evaluation field team will travel back to Lusaka					X

Evaluation Matrix

Impact What have been the positive and negative (intended and unintended) impacts of the WorldFish intervention on gender empowerment?				
Sub-questions	**Method**	**Indicator**	**Data Source**	**Analysis**
How has WorldFish interventions enhanced more gender access and control over resources, technology, and information among smallholder farmers?	Pro-WEAI survey	- Pro-WEAI indicators - Ownership of ponds - Access to input market - Access to aquaculture information - Participation in WF training	Fish farmers	Inferential statistical analysis (ISA)
	FGD			Content Analysis
	Case study		Fish farmers, SMEs owners	Narrative analysis
What factors contribute to enhancing or non-enhancing equal gender access and control over resources, technology, and information in the targeted communities?	Pro-WEAI survey	- Social/cultural factors - Environmental factors - Economic factors	Fish farmers	ISA
	FGD			Content Analysis
	Case study		Fish farmers, SMEs owners	Narrative analysis
To what extent are women's leadership improved in general and specifically in the context of food systems and climate resilience?	Pro-WEAI survey	- Pro-WEAI indicators - Women in leadership roles in food systems /cooperatives - Knowledge on climate resilient practices	Fish farmers	ISA
	FGD			Content Analysis
	Case study		Fish farmers, SMEs owners	Narrative analysis
	KII		Project staff, SMEs owners	Content Analysis
In what ways have WorldFish interventions encouraged more women participation in aquaculture (smallholder productivity) in the intervention areas?	Pro-WEAI survey	- Pro-WEAI indicators - Participation in WF training - Access to input/output market - Improved business model	Fish farmers	ISA
	FGD			Content Analysis
	Case study		Fish farmers, SMEs owners	Narrative analysis
	KII		Project staff, SMEs owners	Content Analysis
	FGD		Fish farmers	
How has WorldFish interventions promoted climate resilience (and smallholder productivity) and productivity of smallholders (especially women)?	Pro-WEAI survey	- Knowledge on climate resilient practice - Adoption of climate resilient practices	Fish farmers	ISA
	KII		Project staff, SMEs owners	Content Analysis
	FGD		Fish farmers	

Qualitative Data Collection Tools

ORAL INFORMED CONSENT

My name is _____, and I am coming from the _____*insert project/institution name*_____office. We are conducting a research study to understand the status of women in your community.

Since you are (or are not) [Circle the appropriate choice] a beneficiary of the project we are asking you to participate in this study. Your participation would be in a focus group discussion with other beneficiaries from your community. In this discussion, you will be asked about the roles and responsibilities of women in your community. This discussion will last for _____.

This discussion is for research purposes only, and all the information obtained will be kept safe in our files. We ask all group members to respect others' privacy and not tell people outside the group what was said in the group, but we cannot be sure this will not happen so others may learn something about you. You will not be identified in any presentation of the study reports. With your permission, we would like to audio record the group discussion.

Your participation in this study is completely voluntary, and you may leave the discussion at any time. Also, you are free to refuse to answer any questions that you feel are not appropriate or that make you feel uncomfortable. You may ask us any questions about the study at any point during the discussion. Your participation or non-participation in the focus group will not affect any services you currently receive from any of the ___insert the services provided to project participants_____in any way.

There is no anticipated discomfort for those contributing to this study, so the risk to participants is minimal – but as stated above, others outside the group may learn something about you. Although you may not directly benefit from taking part in this study, the information you provide may lead to improved programs and services in the community.

There is no direct compensation for your participation.

You can have a copy of this form, if you want. Do you have any questions?
[Check whether the participants have understood the question and any part of the informed consent.]

If you have any concerns about this study, you may contact:

Dr Kwaku Arhin-Sam Director, Friedensau Institute for Evaluation

Do you agree to participate in this study? *[If YES, indicate below that the oral informed consent has been obtained. Then proceed with the question below regarding the audio recording. If they refuse, thank them for their time and dismiss them.*]

□ Oral informed consent received

Do you agree to be audio recorded? *[If YES, indicate below. If any of the participants respond "NO", proceed with the focus group without recording.]*

□ Consent to audio record interview received

Signature of interviewer: _____Date: _____/_____

Focus Group Discussions with Fish Farmers

Background information

A1	Name of site/community/village	
A2	Date (dd, mm, yyyy)	
A3	Name of facilitator	
A4	Name of note taker	

Characteristics of the Respondents

Code	Name	Sex	Age	Marital Status	Project beneficiary Y/N

Role models of women and men	• What types of women are admired in your village/community? • Who is considered a good woman and why? What types of women are admired, have high status/reputation and why? By men, and by women? • What types of men are admired in your village/community? • Who is considered a good man and why? What types of men are admired, have high status/reputation and why? By men, and by women?
Local definitions of empowerment	• How would you describe a woman in your community who can make important decisions in her life and put those into action? • What is this woman like? What is her life like? • How is this different from a man?
Local perceptions of empowered men and women	• Are there many women like that who are fish farmers in your community? Why/why not? • How are these women fish farmers regarded: By other women? By other men?
Community members' perceptions of their own empowerment change over time	• Do you think the number of empowered women fish farmers has changed since the WorldFish Project? Why or why not? • How does the WorldFish project empower women?
Decision-making related to production and household reproduction	• Which aquaculture decisions do men and women make together, if any? - When men and women in a household make a decision about fish production together, how much influence does each person have and who has the final say? • What are the most common topics of disagreement? How is disagreement resolved? • Are there any decisions related to fish production that women make alone? Which ones? • Are there any decisions that men make alone? Which ones? • Why are certain decisions over fish production made together or alone? • In households where men and women make most decisions together, how are women in those households perceived by other women and men in their community? • And how are men in those households perceived by women and men in their community? • Do you think that the ways fish production decisions are typically made are good or would you like to see these change? Why? • Have the ways women and men make decisions about production changed in your community since [reference event from above]?
Decision-making related to income	• Do men and women fish farmers make decisions over the use of income together? If so, which sources of income? - What does it mean to make decisions together? How much influence does each person have and does any one person have the final say? What are the common sources of disagreement, and how are they resolved?

	- Do husbands and wives always know the income that their spouse brings in? • Do women/men make decisions over the use of income alone? If so, which sources of income? - Why are there differences between the decisions over income which men and women make together and decisions over income taken alone? • Do you think the ways decisions over income are made in your community are good or would you like to see these changes? Why? • Are there some households where women earn high incomes? What are the characteristics of these households and/or women (e.g. older women, widows, first wives, etc.)? - How are these women perceived by other women and men in your community? - How are their husbands perceived by women and men in your community? • Do you think that the amount of income earned by women and by men in a household affects their relationship? If so, how? • Do you think the WorldFish project has enhanced farmers' decisions about their income?
Shocks	• What are the major sources of shocks in this community? • When [name the shock] happens, does it affect men and women differently? In what ways is the effect different? • How does concern about shocks affect what people do/don't do to prevent or prepare for them?
Inheritance patterns	• Do women in your community generally inherit land or other family goods? Why/why not? • Do you think the system of inheritance is good or would you like to see it change?
Leadership	• How do women and men typically come together to form a union in your community? • If cooperatives are made, which people are usually the leaders? Men or women? Why/ why not? • Do you have examples of women fish farmers who are leaders in your community?
Climate Resilience	• How does climate change affect fish farming in your community? • In what way has the WorldFish project supported climate resilience in fish farming in your community? • What do you do differently compared to what you used to do regarding fish farming?
Closing question	• What would you like to see in women fish farmers' future in your community?

Semi-Structured Interview for Life Histories with Female Fish Farmers

A. Background information

A1	Name of site/community/village	
A2	Date (dd, mm, yyyy)	
A3	Name of facilitator	
A4	Name of note taker	

B. Characteristics of the respondent

B1	Name of respondent	
B2	Sex	
B3	Age	
B4	Marital status	
B8	Level of education completed	
B9	Length of time lived in the community	

B.LIFE STAGE/QUESTIONS

Childhood and adolescence

1. Where did you grow up as a child?
2. How would you describe yourself as a child?

3. What were some particularities in how you were raised because you were a girl/boy, if any? Examples? What were some things you could/could not do because you were a girl/boy? How did you feel about that?
4. Where were some places you could/could not go (by yourself or accompanied by others) because you were a girl/boy? How did you feel about that?
5. What did you want to be or do when you grew up? Did you have someone you wanted to become like, and why?
6. How far did you go in school (level of schooling completed), and why?

Adulthood

1. How many children did you want to have? Did you and your spouse/partner talk about having children, and why?
2. How many children do you have?
3. Do you raise your girl/boy children differently? If so, how? Why?
4. How are decisions usually made in your household (related to the household, yourself, your spouse/partner, your children, etc.)?
5. In the past five years, have there been changes on how decisions are made in your household? What caused those changes?
6. On what topics have the decision-making changed?
7. Please tell me about what you do for income. What do you like or not like about it?
8. In past three years, what has changed in the way you do fish farming? How does that make you feel?
9. How is your income used?
10. Do you belong to any groups inside or outside your community, and why? How do you participate in these groups?
11. What are some benefits to participating in these groups? What are some difficulties/challenges to participating in these groups?
12. What are some things you can/cannot do because you are a woman/man?
13. FOR WOMEN: Are there any things you would like to do, but cannot because you are a woman? Why?
14. Under what conditions could you do those things? What would happen if you did those things?
15. FOR WOMEN: Are there any places you would like to go (alone), but cannot because you are a woman? Why?
16. How far away from home is that? Under what conditions could you go to those places? What would happen if you went to those places?
17. How has the project from WorldFish changed the way you see women and men fish farmers?
18. How do you understand empowerment?
19. Do you know any woman whom you will describe as empowered? Why/why not?
20. Do you see yourself as empowered? Why/why not?
21. Have your views of your own ability to make your own ability to make important decisions changed over time? If so, what caused those changes? (**Probe for any influence of program/project interventions*)
22. What are your concerns for the future?
23. How do you see yourself in the future, and why?
24. What do you look forward to?

Key Informant Interviews with SME Owners

Background information

A1	Name of site/community/village	
A2	Date (dd,mm,yyyy)	
A3	Name of facilitator	
A4	Name of note taker	

Characteristics of the respondent

B1	Name of respondent	
B2	Sex	
B3	Age	
B4	Name of respondent's enterprise	
B5	Type of enterprise (formal/informal, Wholesale/intermediary/retail)	
B6	Type of market (formal/informal)	
Location of sales and physical	- From whom do you buy input products? - Where do you buy your product?	

access to market	- Do small farmers have difficulty getting products from you? - Is it harder or easier for men or women to get products from you?
Seasonality and price considerations	- When do farmers buy more products? - Do men and women buy at different times? If so, why do you think that is? - Do you believe that there are differences in the volume or quality of the product that you sell to men or women fish farmers? - Do you have to worry about the product quality going bad after you sell it it?
Gender barriers	- Do you have regular customers? If so, is there a contract with them? - Are more of your customers' men or women? Why/why not? - Do women customers face challenges buying directly from you? What kinds of problems (e.g. transport, knowledge, etc.)? - Have you noticed any differences in selling to men or women?
Payment methods	- How do people pay for the produce (e.g. cash or another form of mobile money, bank transfer, in kind, etc.)?

Credit access	- Where do you go to obtain credit for your trading business? - Is it easier or harder for men or women to get access to credit? If so, how?
Sales and value-added	- Do you or your shop process it in any way before selling it?
Market structure	- What does it take to become an agrobusiness owner (resources, training, transport)? - Is it harder for women to become SME owners than it is for men? Why/why not? - What are the characteristics that make a successful trader? - Is this market dominated by large or small traders/suppliers/buyers?
Observed changes	- If you compare yourself and your business in the last 5 years, do you see any change? Why? Who not? - Do you see changes in how you deal with male and female fish farmers? Why and why not? - In terms of percentages, what percentage of these changes will you attribute to your involvement with the WorldFish project? Why/why not - How does climate change affect your business? - Do you know of anything that can be done to achieve climate resilience? Why/why not? - How has the WorldFish project helped you to become climate resilient?
On empowerment	- What is empowerment to you? - Do you know anyone whom you can describe as empowered? What is this person like? - Will you consider yourself empowered? Why/why not?

Key Informant Interviews with Project Staff

Background information

A1	Name of site/community/village	
A2	Date (dd, mm, yyyy)	
A3	Name of facilitator	
A4	Name of note taker	

Characteristics of the respondent

B1	Name of respondent	
B2	Sex	
B3	Job title	
B4	Distance of respondent's office from sample community (km)	

Project objectives	- What do you think are the main objectives of this project? (Do not probe specifically about women's empowerment. Note exact wording as much as possible)
Respondent's role	- What has been your main role in this project?
Personal reflections	- What have been the best parts of working on this project, for you? - What have been the worst, or most frustrating?
Project staffing	- How many of the field staff (who work directly with the beneficiaries) are men? Women? - How many of the project management staff (the ones making direct decisions about the project, usually in-country) are men? Women? - Describe local men and women's interactions with project staff - Are there any particular difficulties for women project staff? (examples might be difficulties in travelling to communities, etc.)
Engaging women	- Has it been easy or difficult to engage women in the project? - Was there any resistance on behalf of male spouses or the male community leaders to women's participation? - How easy is it for male project staff to interact with women? - How easy is it for women project staff to interact with men?
Impact of project	- What changes do you think the project has contributed to in the community? *(Probe for positive as well as negative impacts)* - Did you observe changes in the empowerment of individual women? How would you describe these women? - Do you think any project interventions have caused changes in gender relations? If so, which and in what ways? - Which specific project interventions, if any, have had a role in changing social norms? In what ways?