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# Smallholder fish farmers population census report 2020:
## Northern and Luapula provinces, Zambia


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# Smallholder fish farmers population census report 2020: Northern and Luapula provinces, Zambia


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## Photo credits

Front cover, Chosa Mweemba/WorldFish; page 4, Tabitha Mulilo/WorldFish

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# Executive summary

## Introduction

The main objective of the census was to provide baseline data for the Aquaculture Technical, Vocational, and Entrepreneurship Training for Improved Private Sector and Smallholder Skills project (AQ TEVET). The project is implemented by WorldFish in partnership with the Natural Resource Development College in Lusaka, Zambia, the BluePlanet in Norway and the Musika Development Initiatives in Zambia's Northern and Luapula provinces. AQ TEVET aims to increase the number of human resources working for the private sector. It also aims 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. The census collected data to understand the smallholder fish farming systems in Northern and Luapula provinces, including the fish farmers, their locations and the fish production systems. The census collected the following data on the smallholder farmers: (i) the demographics of the farmers, (ii) fish farming background, (iii) resources and fish species cultured, (iv) gender, youth and the division of roles in fish farming, (v) access to input and output markets, (vi) production constraints and opportunities, (vii) and the Global Positioning System (GPS) of the farming households.

## Demographics of the farmers

In total, 2341 smallholder farmers participated in the census: 61% in Northern Province and 39% in Luapula Province. Of the overall total, most (72.1%) were actively involved in fish farming, while the rest had abandoned the practice at the time of the census. Most of the farmers were men. The average age of the farmers was approximately 44.3, with young farmers (defined as farmers aged between 15 and 35 years old) accounting for less than one-third of the total. Regarding school, the largest share of farmers had received primary education, while only a handful had tertiary education. The share of women farmers who never went to school was slightly higher compared to their male counterparts. In terms of marital status, the vast majority were married, but more women farmers were widowed, divorced or separated than men farmers. Each household had an average of seven people at the time of the census.

## Fish farming background

The largest proportion of the farmers had only 1–5 years of experience in fish farming. Several reasons were given to explain why the farmers had started to farm fish. Most cultivated fish for both consumption and income, while the rest did so for consumption only or solely for income. Almost all of the farmers owned land, though the share of women who did so was lower than for men. Only a small proportion of the farmers rented. A little over a quarter of the farmers had abandoned fish farming for one or more of the following reasons: inadequate access to seed/fingerlings, theft of fish from ponds, water shortages, loss of fish to predators, lack of feed, fishstock destroyed by floods, and limited finances. Most of the farmers had a production cycle of 7–12 months, followed by 6 months. Few had a production cycle that lasted more than a year.

## Smallholder resources and fish species farmed

Almost every single farmer used an earthen pond for fish farming. At the time of the census, there were 5090 fishponds in total across Northern and Luapula provinces. The smallest was 4 $m^2$ (2 x 2 m) and the largest 15,000 $m^2$ (150 x 100 m). The average cost for constructing a pond 100 $m^2$ or smaller was ZMW 175.7 while ones that were at least 500 $m^2$ cost ZMW 988.

Farmers cultured the following fish species (in order of popularity): redbreast bream (*tilapia rendalli/ Coptodon rendalli*), a combination of greenheaded bream (also known as longfin tilapia / greenhead tilapia) (*Oreochromis macrochir*) and redbreast bream, tilapia polyculture, Tanganyika bream (*Oreochromis tanganicae*), Nile bream (*Oreochromis niloticus*), banded bream (tilapia sparmani), three-spotted bream (*Oreochromis andersonii*), and a combination of African catfish (*Clarias gariepinus*) with a species of *Oreochromis*. A majority of the farmers stocked one fingerling per square meter, while just over one-third averaged two to three fingerlings. The main source of water for fish farming was underground water, followed by water from the streams harvested using furrows. The basic agriculture tools that the farmers owned included a hoe, axe, pick, shovel, bucket and basket.

## Gender, young farmers and the division of roles in fish farming

The study sought to understand the engagement of women and men by looking at decision-making related to critical decision points in fish farming. The results show that women, men and young people engage in different activities and decisions. However, they often had different perceptions regarding who was engaged in or was responsible for certain decisions. For example, the men stated that male household heads were responsible for making decisions on land allocation while women said it was a joint decision. Single women were likely to say that the female household head was the decision-maker or responsible for certain activities while married women were likely to say it was a joint responsibility with their spouses. Both men and women believed that decisions on acquiring fingerlings were usually made together. However, a majority of women farmers often stressed that decisions on this were made jointly compared to a minority of men. Women who were unmarried selected the female household head as the primary person responsible for making this decision.

Regarding fertilizer application, women played a pivotal role. The men acknowledged that women were either solely responsible or at least involved jointly in making these decisions. This high level of recognition could be based on the fact that most farmers used organic fertilizers like leaves and kitchen wastes, which women had easy access to.

The results of decision-making on fish marketing by marital status are consistent with other results. Unmarried women consistently said they were responsible for making these decisions. A significant proportion of single men also claimed that the decisions were the responsibility of other female household members. Young farmers were also highly engaged in these decisions and related activities. However, young women were likely to say the female household head or another female was responsible for making such decisions. For their part, young men often selected the female household head over the male household head as a prime decision-maker when it came to marketing. The high recognition of women among young men could mean that many of the young men farmers reside in female-headed households. The results also show that the percentage of younger farmers who had never harvested fish was higher than among older farmers.

## Access to input markets

The primary sources of fingerlings for the farmers was other farmers and recycled fingerlings from their own farm. Some farmers sourced their fingerlings from a government hatchery, but only a few sourced their fingerlings from local breeders. At the time of the census, almost none of the farmers used sex-reversed fingerlings. Most did not have a specific month for stocking their fishponds, meaning they could stock any month of the year whenever they accessed fingerlings. For feeding, a large percentage (81%) of the farmers used noncommercial feed, while the rest used a combination of commercial and noncommercial feed. Only a handful exclusively used commercial feed. Most farmers who used commercial feed traveled over 20 km to get it, Only a small percentage traveled 11–20 km. A large percentage of farmers used animal manure to fertilize their ponds, while only a handful used inorganic fertilizers to do so.

## Access to extension services

Access to extension services is low. Among active farmers, over three-quarters had not received any extension services in the 12 months prior to the census. A significant proportion of farmers got their information and knowledge of aquaculture from other farmers.

## Access to output markets

For harvesting, most of the farmers practiced partial harvesting, compared to those who harvested their fish either completely or never at all. It was difficult to estimate total harvests for farmers who practiced partial harvesting. However, for those who carried out a complete harvest, we estimated an average of about 35 kg of fish harvested in each production cycle. Overall, most of the farmers sold their fish to neighbors at farm gates. Only a few sold their fish at church. The average price of fish was ZMW 20.4/kg. The lowest price was ZMW 10/kg and the highest ZMW 40/kg. The average income from fish farming was ZMW 1263.3 per growing cycle. The lowest reported income was ZMW 5 and the highest ZMW 36,000.

## Production constraints and opportunities

The two biggest constraints mentioned were a lack of fingerlings and a lack of access to or availability of feed. A large majority of the smallholder farmers felt that they had the financial capacity to buy commercial feed if it was made available in their locations. Men and women farmers mentioned similar constraints.

# 1. Introduction and background

The smallholder fish farmers population census was conducted from November 2, 2018, to April 30, 2019, in Zambia's Northern and Luapula provinces. It was carried out by the AQ TEVET project, which is funded by the Norwegian Agency for Development Corporation. The project is implemented by WorldFish in partnership with Zambia's Natural Resource Development College (NRDC) in Lusaka, the BluePlanet based in Norway, and Musika in Zambia's Northern and Luapula provinces. The goal of the project is "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."

The AQ TEVET project comprises the following two components:

- Component 1 aims to upgrade the fisheries science curriculum (long- and short-term courses) and training tools as well as to develop an online training platform and internship program at the NRDC. This component aims to scale the online platform and upgraded curriculum to other technical, vocational and entrepreneurship training over the lifespan of the project and beyond.
- Component 2 aims to enhance the technical education, vocational and entrepreneurship skills of rural women, men and young smallholder commercial fish farmers and to increase their links to input and output markets and entrepreneurship opportunities through private sector extension support and services delivery. The census data was collected under component 2 of the project.

The main objective of the census was to provide baseline data for the AQ TEVET project. In addition, the census had the following three sub-objectives:

1. To provide data to help project partners and stakeholders understand the smallholder fish farming systems in Northern and Luapula provinces, including the socioeconomic attributes of the farmers, their geospatial location and their fish production systems.
2. To contribute to updating the government register for smallholder aquaculture farmers to easily deliver extension services to them.
3. To develop maps and farmer registers to help the private sector in the aquaculture industry (especially those linked to the project) develop business models that are responsive to the needs of farmers and link farmers to input and output markets.

The aquaculture sector in Zambia accounts for about 36,105 t (29%) of total fish production, which makes up only 3.2% of the country's gross domestic product (Ministry of National Development Planning 2017). Domestic fish supply is low at 7.2 kg/capita annually comprising of 5.1 kg/capita from capture fisheries and 2.1 kg/capita from aquaculture (Kakwasha et al. 2020). The primary cause of low fish consumption is low production in the sector. With a growing population, the government through its 2017–2021 7th National Development Plan estimates that the country will have a shortfall of 107,883 t of fish supply to address its target of 12 kg for annual fish consumption per capita (Ministry of National Development Planning 2017). With close to 45% of the water resources in southern Africa found in Zambia (WorldFish 2020), the country has the potential to become a regional powerhouse in the aquaculture sector. The availability of water resources along with a huge unmet demand for fish means that the aquaculture sector has enormous potential in Zambia. However, this potential, sadly, has not been fully realized. A lack of access to quality inputs, extension services and outputs markets has often been listed as one of the most significant constraints to the sustainable growth of the country's smallholder aquaculture sector (Brummett et al. 2008; WorldFish 2020). The census results will provide stakeholders with information to understand the sector and develop solutions to address these constraints.

# 2. Research methodology

## 2.1 Description of the study areas

The census was conducted in Northern and Luapula provinces where WorldFish and Musika are implementing the AQ TEVET project. Zambia has three distinct agro-ecological zones (AEZs) (World Bank Group 2019):

1. AEZ I covers most of the country's Southern and Western provinces. It is a drought-prone area characterized by low annual rainfall (less than 800 mm) and a short, hot growing season of 60–90 days.
2. AEZ IIa and IIb cover much of Zambia's eastern, central and western regions and have the country's highest agricultural potential with seasons of 90–150 days. AEZ IIa has slightly higher annual rainfall (800–1000 mm) than AEZ IIb (600–800 mm).
3. AEZ III covers the northern regions of the country. It gets 1000–1500 mm of rainfall each year, and the season lasts 140–200 days.

Photo credit: Tabitha Mutia/WorldFish

Women and men harvesting fish.

Luapula and Northern provinces are in the northern zone, which receives the highest amount of rainfall in the country. 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 highest number of smallholder fish farmers in the country (CSO 2019). The 2017–2018 livestock census shows that there were 9615 households involved in fish farming countrywide as of January 2018, and Northern Province had the highest proportion at 33.9 percent (CSO 2019).

## 2.2 Study design and sampling

The districts selected as part of the census were those that provincial and district fisheries officers (DFOs) reported to have fish farmers who were either actively involved in fish farming or had abandoned it (Table 1). The farmers were divided into active and inactive farmers and defined as follows:

- **Active farmers**: Any farmers who had aquaculture facilities, such as a fishpond, and had stocked them with fish, or farmers who had harvested fish in the previous 6 months before the census even if they did not have stocked ponds at the time of the census.
- **Inactive farmers**: Farmers who had aquaculture facilities, such as a fishpond, but had stopped fish farming in the previous 12 months before the census.

The fish farmer registers prepared by the Department of Fisheries were used to identify the farmers. Census enumerators also collaborated with DFOs to identify all fish farmers, whether they were in the existing registers or not, and whether they were currently active or inactive. Farmers were also instrumental in identifying other fish farmers in their community to ensure that all fish farmers were enumerated.

## 2.3 Data collection methods

A structured questionnaire, with both closed and open-ended questions, was used to collect the data. Detailed information was collected on the following themes:

- spatial location of each farmer's household
- demographics of the smallholder farmers
- fish farming background of the farmers
- resources and fish species cultured
- gender, youth and the division of roles in fish farming
- access to input and output markets
- production constraints and opportunities.

Data was collected using a digital questionnaire developed through the iForm app and uploaded to a tablet. Enumerators recorded the responses on the tablet and transmitted the recorded data to an online server after the interview. To collect the data, the study used three male and two female enumerators, who were trained over 3 days prior to the survey. The questionnaire was pretested in Kasama District, which was not part of the census enumeration. After the pretest, the tools were revised and finalized.

## 2.4 Data analysis

The data was analyzed using STATA software version 16. Descriptive statistics were used, such as frequencies, pie charts, mean, sum, proportions and percentages.

| Northern Province | Luapula Province |
|---|---|
| Mpulungu | Mansa |
| Mungwi | Samfya |
| Luwingu | Chipili |
| Mbala | Kawambwa |
| Mporokoso | |

**Table 1**. Selected districts for the census.

# 3. Results

This part of the report presents the census results in six different sections: (1) demographics of the farmers, (2) fish farming background, (3) resources and fish species cultured, (4) gender, youth and the division of roles in fish farming, (5) access to input and output markets, and (6) production constraints and opportunities.

## 3.1 Demographics of the farmers

A total of 2341 smallholder farmers took part in the survey: 61% in Northern Province and 39% in Luapula Province (Table 2). Luwingu had the largest proportion of farmers among all districts followed by Mbala and Kawambwa, while Chipili had the lowest. Luwingu and Mansa districts had the highest percentage of farmers who were actively involved in fish farming, while Kawambwa had the largest proportion of those who abandoned farming followed by Samfya and Mpulungu. Figure 1 shows the spatial distribution of farmers in the two provinces. (See Annex 1 for more information on the percentage distribution of farmers by camp and district and Annex 2 for maps showing distribution of farmers by sex and age.)

Of all the farmers in the two provinces, nearly three-quarters were actively involved in fish farming while the rest had abandoned the practice at the time of the census (Table 3). Men made up the highest percentage of fish farmers in the two provinces.

In terms of the age distribution, overall the largest percentage of smallholder farmers were aged 36–64 (Figures 2 and 3). The distribution of farmers within age groups was similar for men and women (Figure 3).

Young farmers (aged between 15 and 35 years old) made up nearly one-third of smallholder farmers, while older farmers (65 years and above) constituted less than 10 percent. The average age of the farmers was 44.3 (±0.3). Ages ranged from 15 to 93 years old.

| District | All fish farmers | | Active farmers (%) | Inactive farmers (%) |
|---|---|---|---|---|
| | Number | Percentage | | |
| Luwingu | 421 | 18.0 | 88.6 | 11.4 |
| Mbala | 374 | 16.0 | 83.2 | 16.8 |
| Kawambwa | 358 | 15.3 | 50.0 | 50.0 |
| Mansa | 267 | 11.4 | 88.4 | 11.6 |
| Mporokoso | 243 | 10.4 | 71.6 | 28.4 |
| Mungwi | 225 | 9.6 | 72.0 | 28.0 |
| Samfya | 195 | 8.3 | 51.8 | 48.2 |
| Mpulungu | 160 | 6.8 | 57.5 | 42.5 |
| Chipili | 98 | 4.2 | 60.2 | 39.8 |
| **Total** | **2341** | **100.0** | **72.1** | **27.9** |

**Table 2**. Farmers by district.

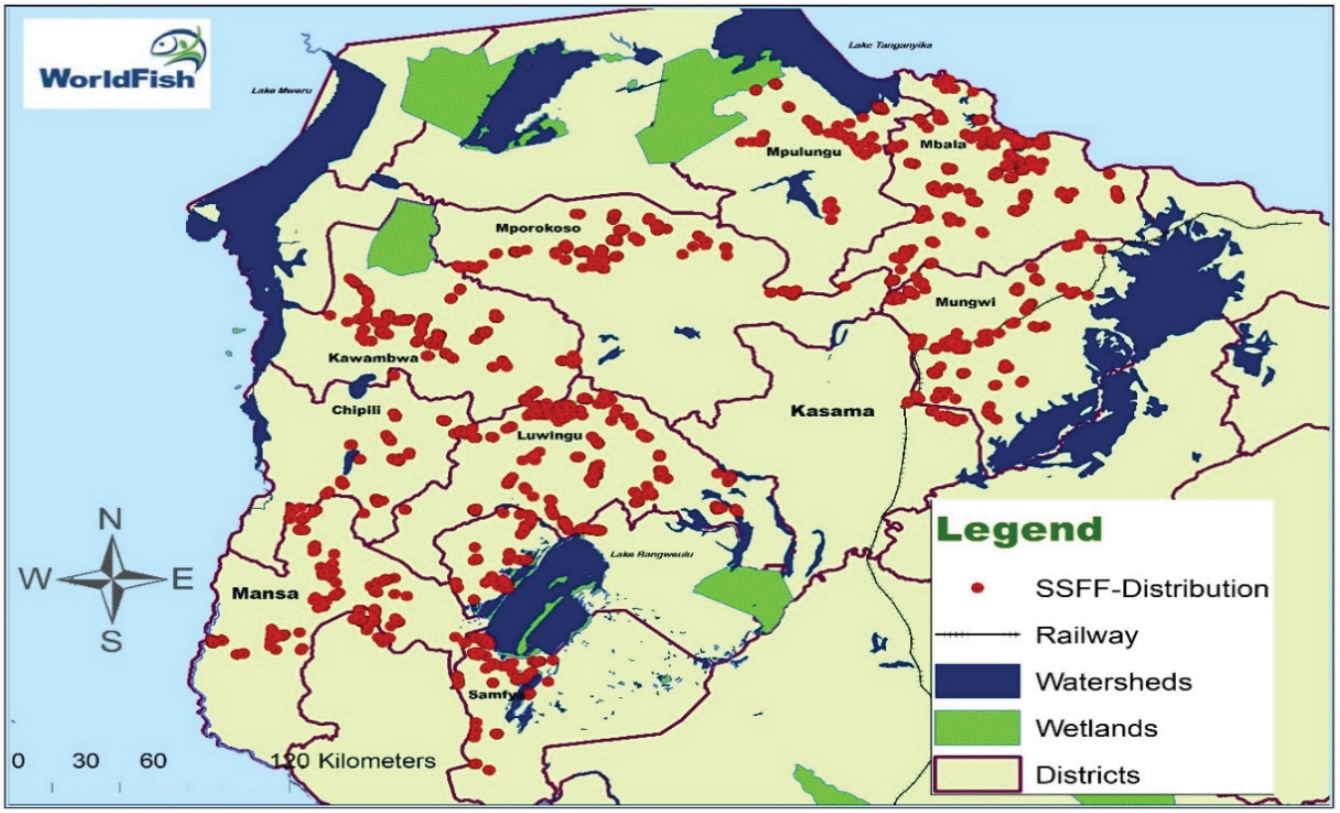


**Figure 1**. Spatial distribution of the farmers by district.

| Province | All fish farmers | | Active farmers (%) | Inactive farmers (%) |
|---|---|---|---|---|
| | Number | Percentage | | |
| Northern | 1427 | 61.0 | 77.9 | 22.1 |
| Luapula | 914 | 39.0 | 62.9 | 37.1 |
| **Total** | **2341** | **100.0** | **72.1** | **27.9** |

**Table 3**. Farmers by province.

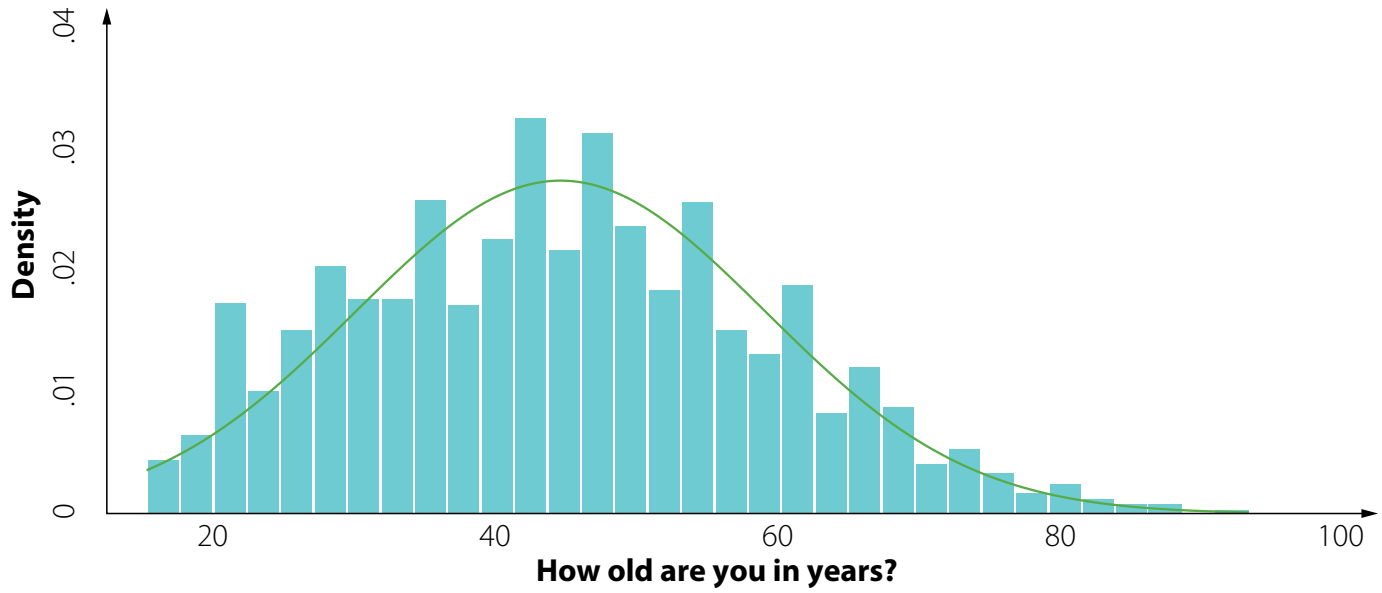


**Figure 2**. Age of farmers.

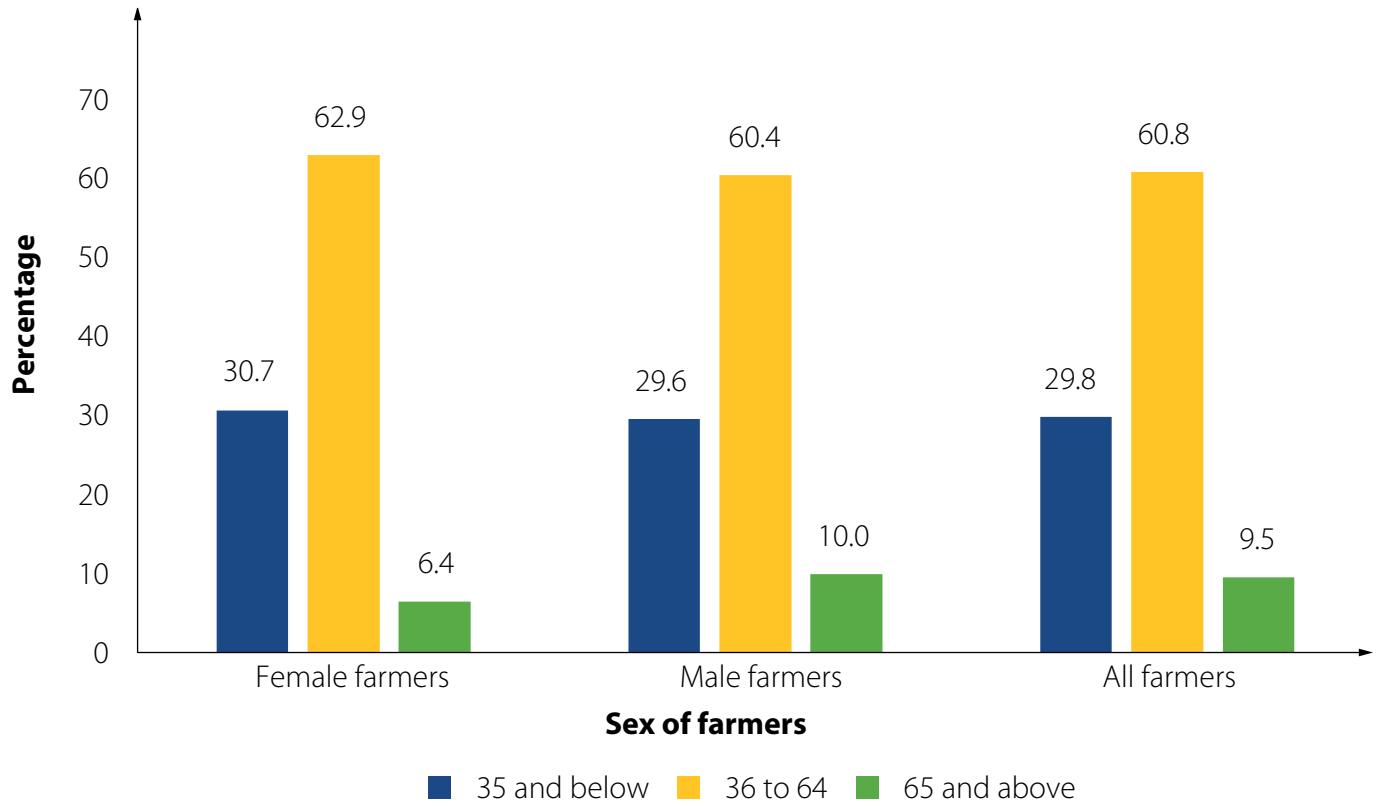


**Figure 3**. Age of farmers (by sex).

Regarding school, the majority of the fish farmers had some level of formal education (Table 4). Most had received primary education followed by those with secondary education. Only a small percentage of farmers had tertiary education. The majority of the women farmers had primary education, while the largest percentage of men farmers attained secondary education. In addition, the percentage of women farmers who never went to school was slightly higher than among the men.

The vast majority of the farmers were married compared with those who were single, widowed, divorced or separated (Table 5). Almost all the men were married, while a bit less than three-quarters of the women were married. Women made up the largest proportion of farmers who were widowed, divorced or separated.

Household sizes were relatively large (Figure 4). Each fish farming household had an average of seven people at the time of the census.

## 3.2 Fish farming background

Figure 5 shows the share of experience among the farmers. Most had only 1–5 years of experience.

| Level of education | Men farmers (%) n=2013 | Women farmers (%) n=328 | All farmers (%) n=2341 |
|---|---|---|---|
| Primary | 44.8 | 65.6 | 47.7 |
| Secondary | 46.8 | 26.8 | 44.0 |
| Tertiary | 5.4 | 2.7 | 5.0 |
| None | 3.0 | 4.9 | 3.3 |
| **Total** | **100.0** | **100.0** | **100.0** |

**Table 4**. Education level of the farmers (by sex).

| Marital status | Men farmers (%) | Women farmers (%) | All farmers (%) |
|---|---|---|---|
| | n=2013 | n=328 | n=2341 |
| Married | 91.3 | 71.0 | 88.5 |
| Single | 7.3 | 7.3 | 7.3 |
| Widowed | 0.6 | 15.9 | 2.7 |
| Divorced | 0.5 | 3.7 | 0.9 |
| Separated | 0.3 | 2.1 | 0.6 |
| Cohabiting | 0.1 | 0.0 | 0.0 |
| **Total** | **100.0** | **100.0** | **100.0** |

**Table 5**. Marital status of the farmers (by sex).

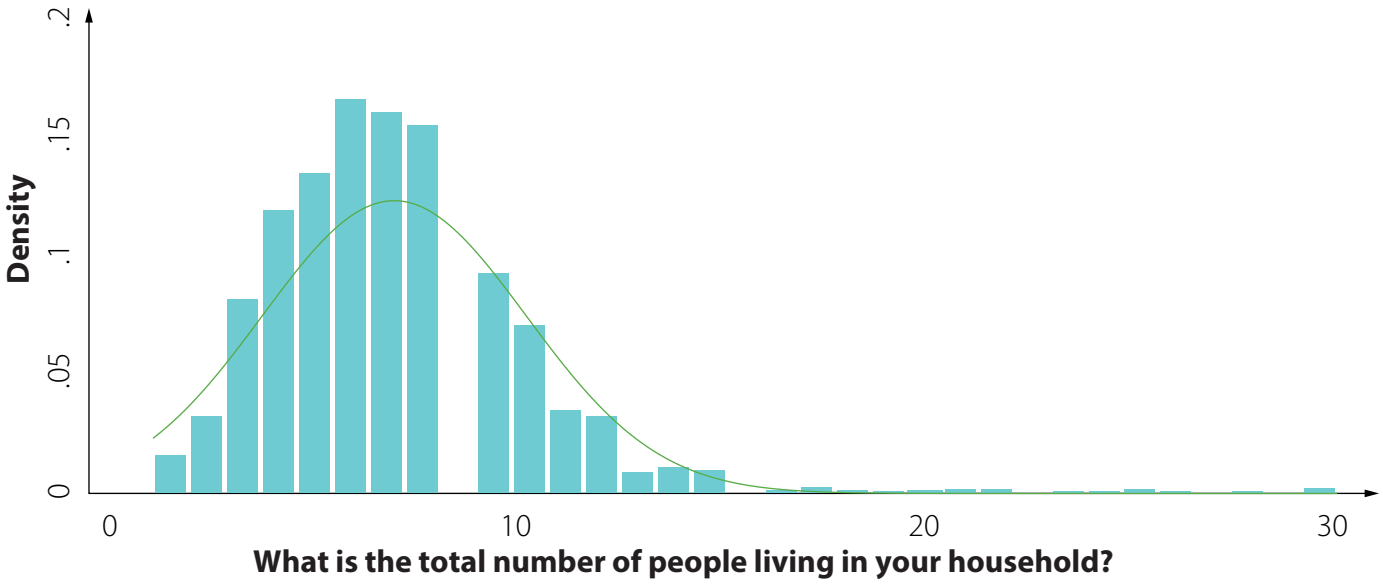


**Figure 4**. Household size (mean = 7).

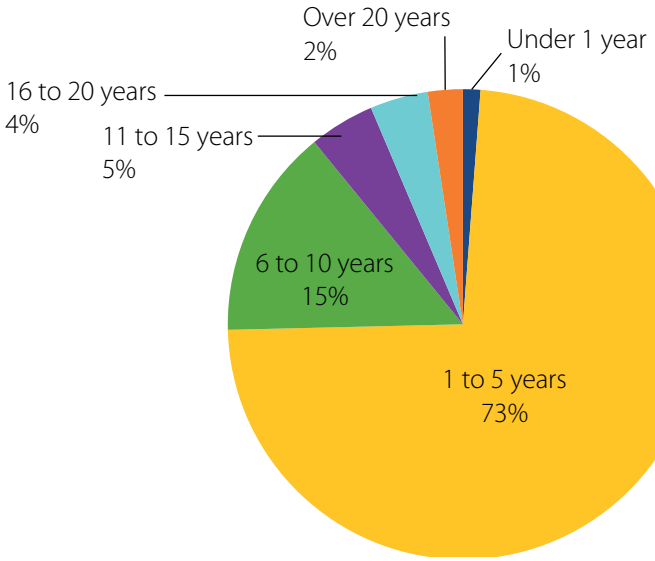


**Figure 5**. Fish farming experience among the farmers.

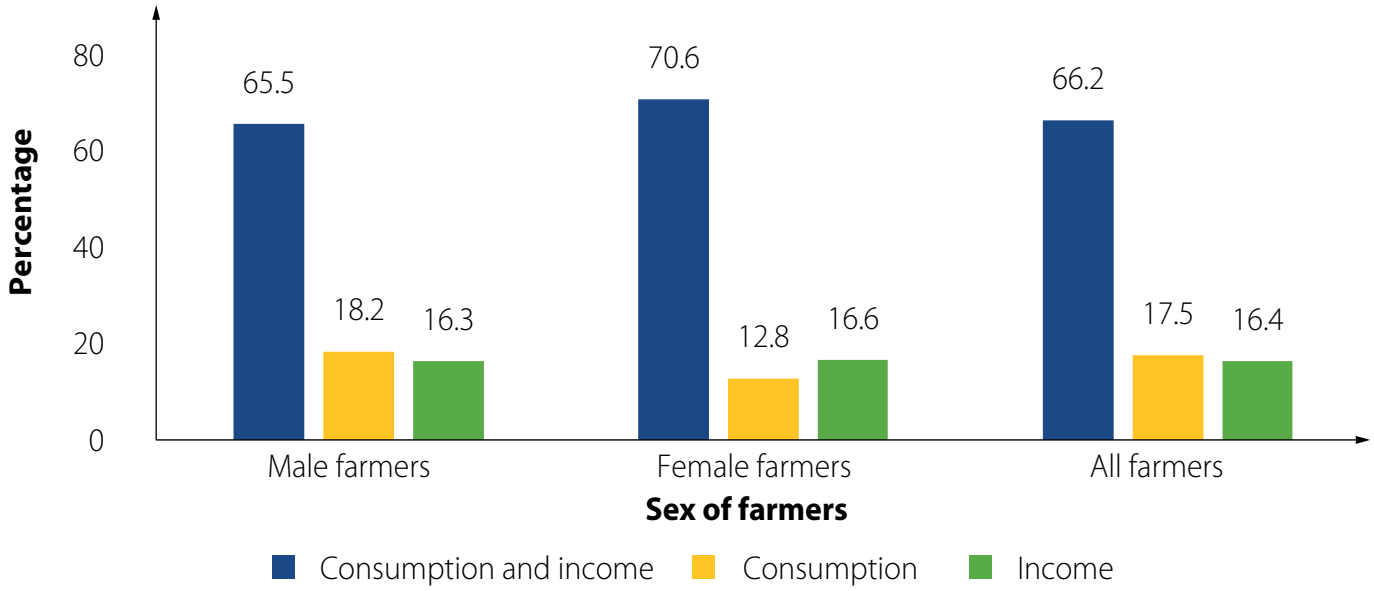


**Figure 6**. Motivation for starting fish farming (by sex).

Farmers were asked what the primary reason was for venturing into fish farming (Figure 6). Almost two-thirds said that they started farming to have fish for both consumption and income. The rest said their main reason was either for consumption or for income generation. The proportion of women farmers who said that their fish was for both consumption and income was slightly higher than among the men.

Farmers were also asked who owns the land they farm on (Table 6). Almost all of them owned the land, while the rest used land from extended family. Only a tiny proportion rented land. The proportion of women who owned land was lower than men. Because of this, women were more likely to use land owned by extended family members and/or their spouse.

## 3.3 Smallholder resources and fish species cultured

This section describes the resources that fish farmers have and the fish species they culture. Almost every single farmer used earthen ponds for fish farming (Figure 7).

At the time of the census, there was a total of 5090 fishponds. Nearly two-thirds were active while the rest were not (Figure 8). Active ponds were defined as those stocked with fish while inactive ponds had none.

Pond sizes ranged from 4 $m^2$ (2 x 2 m) to 15,000 $m^2$ (150 x 100 m). (See Annex 3 for more information on the number and sizes of the individual fishponds that farmers owned.) Most farmers stocked one fingerling

| | Land ownership | | |
|---|---|---|---|
| | **Men farmers** | **Women farmers** | **All active farmers** |
| **Land ownership** | **n=1425** | **n=224** | **n=1649** |
| Self-owned | 94.2 | 78.6 | 92.1 |
| Extended family | 5.2 | 6.7 | 5.4 |
| Spouse owns | 0.3 | 12.1 | 1.9 |
| Rented | 0.4 | 2.7 | 0.7 |
| **Total** | **100.0** | **100** | **100.0** |

**Table 6**. Land ownership among the farmers.

per square meter and just over two-thirds stocked two to three fingerlings. Only a small percentage of farmers stocked six to ten (Figure 9).

When it comes to stocking fishponds, farmers do so throughout the year (Figure 10). The vast majority did not have a specific month for stocking fingerlings.

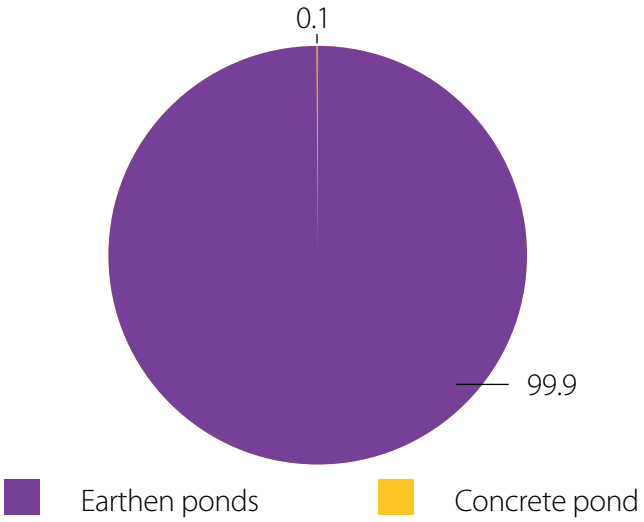


**Figure 7**. Aquaculture facilities used by the farmers.

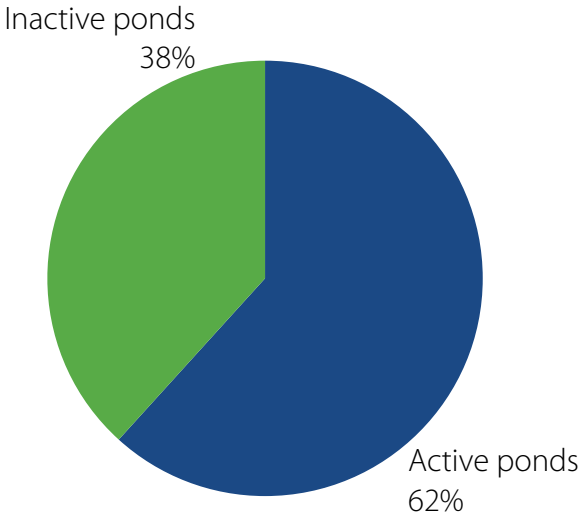


**Figure 8**. Active and inactive fishponds.

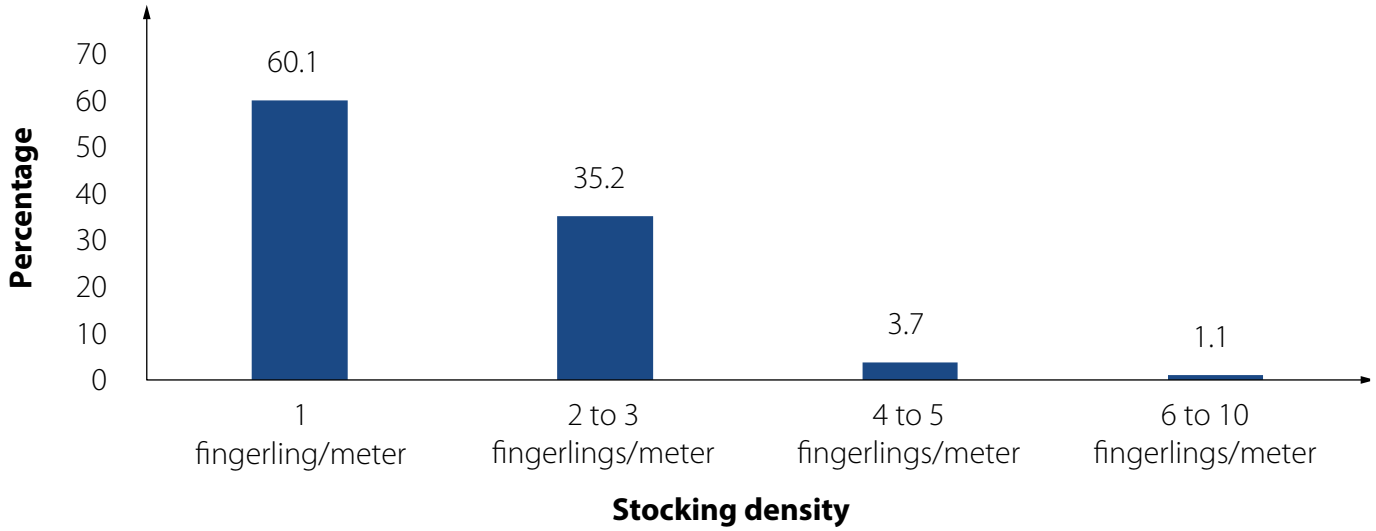


**Figure 9**. Stocking density of fingerlings.

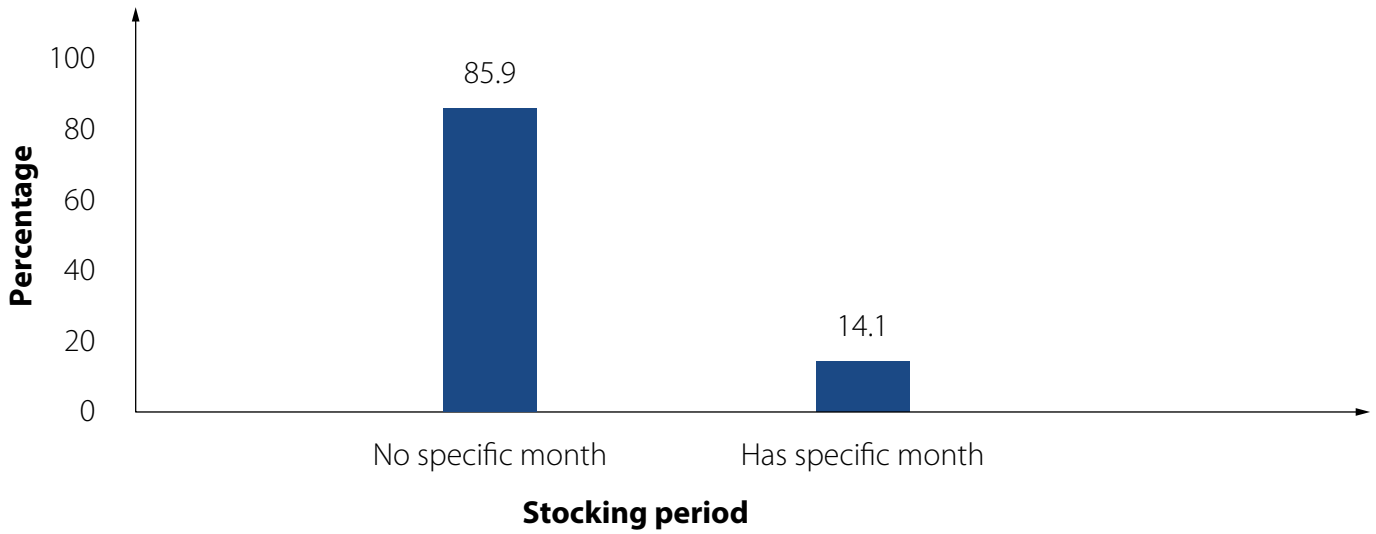


**Figure 10**. Months for stocking fingerlings.

Regarding the sources of water farmers used for fish farming (Figure 11), just over half used underground water (spring water). Most farmers constructed their fishponds in wetlands for easier access to underground water. A little less than half sourced water from streams. Less than 1 percent sourced water for fish farming from a borehole. Regardless of the water source, nearly all of the farmers said they had access to water throughout the year (Figure 12).

Most farmers practiced semi-intensive aquaculture systems (Figure 13). In the census, semi-intensive was defined as aquaculture fish production from pond systems beyond the level supported by food that is naturally available in the fishpond through the use of supplementary feeds. Supplementary feeds range from commercial feed to noncommercial feeds, such as cassava meal, nshima, plants and vegetables, maize bran, and many other cereals. Intensive fish farming was defined as aquaculture production from pond systems using exclusively commercial feeds. Lastly, extensive was defined as fish production based on the use of organic and inorganic fertilizers that promote the growth of simple plants to form the basis of the food chain in the pond.

Among the fish species cultured (Table 7), redbreast and greenheaded breams were the most popular. Approximately one-third of the farmers cultured more than one *Oreochromis* species.

In terms of the tools the farmers owned (Table 8), most only used basic agriculture tools, such as a hoe, axe, pick, shovel, bucket and basket.

Table 9 shows the average cost of pond construction. It must be noted, though, that these costs are likely underestimated because many smallholder farmers used unpaid family labor, which was not costed.

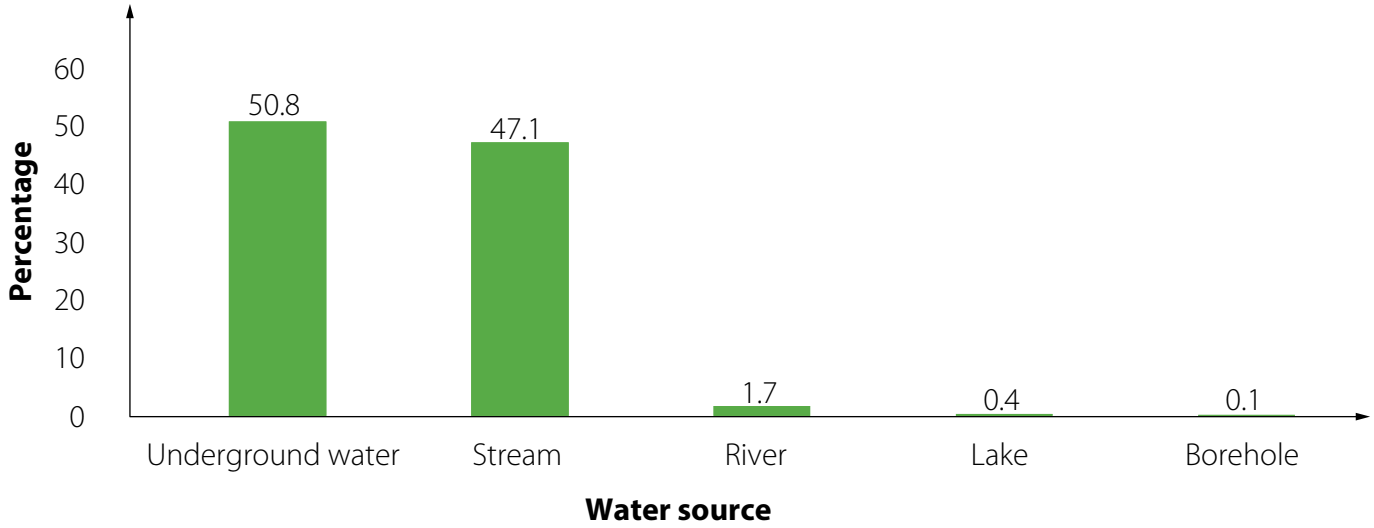


**Figure 11**. Sources of water for fish farming.

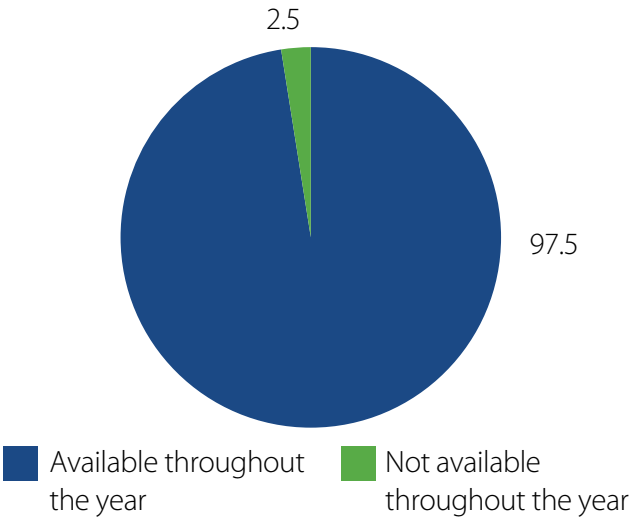


**Figure 12**. Water availability.

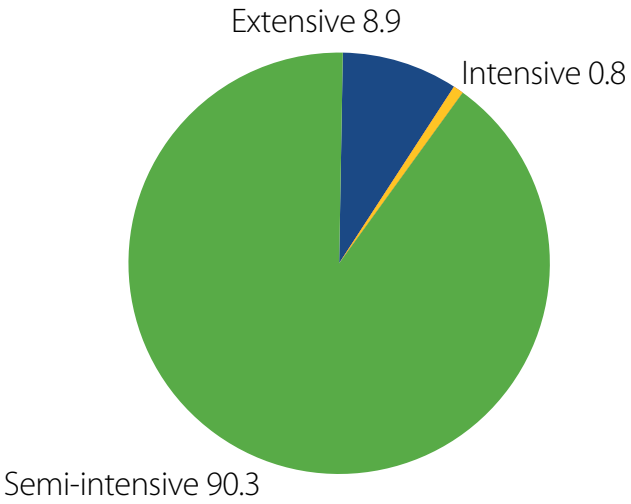


**Figure 13**. Aquaculture system intensity.

| Species | Number of farmers | Percentage |
|---|---|---|
| Redbreast bream | 664 | 39.5 |
| Greenheaded bream / Longfin tilapia | 266 | 15.8 |
| Tanganyika bream | 74 | 4.4 |
| Nile bream | 38* | 2.3 |
| Banded bream | 21 | 1.3 |
| Three-spotted bream | 9* | 0.5 |
| Green headed bream and redbreast bream | 390 | 23.2 |
| Tilapia polyculture | 215 | 12.8 |
| African catfish and an *Oreochromis* species | 4 | 0.2 |
| **Total** | **1681** | **100.0** |

**Species that are not native to the water bodies in Luapula and Northern provinces.*

**Table 7**. Fish species cultured.

| Tools | Active men farmers (%) | Active women farmers (%) | All active farmers (%) |
|---|---|---|---|
| | n=1451 | n=236 | n=1687 |
| Basic agriculture tools | 87.5 | 90.3 | 87.9 |
| Fish nets and basic agriculture tools | 11.2 | 8.9 | 10.9 |
| Diesel generator, hapa and water tank | 0.1 | 0 | 0.1 |
| No tools | 0.2 | 0 | 0.2 |
| Pumps and basic agriculture tools | 0.3 | 0 | 0.3 |
| Kitchen scale and basic agriculture tools | 0.3 | 0 | 0.2 |
| Wheelbarrow and basic agriculture tools | 0.4 | 0.9 | 0.5 |
| **Total** | **100.0** | **100.0** | **100.0** |

**Table 8**. Tools used for aquaculture (by sex).

| Pond size ($m^2$) | Average construction cost (ZMW) | Std. Err. (±) |
|---|---|---|
| ≤100 | 175.7 | 14.2 |
| 200 | 214.1 | 29.1 |
| 300 | 590.4 | 83.5 |
| 400 | 932.4 | 119.5 |
| 500 | 838.9 | 159.3 |
| >500 | 988.0 | 77.6 |

**Table 9**. Average cost of pond construction.

Well over three-quarters of the farmers did partial harvests (Table 10). The rest either never harvested or conducted complete harvests. This made it difficult to estimate the quantity of fish the farmers harvested. However, the results showed that farmers who carried out a complete harvest produced an average of 35 (±3.7) kg of fish in each production cycle.

## 3.4 Gender, youth and the division of roles in fish farming

### 3.4.1 Women's participation in fish farming

This section discusses the division of roles in fish farming as well as the participation of men and women regarding decisions related to fish farming.

The responsibility for making decisions regarding land used for building fishponds fell mainly to male household heads (Table 11). The majority of men farmers said that the decision was made solely by the male household head, while just over one-third of women farmers said they made these decisions together with their husband. Among women farmers, the second-most frequently mentioned decision-maker was either a female head or other female members of the household. Men did not report a significant role for women in making this decision.

An analysis of the data by marital status (Table 12) shows that unmarried women farmers were more likely to select a female household head as the primary decision-maker compared to married ones, who chose joint decision-making between spouses. Just like the married women, married men farmers also said that this decision was a joint responsibility of husband and wife. Unmarried men were just as likely as unmarried women to say that

| Harvest strategy | Active men farmers (%) | Active women farmers (%) | All active farmers (%) |
|---|---|---|---|
| | n=1451 | n=236 | n=1687 |
| Partial | 81.5 | 83.9 | 81.9 |
| Never | 9.9 | 7.2 | 9.5 |
| Complete | 8.6 | 8.9 | 8.7 |
| **Total** | **100.0** | **100.0** | **100.0** |

**Table 10**. Harvesting strategies (by sex).

| Responsibility for land allocation for pond construction | Active men farmers (%) | Active women farmers (%) | All active farmers (%) |
|---|---|---|---|
| | n=1451 | n=236 | n=1687 |
| Male household head | 68.2 | 17.0 | 61.1 |
| Male household member | 19.5 | 8.1 | 17.9 |
| Both husband and wife | 11.2 | 37.7 | 14.9 |
| Female household head | 0.4 | 26.7 | 4.1 |
| Female household member | 0.4 | 9.8 | 1.7 |
| Not sure | 0.1 | 0.4 | 0.2 |
| Employee | 0.1 | 0.4 | 0.1 |
| **Total** | **100.0** | **100.0** | **100.0** |

**Table 11**. Responsibility for making decisions to allocate land to construct fishponds (by sex).

this was the responsibility of the female household head, possibly because many unmarried men lived in households headed by women.

Another important decision farmers were asked about concerned who in the household has the responsibility to decide on acquiring fingerlings (Figure 14) and fertilizers (Table 13). Both men and women farmers said that spouses often made decisions on acquiring fingerlings jointly, but a greater proportion of women stressed that these decisions were made jointly. Men were more likely than women to say that they made these decisions alone, while the reverse was true among women. This difference between men's and women's perceptions could be related to the fact that there was a larger proportion of unmarried women farmers among the female respondents.

| Responsibility for land allocation for pond construction | Marital status men | | Marital status women | |
|---|---|---|---|---|
| | Unmarried | Married | Unmarried | Married |
| | n=154 | n=1297 | n=64 | n=172 |
| Both husband and wife | 31.2 | 72.6 | 23.4 | 43 |
| Female household head | 55.8 | 15.2 | 56.3 | 15.7 |
| Male household head | 6.5 | 11.8 | 3.1 | 22.1 |
| Female household member | 2.6 | 0.2 | 9.4 | 9.9 |
| Male household member | 2.6 | 0.2 | 6.3 | 8.7 |
| Employee | 1.3 | - | - | 0.6 |
| Not sure | - | 0.1 | 1.6 | - |

**Table 12**. Responsibility for making decisions to allocate land to construct fishponds (by marital status).

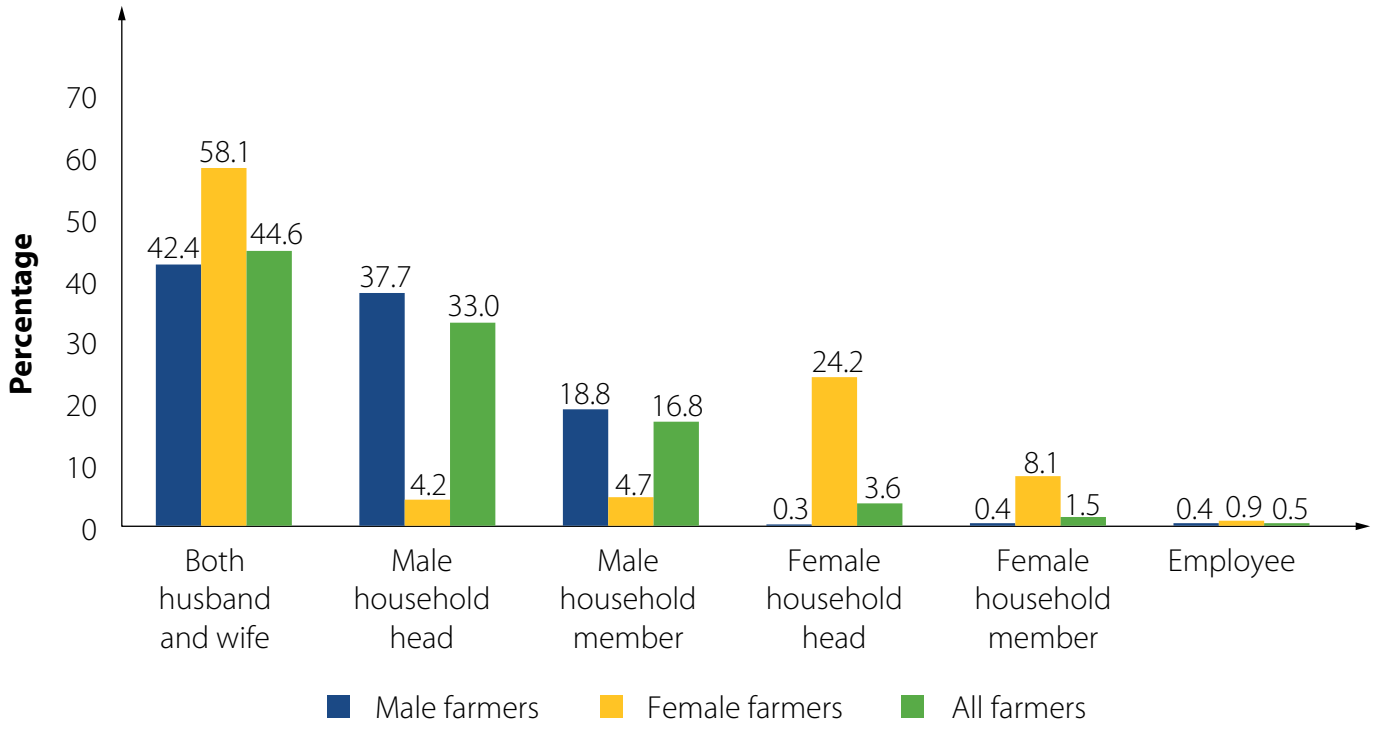


**Figure 14**. Responsibility for making decisions to acquire fingerlings (by sex).

| Responsibility for fertilizing the ponds | Active men farmers (%) | Active women farmers (%) | All active farmers (%) |
|---|---|---|---|
| | n=1451 | n=236 | n=1687 |
| Both husband and wife | 32.5 | 30.1 | 32.1 |
| Male household head | 23.0 | 1.7 | 20.0 |
| Female household head | 11.9 | 44.1 | 16.4 |
| Young farmer | 3.5 | 3.4 | 3.5 |
| Employee | 0.8 | 0.9 | 0.8 |
| Children | 0.4 | N/A | 0.4 |
| Do not use fertilizer | 28.0 | 19.9 | 26.9 |
| **Total** | **100.0** | **100.0** | **100.0** |

**Table 13**. Responsibility for making decisions to acquire fertilizers (by marital status).

Regarding fertilizers, about one-third said that they made these decisions together with their spouse (Table 13). Although children are not involved in this decision-making, they played a role in putting farm materials, such as leaves, into ponds. Farmers used these materials to fertilize their fishponds. It would seem that women play a big role, either as part of joint decision-making or making the decision alone, and the men acknowledged the women's involvement. High levels of engagement by women could be based on the fact that most farmers use organic fertilizers like leaves and kitchen waste that women have easy access to. It is worth noting that just over a quarter of the respondents said that they did not fertilize their fishponds at all, so they did not engage in these discussions.

When broken down by marital status (Table 14), single, divorced, separated or widowed women farmers said that they could make their own decisions regarding acquiring fingerlings. Unmarried women selected their female household head as the main person with this responsibility. A large proportion of both married men and women farmers said that it was a joint responsibility. More joint decisions on fingerlings can also be related to the fact that most fingerlings are locally sourced from other farmers or saved on the farm. It would seem that married women see a bigger role for themselves through joint decisions to acquire fingerlings than other groups. Single men, however, were more likely to say that it is the responsibility of other male household members.

There is a similar trend regarding the construction of fishponds (Figure 15). Almost two-thirds of women farmers said that spouses do it together. Single women farmers were more likely to say female household heads make that decision, while the majority of married women regarded it as a joint decision. In contrast, men farmers overwhelmingly regarded this decision as the responsibility of male heads or other male household members, as in the case of single men.

The largest share of farmers said that spouses made decisions together on how to prepare the fishpond, followed by the male household head and a male household member (Figure 16). However, among women farmers, although joint decision was still top, female-headed households and other female household member were mentioned second and third. The role of men among women farmers was regarded as minimal.

A similar trend was observed in the responses for maintaining fishponds.

Overall, almost half of the farmers said that spouses share the responsibility of harvesting (Figure 17). Slightly more women farmers than men ones said that they did not take part in harvests. It is clear from the results that both men and women play a key role during fish harvesting. A little over a third of farmers had not harvested their fish at the time of the census.

| Responsibility for acquiring fingerlings | Marital status men | | Marital status women | |
|---|---|---|---|---|
| | Unmarried | Married | Unmarried | Married |
| | n=153 | n=1297 | n=64 | n=172 |
| Both husband and wife | 11.1 | 46.1 | 28.1 | 69.2 |
| Male household head | 22.9 | 39.4 | - | 5.8 |
| Male household member | 63.4 | 13.6 | 6.3 | 4.1 |
| Employee | - | 0.5 | 1.6 | 0.6 |
| Female household member | 2.0 | 0.2 | 10.9 | 7.0 |
| Female household head | 0.7 | 0.2 | 53.1 | 13.4 |

**Table 14**. Responsibility for making decisions to acquire fingerlings (by marital status).

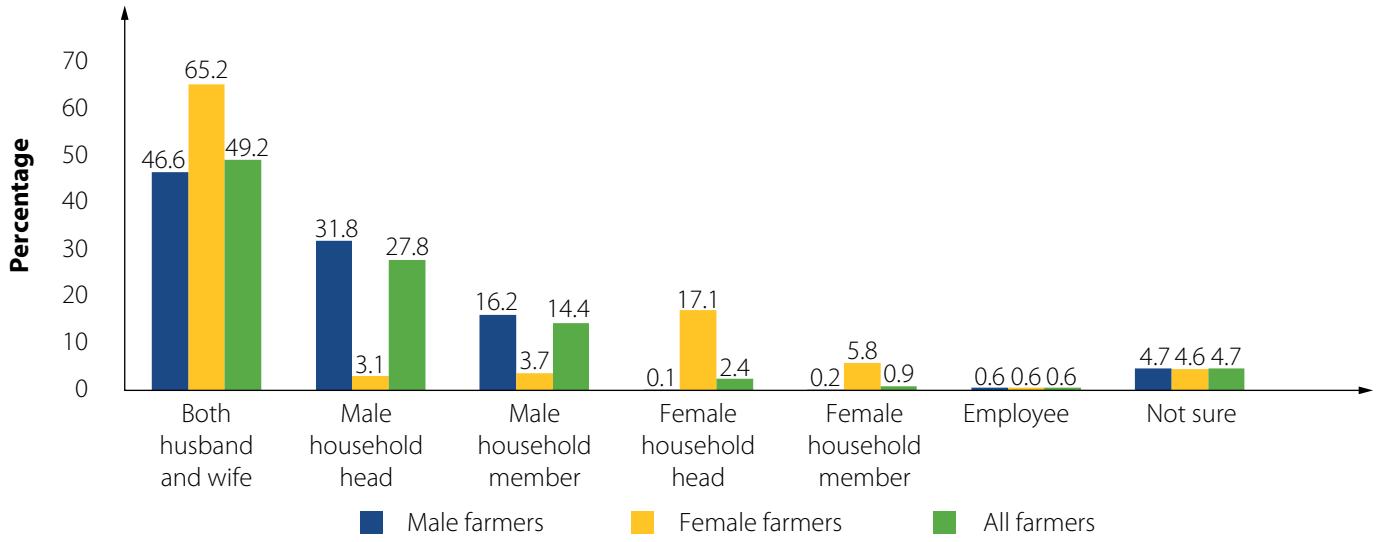


**Figure 15**. Responsibility for pond construction (by sex).

| Responsibility for pond construction | Marital status of men | | Marital status of women | |
|---|---|---|---|---|
| | Unmarried | Married | Unmarried | Married |
| | n=153 | n=1297 | n=64 | n=172 |
| Male household head | 20.9 | 44.2 | 1.6 | 5.2 |
| Both husband and wife | 9.8 | 40.1 | 31.3 | 69.8 |
| Male household member | 68.6 | 14.7 | 4.7 | 4.7 |
| Employee | - | 0.8 | 1.6 | 0.6 |
| Female household member | - | 0.2 | 7.8 | 8.1 |
| Female household head | 0.7 | - | 53.1 | 11.6 |

**Table 15**. Responsibility for pond construction (by marital status).

The degree of divergence between men and women, regardless of marital status, shows the different perceptions they have regarding who is responsible for making this decision (Table 16).

| Responsibility for pond preparation | Active men farmers (%) | Active women farmers (%) | All active farmers (%) |
|---|---|---|---|
| | n=1451 | n=236 | n=1687 |
| Both husband and wife | 42.2 | 61.4 | 44.9 |
| Male household head | 37.6 | 3.0 | 32.8 |
| Male household member | 19.1 | 4.2 | 17.0 |
| Female household head | 0.1 | 21.6 | 3.1 |
| Female household member | 0.2 | 8.1 | 1.3 |
| Employee | 0.7 | 1.7 | 0.8 |
| Not sure | 0.1 | | 0.1 |
| **Total** | **100.0** | **100.0** | **100.0** |

**Table 16**. Responsibility for preparing fishponds (by sex).

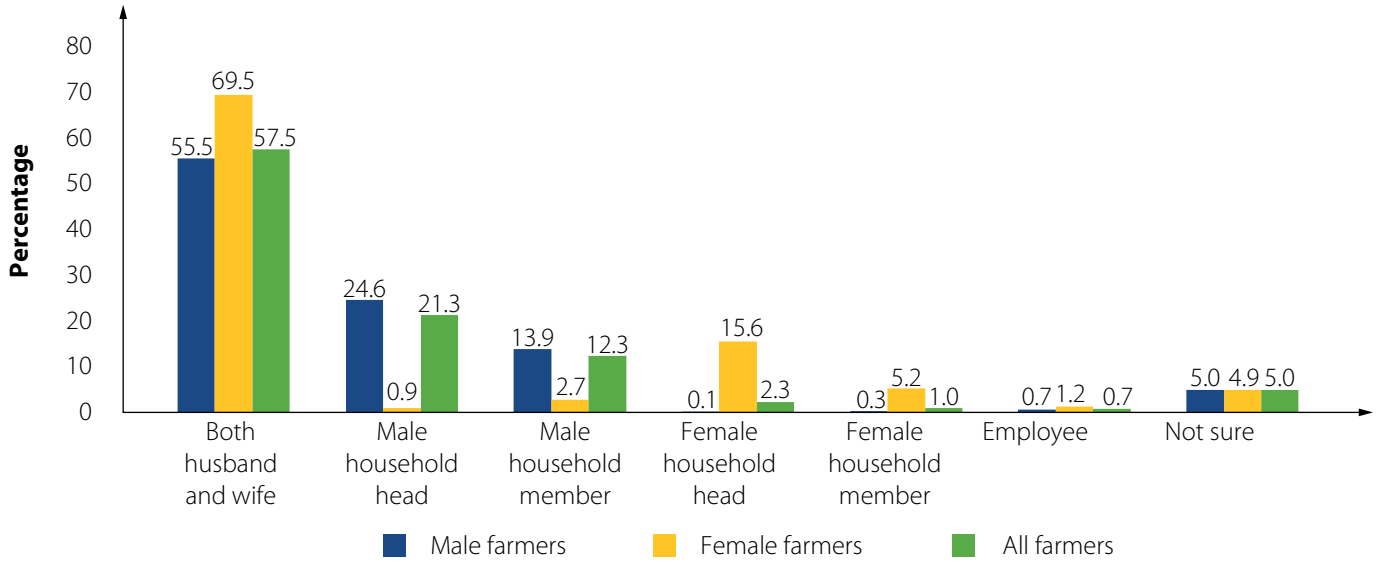


**Figure 16**. Responsibility for maintaining fishponds (by sex).

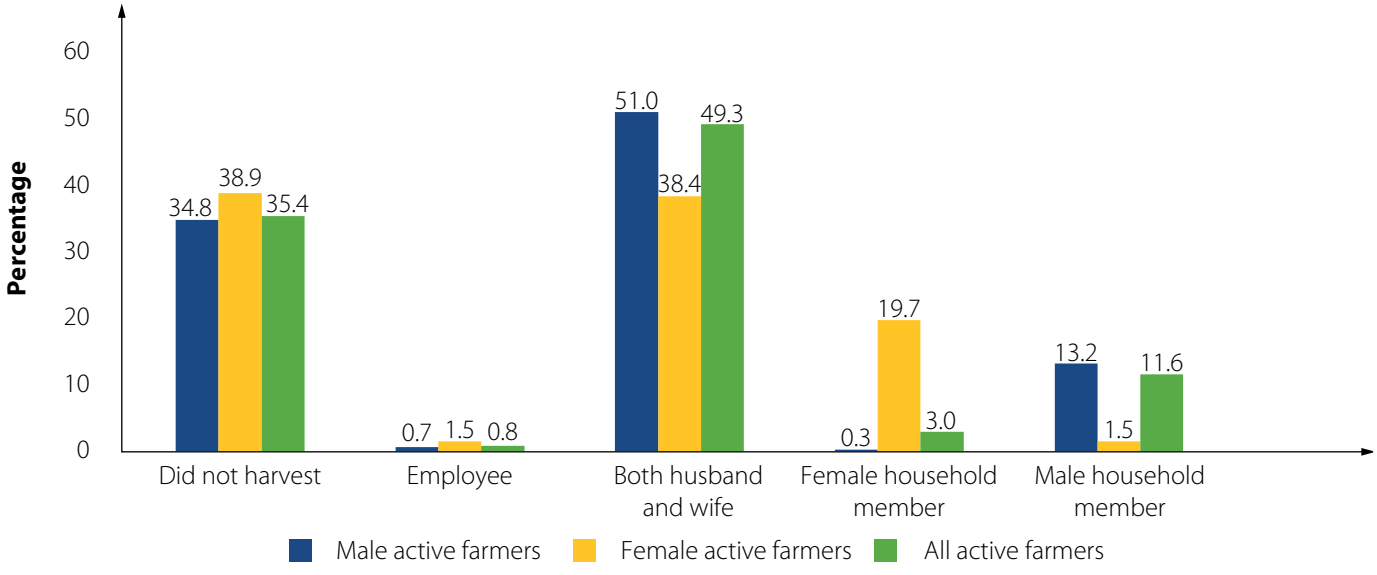


**Figure 17**. Responsibility for harvesting fish (by sex).

Based on marital status (Table 17), among those who harvested fish, both married men and women farmers were likely to say that it is the joint responsibility of spouses. Unmarried men were likely to choose other male members of the household, while unmarried women were likely to choose other female household members. Among single farmers, a significant proportion of single men also selected other female household members as having the responsibility to decide on fish harvesting, but only a negligible percentage of single women said the same for other male household members. The differing perceptions of single women might reflect that unmarried women were likely to be household heads. In contrast, a significant proportion of single men could be young men living in female-headed households.

When it comes to marketing and sales (Figure 18), a large proportion of farmers had never sold fish. The percentage of these farmers was slightly higher among women farmers than among men farmers.

The results for decision-making on fish marketing according to marital status (Table 18) are consistent with other results. Unmarried women farmers consistently said that they are the ones who

| Decision-making for fish harvesting | Marital status of men | | Marital status of women | |
|---|---|---|---|---|
| | Unmarried (%) | Married (%) | Unmarried (%) | Married (%) |
| | n=69 | n=928 | n=45 | n=108 |
| Both husband and wife | 20.3 | 65.4 | 31.1 | 57.4 |
| Female household member | 30.4 | 20.0 | 62.2 | 39.8 |
| Male household member | 49.3 | 13.7 | 2.2 | 1.9 |
| Employee | | 0.8 | 4.4 | 0.9 |

**Table 17**. Responsibility for making decisions on harvesting fish (by marital status).

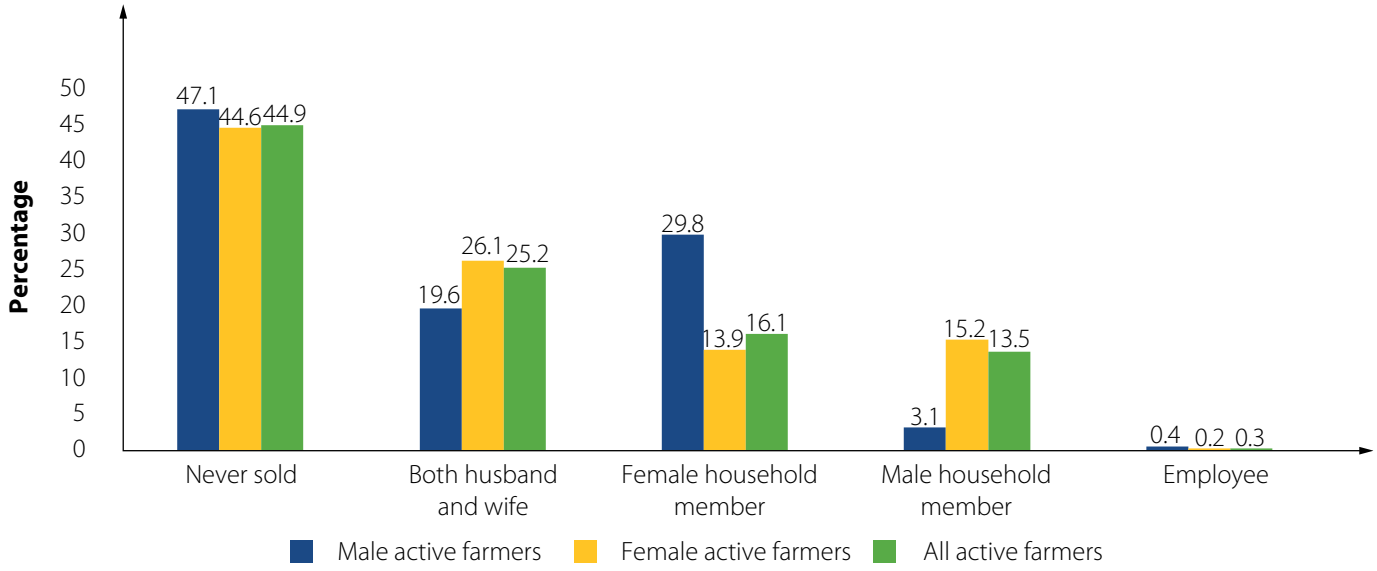


**Figure 18**. Responsibility for marketing and selling fish (by sex).

| Responsibility for fish marketing | Marital status of men | | Marital status of women | |
|---|---|---|---|---|
| | Unmarried (%) | Married (%) | Unmarried (%) | Married (%) |
| | n=60 | n=717 | n=34 | n=87 |
| Both husband and wife | 16.7 | 49.7 | 29.4 | 39.1 |
| Male household member | 53.3 | 25.2 | - | 8.1 |
| Female household member | 30.0 | 24.7 | 70.6 | 51.7 |
| Employee | - | 0.4 | - | 1.2 |

**Table 18**. Responsibility for fish marketing (by marital status).

are responsible for making these decisions. A significant proportion of single men farmers also claimed that the decision is the responsibility of other female household members.

It would seem that there is less joint decision-making on this among farmers compared with decisions on other aspects, such as harvesting, acquiring fingerlings and land allocation. Among the farmers, however, married men were more likely than married women to say that the decision is made jointly. Both married and single women were more likely to say that fish marketing is the responsibility of a female household member, while single men mostly selected other household members.

When it comes to making decisions on how to use income generated from fish (Figure 19), more than two-thirds of all farmers indicated that spouses decide together. The percentage of men who said so was much higher than among the women. The largest percentage of women said that the female household head makes these decisions. This could be because the majority of women farmers interviewed were single and heads of their households.

While men and women farmers differed regarding who is responsible for marketing, married men and women were likely to say that the decision on managing income from fish sales was the joint responsibility of spouses (Table 19).

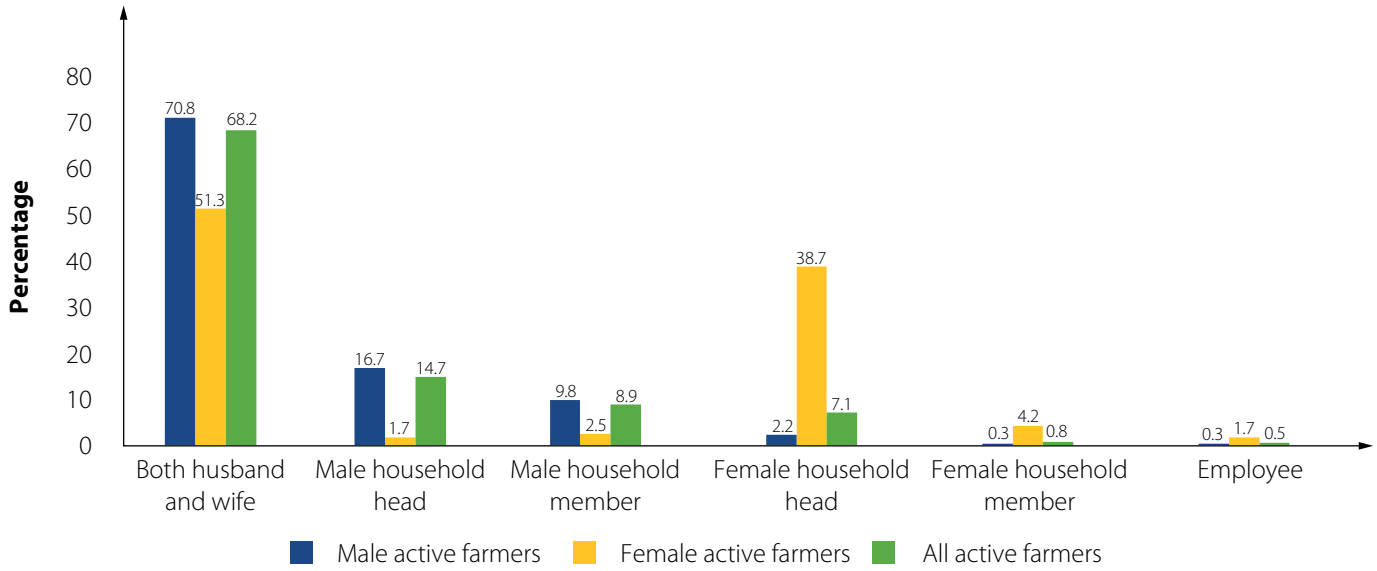


**Figure 19**. Responsibility for decision-making on how to use income (by sex).

| Responsibility for income management | Marital status of men | | Marital status of women | |
|---|---|---|---|---|
| | Unmarried (%) | Married (%) | Unmarried (%) | Married (%) |
| | n=74 | n=745 | n=35 | n=92 |
| Joint decision | 10.8 | 75.4 | 20.0 | 60.9 |
| Male household head | 21.6 | 16.4 | - | 2.2 |
| Male household member | 67.6 | 5.2 | - | 3.3 |
| Female household head | - | 2.4 | 71.4 | 26.1 |
| Employee | - | 0.3 | 2.9 | 1.1 |
| Female household member | - | 0.3 | 5.7 | 6.5 |

**Table 19**. Responsibility for managing income from fish sales (by marital status).

On the other hand, single men were likely to select other male household members, while single women selected female household heads. This might indicate that both single men and women farmers have a bigger say and control over income from fish sales.

### 3.4.2 Participation of youths in fish farming

In the census report, youths were defined as farmers aged between 15 and 35 years old (Ministry of Youth and Sports 2015), while older farmers were those who were over 35. The vast majority of youths said that they owned the land they used for fish farming. The proportion of youths who owned land was higher among males compared to females (Table 20).

Nearly two-thirds of older farmers and more than half of young farmers said that the male household head made decisions on how to allocate land (Table 21). Young men and young women farmers were just about as likely to say that male household heads make decisions on land allocation. Young women were far more likely than young men to indicate that spouses do so together.

| Land ownership | Youth farmers | Older farmers | Total active farmers |
|---|---|---|---|
| | n=544 | n=1093 | n=1637 |
| Self-owned | 85.5 | 95.4 | 92.1 |
| Extended family land | 11.0 | 2.5 | 5.3 |
| Spouse owns | 2.6 | 1.6 | 1.9 |
| Rented | 0.9 | 0.6 | 0.7 |
| **Total** | **100** | **100** | **100** |

**Table 20**. Youth and older farmers who owned land for fish farming.

| Responsibility for land allocation | Active youth farmers | Active older farmers | All active farmers (%) |
|---|---|---|---|
| | n=561 | n=1126 | n=1687 |
| Male household head | 54.2 | 64.5 | 61.1 |
| Male household member | 26.4 | 13.7 | 17.9 |
| Joint decision | 14.3 | 15.3 | 14.9 |
| Female household head | 2.7 | 4.8 | 4.1 |
| Female household member | 2.1 | 1.5 | 1.7 |
| Employee | - | 0.2 | 0.1 |
| Not sure | 0.4 | 0.1 | 0.2 |
| **Total** | **100.0** | **100.0** | **100.0** |

**Table 21**. Participation of youth and older farmers in decision-making for land allocation for fishpond construction.

Regarding harvesting at the household level (Figure 20), just over one-third of youths and over half of older farmers said that spouses jointly make the decisions. The results also show that a much greater share of younger farmers had never harvested fish compared to older farmers. There were no percentage differences in the proportion of young male and female farmers who participate in decision-making for harvesting fish at the household level. For both youths and older farmers, the decision to harvest fish was mostly seen as made jointly with their spouse. However, within households, young men were thought to be more likely engaged in this decision than young women.

Regarding decision-making among farmers about acquiring fingerlings (Figure 21), young men were more likely than older farmers (both men and

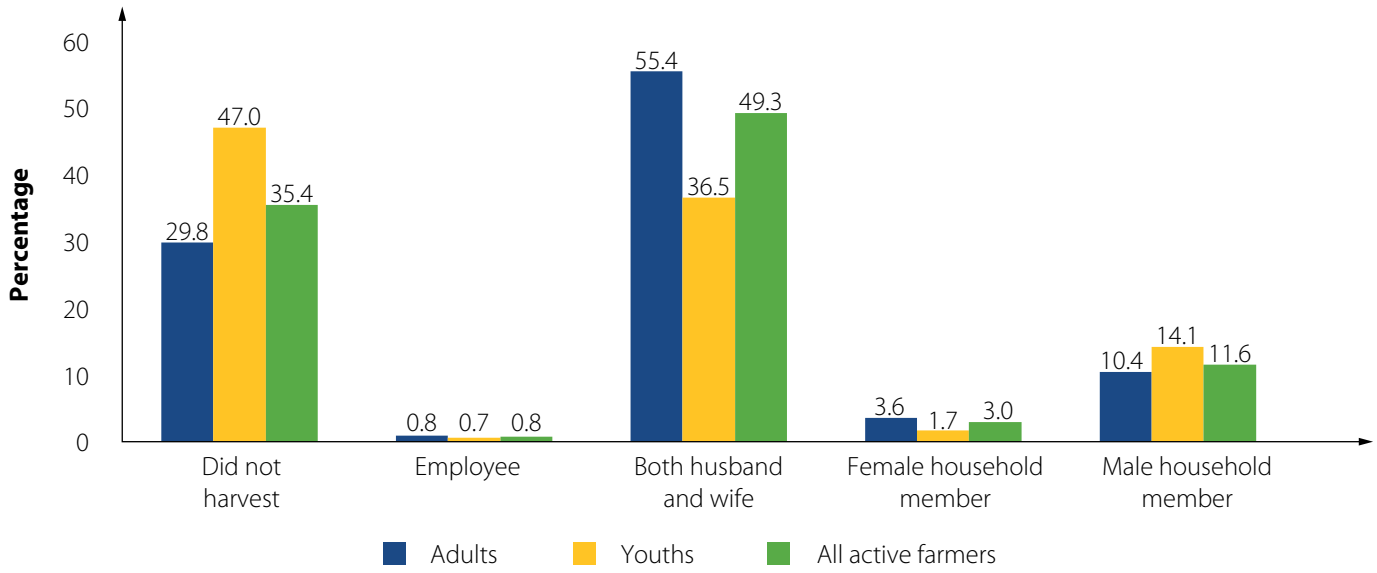


**Figure 20**. Participation of youth and older farmers in decision-making for harvesting farmed fish at the household level.

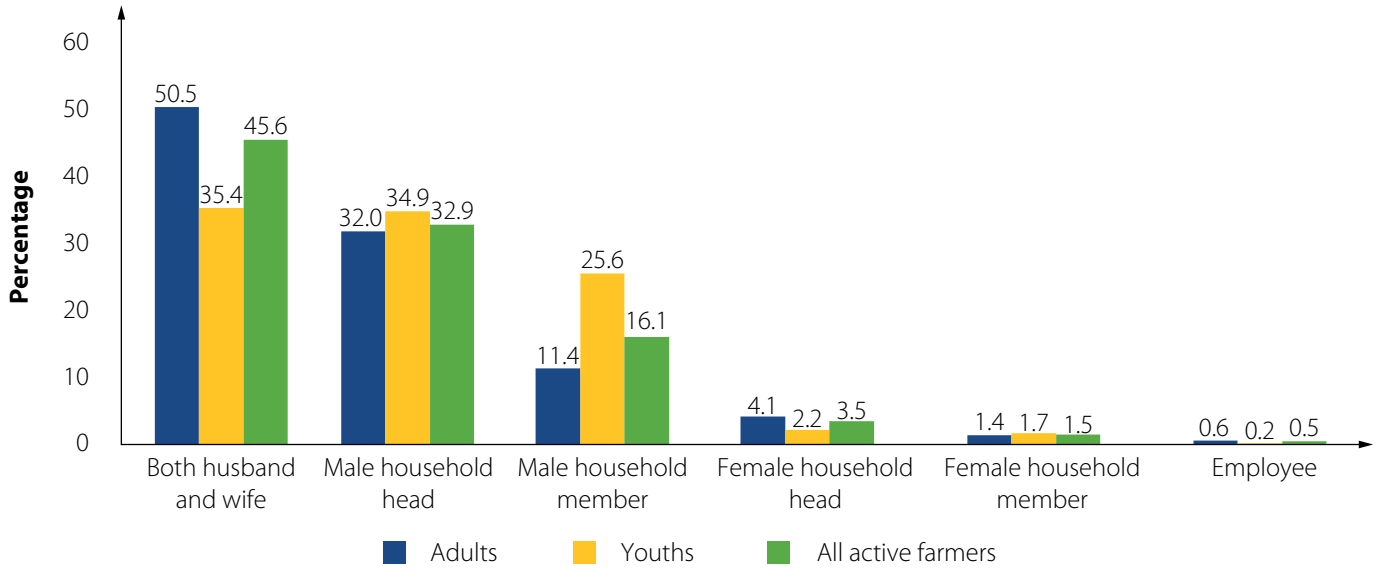


**Figure 21**. Youth and older farmers who participate in decision-making for acquiring fingerlings at the household level.

women) as well as younger women to say that male household heads or other male members make these decisions. In contrast, young women were more likely to perceive decisions as jointly made or made by female household heads or other female members of the household. Both younger and older farmers said that decisions to acquire fingerlings were made jointly by both spouses.

However, more older than younger farmers said that such decisions were made were jointly.

In fish marketing, among youth farmers both spouses participate in making these decisions (Figure 22). However, the share of youths who said that they made these decisions jointly with their spouse was lower compared to older farmers. Over half of youth farmers had never sold fish.

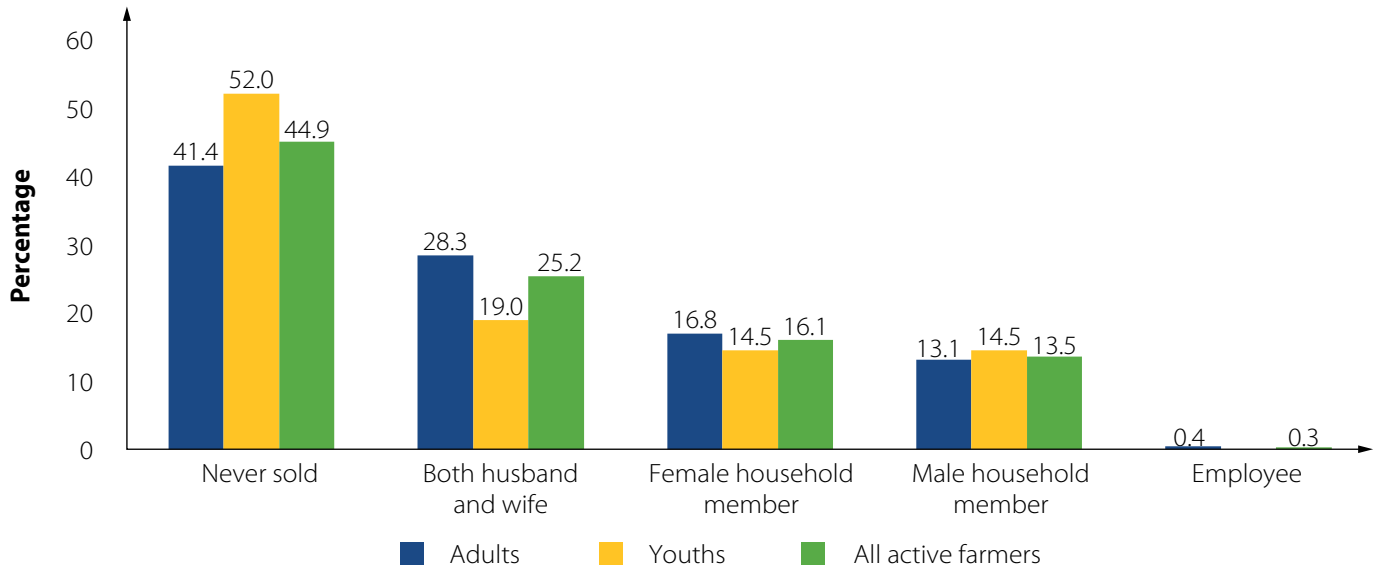


**Figure 22**. Participation of youth and older farmers in decision-making for fish marketing at the household level.

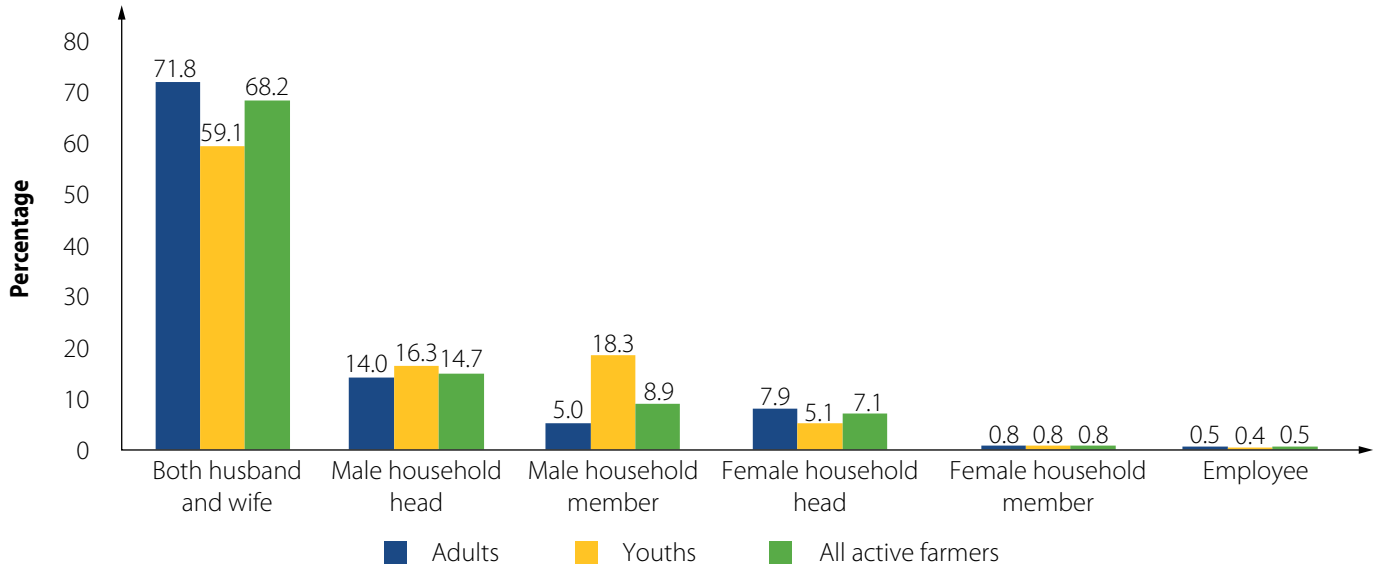


**Figure 23**. Participation of youth and older farmers in decision-making for managing income from fish farming.

## 3.5 Access to input markets

This section discusses the sources of fish farming inputs. Among the farmers, the primary source of seed (fingerlings) was fellow farmers, followed by the farmers' own recycled fingerlings and then the government hatchery (Figure 24). Other sources included wild resources, nongovernmental organizations, private hatcheries and other local breeders.

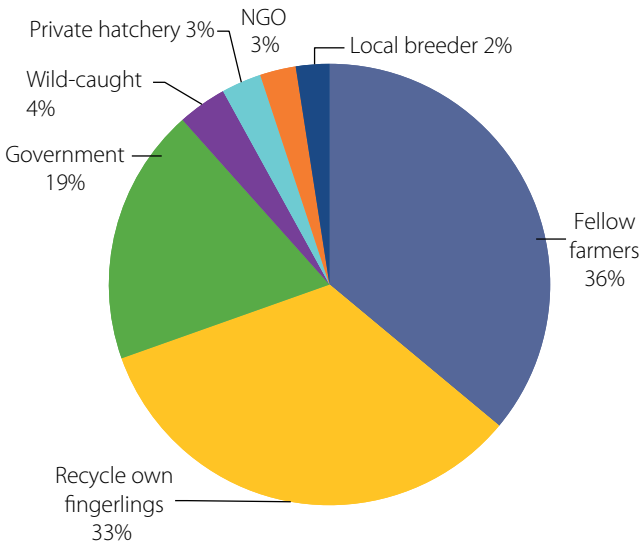


**Figure 24**. Sources of fingerlings.

Using sex-reversed fingerlings for tilapia is encouraged to improve fish production under aquaculture conditions. However, almost all of the farmers in the census do not use sex-reversed fingerlings (Figure 25).

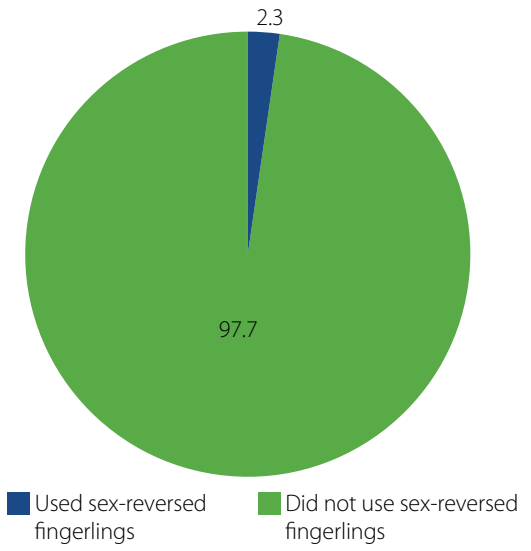


**Figure 25**. Farmers using sex-reversed fingerlings.

The census defined commercial feed as processed feed from feed milling companies while noncommercial feed included using farm materials, such as vegetables, kitchen waste, termites, residue from hammer mills, maize bran and homemade feed from soybeans and sunflowers. Smallholder farmers primarily use noncommercial fish feeds, while some use both commercial and noncommercial feeds, though very few use only commercial feed (Figure 26).

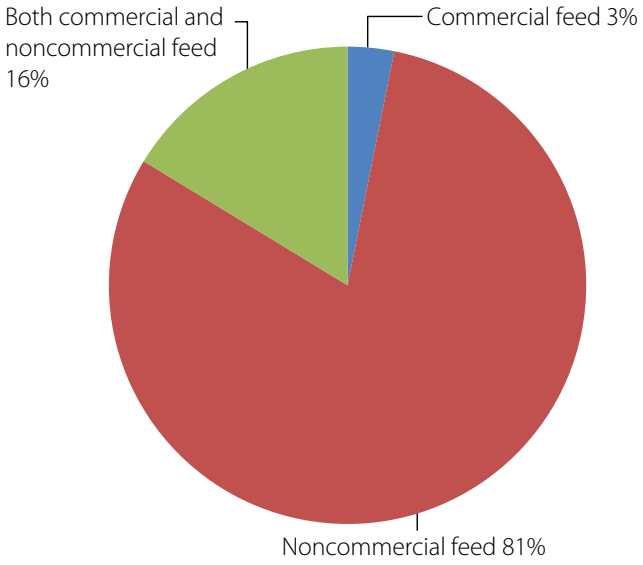


**Figure 26**. Feed types used.

Regarding the distribution of fish feed sources, over three-quarters of the farmers use feed materials from around their farms and homesteads (Figure 27). The next biggest share of the farmers combined feed from two sources: the commercial feed shop and their own farm. The smallest proportions of the farmers used either one or the other.

While a third of the farmers could access feed close to their communities, a majority of the farmers covered long distances of over 20 km to reach the nearest commercial fish feed shop (Figure 28).

When it comes to pond fertilization (Figure 29), organic manure was the primary means of fertilizing ponds. The majority of farmers used animal manure as fertilizer, while inorganic fertilizer was rarely used.

## 3.6 Access to extension services

Access to extension services and knowledge is a key contributor to increased productivity. The analysis in this section is based only on fish farmers who were active at the time of the census.

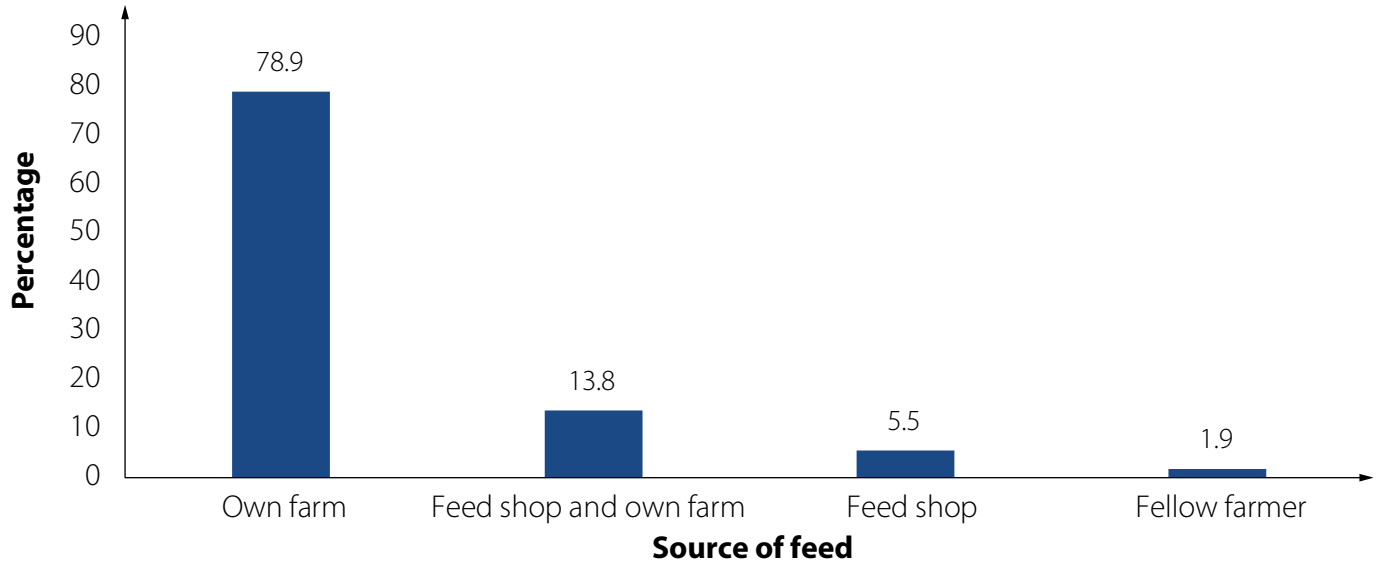


**Figure 27**. Sources of fish feed.

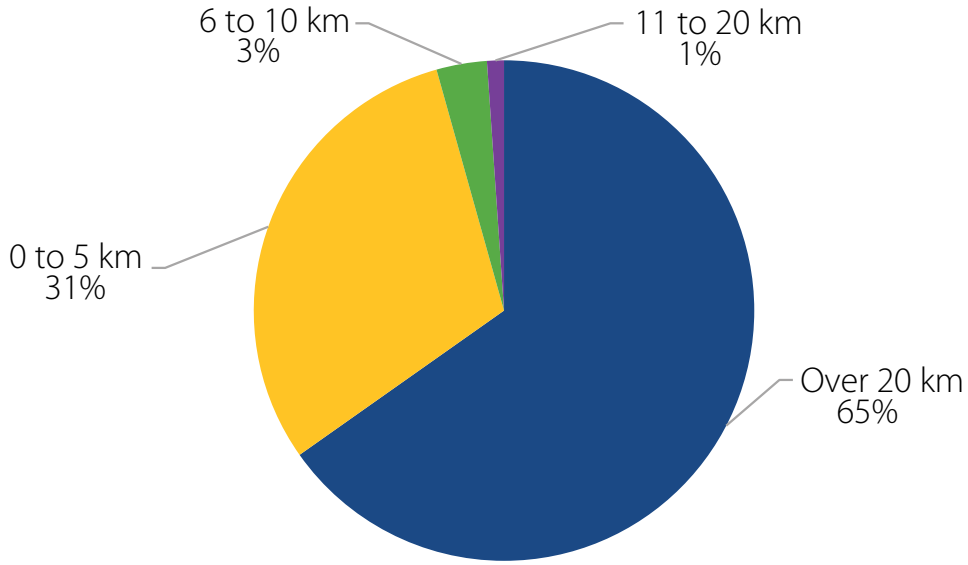


**Figure 28**. Distance covered to access commercial fish feed.

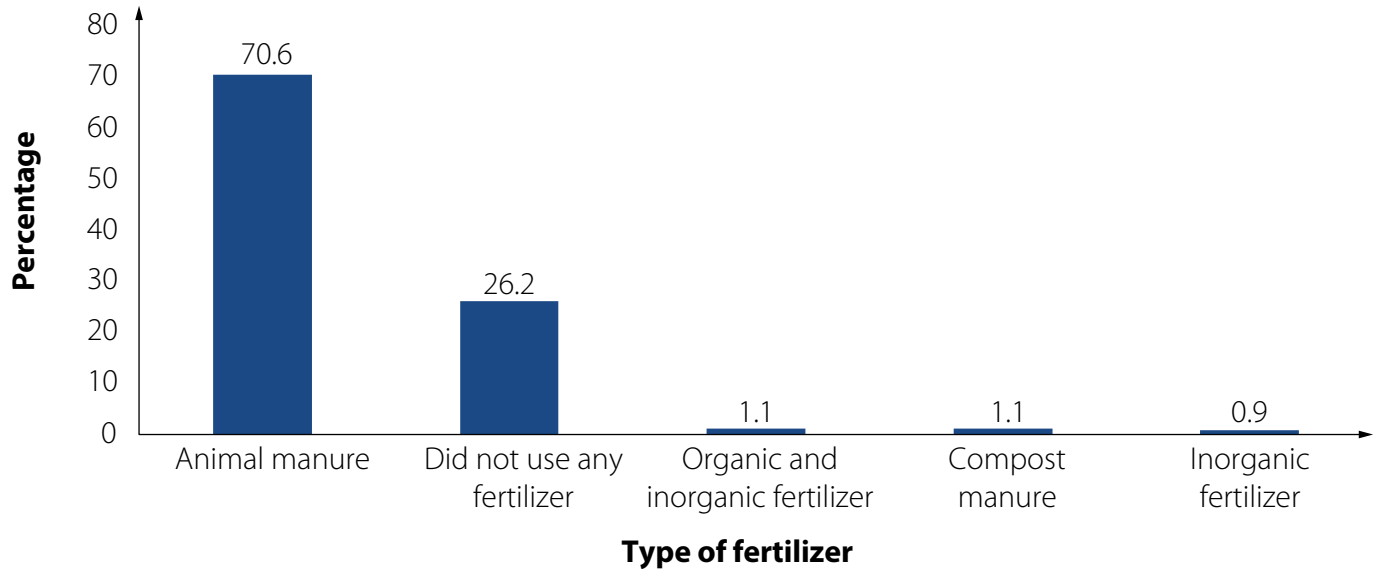


**Figure 29**. Types of fertilizer used.

Access to extension services and technical information on fish farming was limited. Study participants were asked if they had received any extension services over the 12 months prior to the census (Table 22). Less than a quarter of the farmers said that they had received such a visit, while the rest said they had not. The shares were roughly the same for both men and women farmers.

Fellow farmers were a primary source of information on fish farming for the farmers (Figure 30). This was followed by both extensions officers, the Peace Corps and, to a much lesser extent, private consultants.

In the previous 12 months, about a quarter of the farmers had received formal training on fish farming, while the rest said they had not (Table 23). As a result, few farmers had access to the most up-to-date information and knowledge to improve their farming skills.

| Access to extension | Active men farmers (%) | Active women farmers (%) | All active farmers (%) |
|---|---|---|---|
| | n=1454 | n=235 | n=1689 |
| I have never been visited by a fisheries officer in the past 12 months | 79.2 | 75.7 | 78.7 |
| I have been visited by a fisheries officer in the past 12 months | 20.8 | 24.3 | 21.3 |
| **Total** | **100.0** | **100.0** | **100.0** |

**Table 22**. Farmers visited by an extension officer in the previous 12 months.

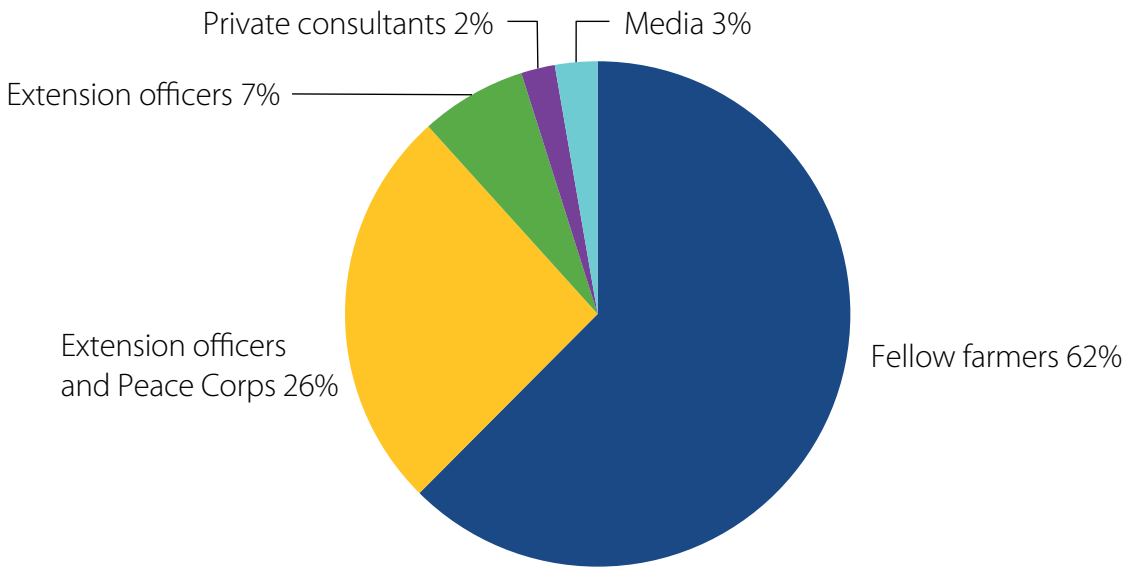


**Figure 30**. Sources of information about fish farming.

| Access to formal training | Active men farmers (%) | Active women farmers (%) | All active farmers (%) |
|---|---|---|---|
| | n=1454 | n=235 | n=1689 |
| Did not receive formal training | 73.8 | 66.0 | 72.7 |
| Received formal training | 26.2 | 34.0 | 27.3 |
| **Total** | **10.0** | **100.0** | **100.0** |

**Table 23**. Farmers who had received formal training on fish farming.

## 3.7 Access to output markets

As for where farmers sold their fish (Figure 31), the majority sold it to their neighbors at their own farm. Less than a quarter of the farmers said that they sold their fish at the local market. Only a handful of farmers sold their fish at church.

Farmers were also asked about how much they earned from selling their fish (Table 24). The average price was ZMW 20.4/kg (±0.2). The lowest price was ZMW 10/kg while the highest was ZMW 40/kg. Among all of the farmers, the average income was ZMW 1263.3 (±101.8) per growing cycle, with men farmers averaging slightly higher earnings than women farmers.

When it came to the length of the fish production cycle (Figure 32), most farmers used a production cycle of 7–12 months, followed by those who used a 6-month cycle. Only a small percentage used a production cycle for over 12 months.

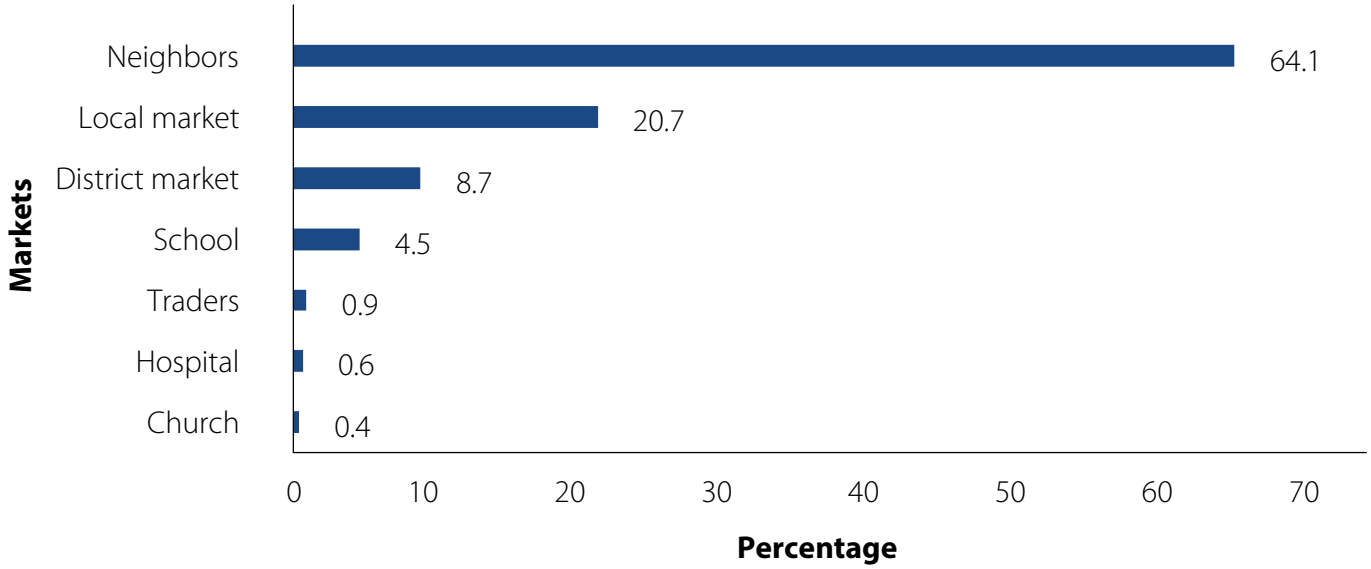


**Figure 31**. Markets for farmed fish.

| Sex | Average income (ZMW) | Std. Err.(±) | Min | Max |
|---|---|---|---|---|
| All farmers | 1263.3 | 101.8 | 5.0 | 36,000 |
| Men farmers | 1273.6 | 109.3 | 5.0 | 36,000 |
| Women farmers | 1194.6 | 281.4 | 6.0 | 27,300 |

**Table 24**. Average income per growing cycle.

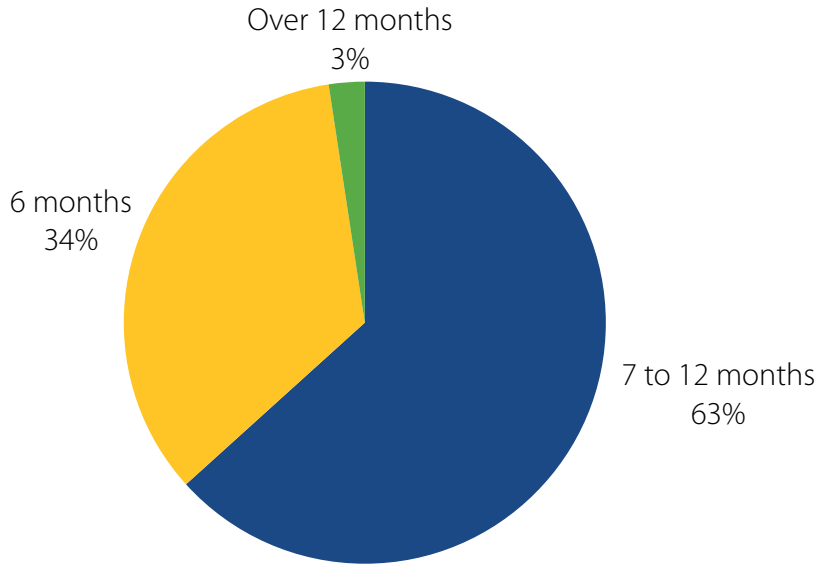


**Figure 32**. Length of production cycle.

As indicated in the previous sections, there are various reasons why farmers venture into fish farming. Some of them get into aquaculture so that they can have fish for consumption. Farmers were asked about the frequency of fish consumption from their farms (Figure 33). Overall, the largest share of farmers consumed fish only at harvest, followed by those who ate it once a month. A small share of farmers who ate fish did so more than once per week. The results further show that the frequency of fish consumption among women is slightly higher than among men.

## 3.8 Production constraints and opportunities

It terms of challenges farmers face (Table 25), a lack of fingerlings was the primary concern followed by a lack of access to feed. Challenges faced by smallholder farmers in each district are presented in Annex 4.

Despite feed being a challenge, the vast majority of farmers said that they had the financial capacity to buy commercial feed (Table 26). This shows that the feed challenge is related to the lack of physical availability of feed close to farmers.

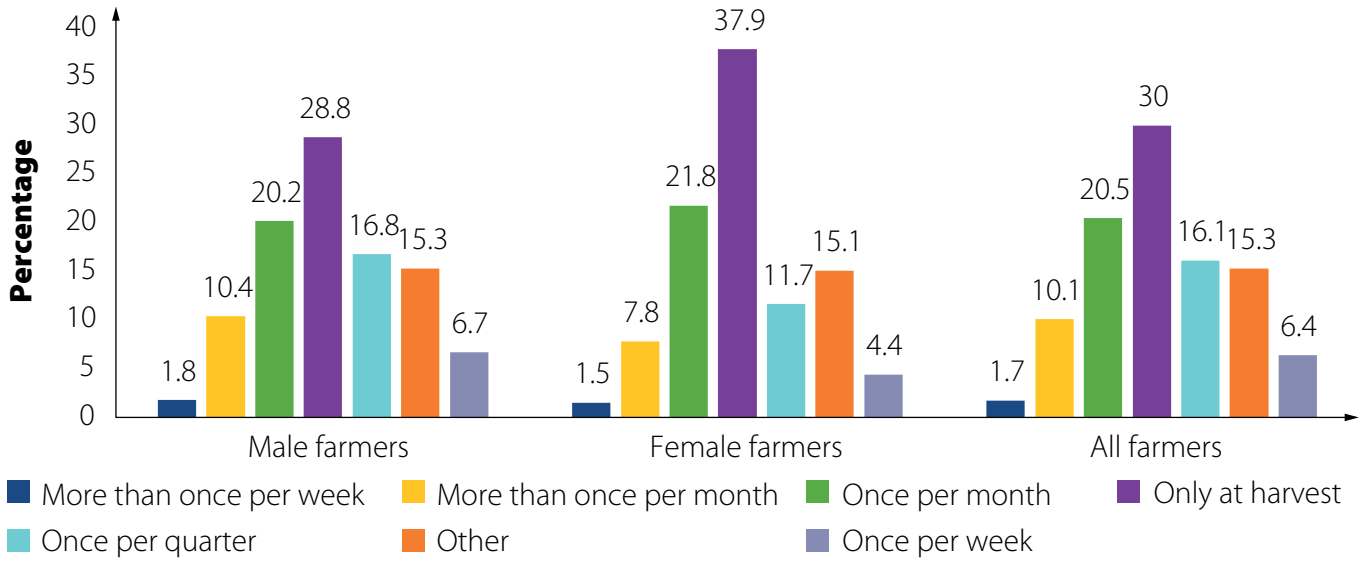


**Figure 33**. Frequency of fish consumption.

| Challenges | Active men farmers (%) | Active women farmers (%) | All active farmers (%) |
|---|---|---|---|
| | n=1451 | n=236 | n=1687 |
| Lack of fingerlings | 51.0 | 35.2 | 48.8 |
| Feed not available | 35.0 | 44.9 | 36.4 |
| Feed too expensive | 4.3 | 5.5 | 4.5 |
| No training | 3.8 | 2.5 | 3.6 |
| Fingerlings too expensive | 2.9 | 4.2 | 3.1 |
| Predation | 1.5 | 2.5 | 1.7 |
| Limited finances | 0.2 | 1.7 | 0.4 |
| Stunted growth | 0.1 | 2.1 | 0.4 |
| Other* | 1.1 | 1.3 | 1.1 |
| **Total** | **100.0** | **100.0** | **100.0** |

**Includes water shortage, poor soil quality, inadequate access to labor and transportation.*

**Table 25**. Challenges faced by active farmers.

Table 26 shows the challenges faced by farmers who abandoned fish farming. The top three challenges given were a lack ofingerlings, shortage of water and theft of fish. Lack of seed/fingerlings was a major challenge for farmers in all the districts except for Mpulungu, Chipili and Mungwi, where shortage of water was a major problem, while farmers in Kawambwa were mostly affected by theft of fish (Tables 31 and 32 in the Annexes).

Despite feed being a challenge, the vast majority of farmers said that they had the financial capacity to buy commercial feed (Table 27). This shows that the feed challenge is related to the lack of physical availability of feed close to farmers.

| Challenges of farmers who abandoned fish farming | Active men farmers (%) | Active women farmers (%) | All active farmers (%) |
|---|---|---|---|
| | n=541 | n=89 | n=630 |
| Lack of fingerlings | 26.3 | 31.5 | 27.0 |
| Water shortage | 26.3 | 23.6 | 25.9 |
| Theft of fish | 18.9 | 28.1 | 20.2 |
| Predation | 13.7 | 12.4 | 13.5 |
| Fish escaped due to floods | 6.3 | - | 5.4 |
| Stunted growth | 4.1 | 1.1 | 3.7 |
| Limited finances | 2.6 | 2.3 | 2.5 |
| No feed | 0.6 | - | 0.5 |
| Other* | 1.5 | 1.1 | 1.4 |
| **Total** | **100.0** | **100.0** | **100.0** |

**Includes farmers who abandoned fish farming as a result of relocation, sickness, death of the household head and lack of training.*

**Table 26**. Challenges faced by farmers who abandoned fish farming.

| Financial capacity | Active men farmers (%) | Active women farmers (%) | All active farmers (%) |
|---|---|---|---|
| | n=1454 | n=235 | n=1689 |
| Have financial capacity | 86.9 | 83.0 | 86.4 |
| Do not have financial capacity | 13.1 | 17.0 | 13.6 |
| **Total** | **100.0** | **100.0** | **100.0** |

**Table 27**. Financial capacity to purchase commercial feed.

# Conclusion

The census collected data to understand the smallholder fish farming systems in Northern and Luapula provinces of Zambia. This included gaining an understanding who the fish farmers are, their location and the fish production systems. Men farmers made up a large proportion of self-identified fish farmers in the census. However, married farmers work jointly with their spouses in various farming activities. Women farmers are more likely than men to be single, widowed or divorced. A woman's marital status influences her ability to engage in certain decisions related to fish farming.

Formal education levels among fish farmers are generally low, though much lower among women. A significant proportion of fish farmers is between 36 and 64 years of age. Many of the fish farmers are relatively new in the sector, with only 1–5 years of experience.

Almost all fish farmers use earthen ponds and rely on family labor to build and maintain them as well as to stock the fish. Farmers have an average of two fishponds, which in most cases are stocked with more than one *Oreochromis* fish species. While farmers usually have access to water, they only have access to the most basic agricultural tools, such as a hoe, axe, pick, shovel, bucket and a basket.

Farmers are also plagued by low productivity. This can be a result of many compounding factors, including limited access to extension services, lack of access to up-to-date knowledge and technologies, lack of access to farm inputs (such as seed and feed) and a lack of access to output markets. A large proportion of farmers, for example, does not use commercial feeds. Also, almost all the farmers do not have access to good quality fingerlings and practice mixed-sex tilapia farming, which has implications for productivity. However, many factors can explain the low productivity of the smallholder aquaculture sector. One of them is inadequate infrastructure, notably inputs and output markets to support the aquaculture subsector. There is also limited access to extension services. As a result, farmers depend on their fellow farmers for supplying farming inputs, such as information about fish farming, fingerlings and feed. Some farmers have resorted to recycling fingerlings and feeding their fish with farm materials such as vegetables, termites and waste materials from the kitchen while others have simply abandoned fish farming. These factors have significantly affected their production, productivity and profitability.

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Ministry of Youth and Sports. 2015. 2015 National youth policy: Towards a skilled, enlightened, economically empowered youth and patriotic youth impacting positively on national development. 1–19.

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# List of figures

# List of tables

# Annex 1. Distribution of smallholder farmers

| Luwingu | | |
|---|---|---|
| **Camp name** | **Number of farmers** | **Percentage** |
| Nsombo | 86 | 20.4 |
| Mufili | 55 | 13.1 |
| Tungati | 53 | 12.6 |
| Luwingu main | 51 | 12.1 |
| Kapisha | 21 | 5.0 |
| Katuta | 19 | 4.5 |
| Chungu | 18 | 4.3 |
| Shimumbi | 18 | 4.3 |
| Chifwile | 16 | 3.8 |
| Mampulanga | 14 | 3.3 |
| Muchelaka | 14 | 3.3 |
| Luena | 13 | 3.1 |
| Mfungwe | 11 | 2.6 |
| Malekani | 8 | 1.9 |
| Lundu | 6 | 1.4 |
| Misambula | 6 | 1.4 |
| Mutondo | 4 | 1.0 |
| Chibaye | 3 | 0.7 |
| Chitunkubwe | 2 | 0.5 |
| Chipemba | 1 | 0.2 |
| Katuta | 1 | 0.2 |
| Rosa | 1 | 0.2 |
| **Total** | **421** | **100.0** |

| Mbala | | |
|---|---|---|
| **Camp name** | **Number of farmers** | **Percentage** |
| Kaka | 55 | 14.7 |
| Masamba | 46 | 12.3 |
| Kakungu | 42 | 11.2 |
| Mwamba | 37 | 9.9 |
| Kawimbe | 27 | 7.2 |
| Mambwe mission | 24 | 6.4 |
| Masamba east | 21 | 5.6 |
| Nondo | 20 | 5.4 |
| Lunzua | 15 | 4.0 |
| Sikalembe | 14 | 3.7 |
| Mutwizi | 11 | 2.9 |
| Senga | 10 | 2.7 |
| Lucheche | 8 | 2.1 |
| Maule | 7 | 1.9 |
| Nsokolo | 7 | 1.9 |
| Kamuzwazi | 5 | 1.3 |
| Kasesha west | 5 | 1.3 |
| Chindo | 3 | 0.8 |
| Kasesha | 3 | 0.8 |
| Chinakila | 2 | 0.5 |
| Kapatu | 2 | 0.5 |
| Chitimbwa | 1 | 0.3 |
| Kaka | 1 | 0.3 |
| Kalongola | 1 | 0.3 |
| Kangu | 1 | 0.3 |
| Kawimbe | 1 | 0.3 |
| Lunse lwamfumu | 1 | 0.3 |
| Masamba east | 1 | 0.3 |
| Mukungwa | 1 | 0.3 |
| Mwembezi | 1 | 0.3 |
| Tanzuka | 1 | 0.3 |
| **Total** | **374** | **100.0** |

| Mpulungu | | |
|---|---|---|
| **Camp name** | **Number of farmers** | **Percentage** |
| Kabamba | 43 | 26.9 |
| Chitimbwa | 40 | 25.0 |
| Kalongola | 24 | 15.0 |
| Mpulungu central | 13 | 8.1 |
| Iyendwe | 12 | 7.5 |
| Chinakila | 9 | 5.6 |
| Vyamba | 5 | 3.1 |
| Kaizya | 4 | 2.5 |
| Kabamba | 3 | 1.9 |
| Kalonda | 2 | 1.3 |
| Mpulungu central | 2 | 1.3 |
| Kapondwe | 1 | 0.6 |
| Lunzua | 1 | 0.6 |
| Mbaso | 1 | 0.6 |
| **Total** | **160** | **100.0** |

| Mporokoso | | |
|---|---|---|
| **Camp name** | **Number of farmers** | **Percentage** |
| Chalabesa | 46 | 18.9 |
| Chisha mwamba | 28 | 11.5 |
| Chiwala | 61 | 25.1 |
| Kalabwe | 24 | 9.9 |
| Kalabwe | 1 | 0.4 |
| Kambobe | 11 | 4.5 |
| Kapanda | 3 | 1.2 |
| Kapumo | 25 | 10.3 |
| Katutwa | 15 | 6.2 |
| Matamba | 1 | 0.4 |
| Matanda | 3 | 1.2 |
| Muchelaka | 1 | 0.4 |
| Mulama | 2 | 0.8 |

| Mporokoso | | |
|---|---|---|
| **Camp name** | **Number of farmers** | **Percentage** |
| Mutotoshi | 8 | 3.3 |
| Mwange | 5 | 2.1 |
| Mwange | 4 | 1.7 |
| Njala mimba | 5 | 2.1 |
| **Total** | **243** | **100.0** |

| Mungwi | | |
|---|---|---|
| **Camp name** | **Number of farmers** | **Percentage** |
| Chimba | 29 | 13.0 |
| Nseluka | 23 | 10.3 |
| Rosa | 19 | 8.5 |
| Chonya | 15 | 6.7 |
| Kafusha | 14 | 6.3 |
| Maliko | 11 | 4.9 |
| Malole | 10 | 4.5 |
| Chamfubu | 9 | 4.0 |
| Itinti | 8 | 3.6 |
| Makasa | 8 | 3.6 |
| Mungwi east | 8 | 3.6 |
| Nfishe | 8 | 3.6 |
| Kaseke | 6 | 2.7 |
| Kayambi | 6 | 2.7 |
| Ngulula | 6 | 2.7 |
| Kamfusha | 4 | 1.8 |
| Mulala | 4 | 1.8 |
| Chafubu | 3 | 1.4 |
| Chipapa | 3 | 1.4 |
| Kalupa | 3 | 1.4 |
| Kamena | 3 | 1.4 |
| Kampanda | 3 | 1.4 |
| Nsombo | 3 | 1.4 |

| Mungwi | | |
|---|---|---|
| **Camp name** | **Number of farmers** | **Percentage** |
| Chandaweyaya | 2 | 0.9 |
| Makasa | 1 | 0.5 |
| Changala | 1 | 0.5 |
| Chikwa | 1 | 0.5 |
| Chilongwa | 1 | 0.5 |
| Chimpili | 1 | 0.5 |
| Chitanga | 1 | 0.5 |
| Ilondola | 1 | 0.5 |
| Kasoma | 1 | 0.5 |
| Katongo | 1 | 0.5 |
| Mambwe mission | 1 | 0.5 |
| Mibulumo | 1 | 0.5 |
| Mungwi central | 1 | 0.5 |
| Mungwi west | 1 | 0.5 |
| Mupeta | 1 | 0.5 |
| Muyala | 1 | 0.5 |
| **Total** | **223** | **100** |

**Table 28**. Smallholder farmers in Northern Province by camp and district.

| Samfya | | |
|---|---|---|
| **Camp name** | **Number of farmers** | **Percentage** |
| Kasaba | 31 | 15.9 |
| Mano | 28 | 14.4 |
| Katanshya | 23 | 11.8 |
| Lubwe one | 16 | 8.2 |
| Mungulube | 10 | 5.1 |
| Samfya central | 10 | 5.1 |
| Chibuye | 9 | 4.6 |
| Mwewa | 8 | 4.1 |
| Kalasamokoso | 7 | 3.6 |
| Munimbwe | 7 | 3.6 |
| Mulakwa | 6 | 3.1 |
| Shimalingu | 6 | 3.1 |
| Chitundwa | 4 | 2.1 |
| Njipi | 4 | 2.1 |
| Samfya central | 4 | 2.1 |
| Chitundwa | 3 | 1.5 |
| Lubwe two | 3 | 1.5 |
| Miponda | 3 | 1.5 |
| Fibalala | 2 | 1.0 |
| Kasanka | 2 | 1.0 |
| Chamalawa | 1 | 0.5 |
| Chinsanka | 1 | 0.5 |
| Makasa | 1 | 0.5 |
| Mbilimamwenge | 1 | 0.5 |
| Mulisha | 1 | 0.5 |
| Mungulube | 1 | 0.5 |
| Muponda | 1 | 0.5 |
| Sikamusili | 1 | 0.5 |
| Wapamesa | 1 | 0.5 |
| **Total** | **195** | **100** |

| Kawambwa | | |
|---|---|---|
| **Camp name** | **Number of farmers** | **Percentage** |
| Chibote | 69 | 19.3 |
| Lusambo | 38 | 10.6 |
| Musungu | 38 | 10.6 |
| Shinonde | 29 | 8.1 |
| Ntembo | 23 | 6.4 |
| Chitondo | 16 | 4.5 |
| Chitondo | 16 | 4.5 |
| Shikalaba | 14 | 3.9 |
| Chimpili | 12 | 3.4 |
| Munkanta | 11 | 3.1 |
| Ntenke | 11 | 3.1 |
| Kala | 8 | 2.2 |
| Kanengo | 8 | 2.2 |
| Wapamesa | 8 | 2.2 |
| Ntembo | 7 | 2.0 |
| Chibote | 6 | 1.7 |
| Chisheta | 5 | 1.4 |
| Folotiya | 5 | 1.4 |
| Chisheta | 4 | 1.1 |
| Kabende | 4 | 1.1 |
| Lengwe | 4 | 1.1 |
| Ntenke | 4 | 1.1 |
| Chimpili | 3 | 0.8 |
| Folotiya | 3 | 0.8 |
| Muyembe | 3 | 0.8 |
| Kalaba | 2 | 0.6 |
| Musungu | 2 | 0.6 |
| Shikalabwe | 2 | 0.6 |
| Kanengo | 1 | 0.3 |
| Luena | 1 | 0.3 |
| Shikalaba | 1 | 0.3 |
| **Total** | **358** | **100** |

| Mansa | | |
|---|---|---|
| **Camp name** | **Number of farmers** | **Percentage** |
| Mabumba | 84 | 31.5 |
| Chisunka | 25 | 9.4 |
| Matanda | 23 | 8.6 |
| Mulonga | 21 | 7.9 |
| Chimfuli | 18 | 6.7 |
| Kalaba | 12 | 4.5 |
| Mutiti | 11 | 4.1 |
| Mabumba | 9 | 3.4 |
| Mbaso | 9 | 3.4 |
| Kabende | 8 | 3.0 |
| Kapyata | 8 | 3.0 |
| Kale | 6 | 2.3 |
| Chisunka | 5 | 1.9 |
| Mibenge | 3 | 1.1 |
| Fimpulu | 2 | 0.8 |
| Kaole | 2 | 0.8 |
| Lupenda | 2 | 0.8 |
| Mansa central | 2 | 0.8 |
| Resettlement scheme | 2 | 0.8 |
| Chimfuli | 1 | 0.4 |
| Chinsanka | 1 | 0.4 |
| Chisembe | 1 | 0.4 |
| Fiyongoli | 1 | 0.4 |
| Lukangaba | 1 | 0.4 |
| Mansa | 1 | 0.4 |
| Mansa central | 1 | 0.4 |
| Mansa resettlement scheme | 1 | 0.4 |
| Matanda | 1 | 0.4 |
| Mulonga | 1 | 0.4 |
| Musule | 1 | 0.4 |
| Mutamba | 1 | 0.4 |

| Mansa | | |
|---|---|---|
| **Camp name** | **Number of farmers** | **Percentage** |
| Mutiti | 1 | 0.4 |
| Mwanachama | 1 | 0.4 |
| Resettlement scheme | 1 | 0.4 |
| **Total** | **267** | **100** |

| Chipili | | |
|---|---|---|
| **Camp name** | **Number of farmers** | **Percentage** |
| Lupososhi | 13 | 13.3 |
| Mwenda | 12 | 12.2 |
| Kanshimba | 9 | 9.2 |
| Mupeta | 9 | 9.2 |
| Kamami | 8 | 8.2 |
| Kalundu | 7 | 7.1 |
| Mukanga | 7 | 7.1 |
| Kashimba | 6 | 6.1 |
| Mutipula | 6 | 6.1 |
| Luminu | 5 | 5.1 |
| Musonda b | 4 | 4.1 |
| Chikaya | 3 | 3.1 |
| Lupososhi | 3 | 3.1 |
| Mwenda | 2 | 2.0 |
| Chipili | 1 | 1.0 |
| Lumini | 1 | 1.0 |
| Mukoshi | 1 | 1.0 |
| Mushimba | 1 | 1.0 |
| **Total** | **98** | **100** |

**Table 29**. Smallholder farmers in Luapula Province by camp and district.

# Annex 2. Distribution of farmers by sex, gender and age

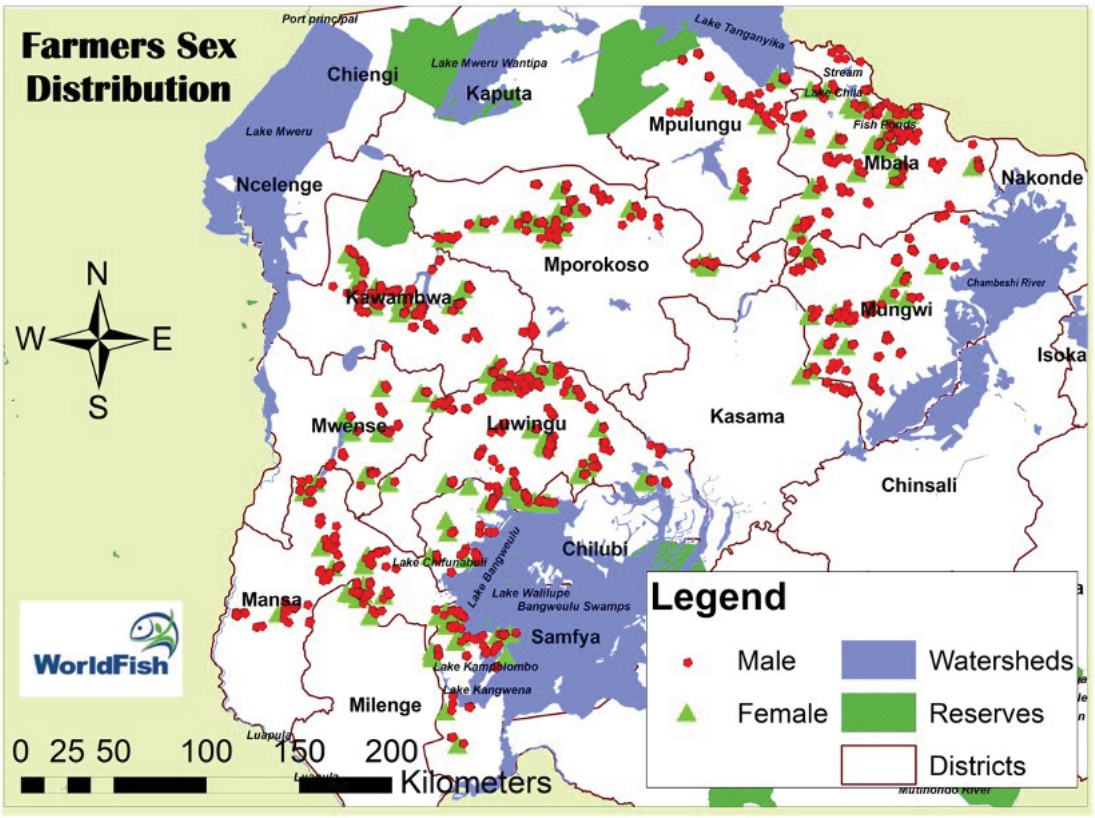


**Figure 34**. Location of farmers by sex and gender.

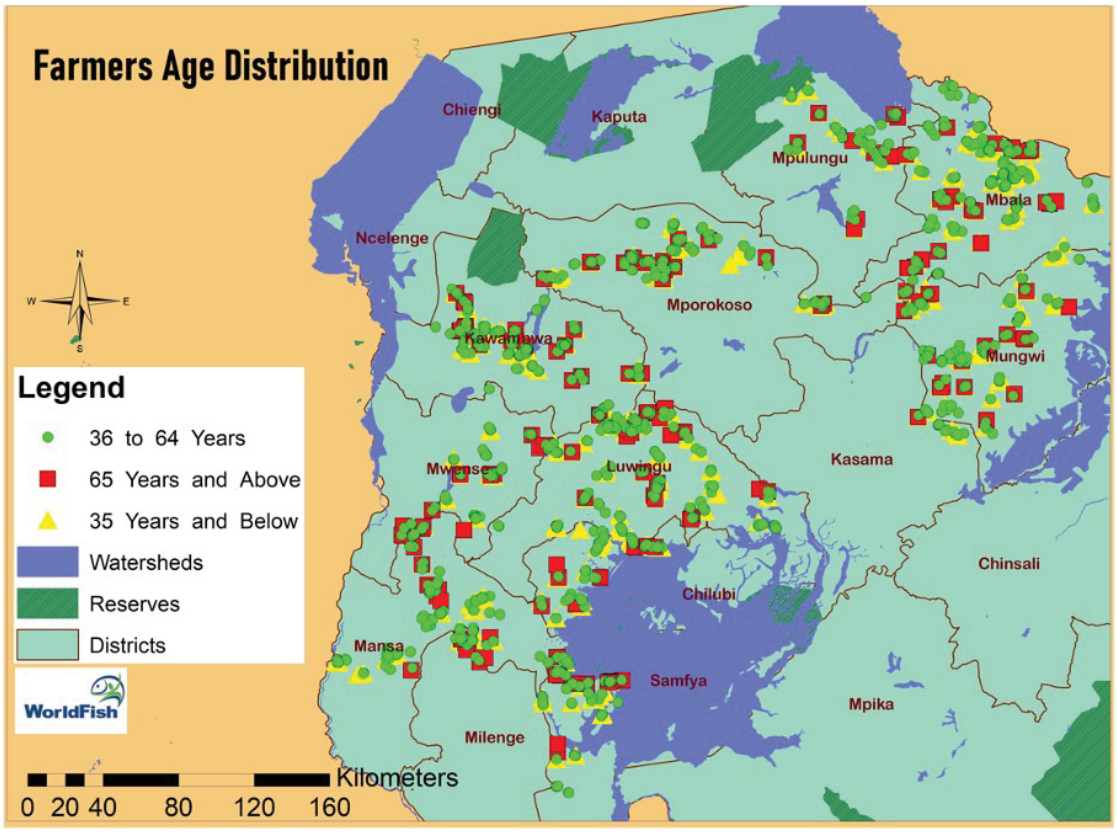


**Figure 35**. Location of farmers by age.

# Annex 3. Size of fishponds

| Size of active ponds ($m^2$) | Number | Percentage |
|---|---|---|
| 5000 | 1 | 0.03 |
| 4800 | 1 | 0.03 |
| 4700 | 1 | 0.03 |
| 3200 | 1 | 0.03 |
| 2700 | 1 | 0.03 |
| 2500 | 6 | 0.19 |
| 2400 | 1 | 0.03 |
| 2000 | 1 | 0.03 |
| 1800 | 2 | 0.06 |
| 1750 | 1 | 0.03 |
| 1600 | 3 | 0.1 |
| 1500 | 9 | 0.29 |
| 1470 | 2 | 0.06 |
| 1440 | 1 | 0.03 |
| 1375 | 1 | 0.03 |
| 1350 | 1 | 0.03 |
| 1344 | 9 | 0.29 |
| 1250 | 26 | 0.83 |
| 1200 | 9 | 0.29 |
| 1000 | 6 | 0.19 |
| 900 | 6 | 0.19 |
| 882 | 1 | 0.03 |
| 875 | 1 | 0.03 |
| 850 | 1 | 0.03 |
| 840 | 2 | 0.06 |
| 820 | 1 | 0.03 |
| 800 | 14 | 0.45 |
| 750 | 33 | 1.05 |

| Size of inactive ponds ($m^2$) | Number | Percentage |
|---|---|---|
| 15,000 | 1 | 0.05 |
| 9000 | 1 | 0.05 |
| 6750 | 1 | 0.05 |
| 3000 | 1 | 0.05 |
| 2500 | 7 | 0.36 |
| 2400 | 1 | 0.05 |
| 1500 | 12 | 0.62 |
| 1260 | 1 | 0.05 |
| 1250 | 23 | 1.18 |
| 1225 | 1 | 0.05 |
| 1200 | 2 | 0.1 |
| 1120 | 1 | 0.05 |
| 1000 | 9 | 0.46 |
| 960 | 1 | 0.05 |
| 900 | 4 | 0.21 |
| 875 | 1 | 0.05 |
| 840 | 1 | 0.05 |
| 800 | 1 | 0.05 |
| 750 | 19 | 0.98 |
| 738 | 2 | 0.1 |
| 725 | 1 | 0.05 |
| 700 | 2 | 0.1 |
| 650 | 1 | 0.05 |
| 640 | 1 | 0.05 |
| 625 | 19 | 0.98 |
| 600 | 21 | 1.08 |
| 540 | 3 | 0.15 |
| 525 | 4 | 0.21 |

| Size of active ponds ($m^2$) | Number | Percentage |
|---|---|---|
| 735 | 3 | 0.1 |
| 720 | 1 | 0.03 |
| 705 | 4 | 0.13 |
| 700 | 1 | 0.03 |
| 676 | 1 | 0.03 |
| 652 | 1 | 0.03 |
| 650 | 3 | 0.1 |
| 625 | 43 | 1.37 |
| 621 | 1 | 0.03 |
| 620 | 1 | 0.03 |
| 600 | 44 | 1.4 |
| 580 | 1 | 0.03 |
| 576 | 1 | 0.03 |
| 575 | 3 | 0.1 |
| 570 | 1 | 0.03 |
| 550 | 5 | 0.16 |
| 540 | 1 | 0.03 |
| 529 | 1 | 0.03 |
| 525 | 16 | 0.51 |
| 504 | 1 | 0.03 |
| 500 | 71 | 2.26 |
| 490 | 1 | 0.03 |
| 484 | 1 | 0.03 |
| 480 | 2 | 0.06 |
| 475 | 1 | 0.03 |
| 450 | 31 | 0.99 |
| 440 | 1 | 0.03 |
| 430 | 5 | 0.16 |
| 425 | 6 | 0.19 |
| 420 | 18 | 0.57 |
| 400 | 99 | 3.15 |

| Size of inactive ponds ($m^2$) | Number | Percentage |
|---|---|---|
| 500 | 77 | 3.95 |
| 480 | 1 | 0.05 |
| 450 | 15 | 0.77 |
| 432 | 1 | 0.05 |
| 420 | 5 | 0.26 |
| 400 | 49 | 2.52 |
| 391 | 1 | 0.05 |
| 378 | 1 | 0.05 |
| 375 | 25 | 1.28 |
| 360 | 7 | 0.36 |
| 356 | 2 | 0.1 |
| 350 | 8 | 0.41 |
| 325 | 7 | 0.36 |
| 324 | 6 | 0.31 |
| 323 | 1 | 0.05 |
| 320 | 10 | 0.51 |
| 319 | 1 | 0.05 |
| 300 | 170 | 8.73 |
| 290 | 1 | 0.05 |
| 288 | 1 | 0.05 |
| 280 | 2 | 0.1 |
| 270 | 5 | 0.26 |
| 260 | 3 | 0.15 |
| 255 | 1 | 0.05 |
| 250 | 38 | 1.95 |
| 240 | 5 | 0.26 |
| 238 | 1 | 0.05 |
| 230 | 2 | 0.1 |
| 225 | 35 | 1.8 |
| 220 | 5 | 0.26 |
| 216 | 10 | 0.51 |

| Size of active ponds ($m^2$) | Number | Percentage |
|---|---|---|
| 396 | 2 | 0.06 |
| 380 | 3 | 0.1 |
| 378 | 1 | 0.03 |
| 375 | 45 | 1.43 |
| 374 | 2 | 0.06 |
| 370 | 2 | 0.06 |
| 368 | 1 | 0.03 |
| 360 | 24 | 0.76 |
| 357 | 1 | 0.03 |
| 352 | 1 | 0.03 |
| 350 | 14 | 0.45 |
| 345 | 1 | 0.03 |
| 340 | 7 | 0.22 |
| 336 | 3 | 0.1 |
| 335 | 2 | 0.06 |
| 330 | 2 | 0.06 |
| 325 | 10 | 0.32 |
| 324 | 3 | 0.1 |
| 322 | 1 | 0.03 |
| 320 | 10 | 0.32 |
| 319 | 1 | 0.03 |
| 313 | 1 | 0.03 |
| 310 | 1 | 0.03 |
| 308 | 1 | 0.03 |
| 306 | 1 | 0.03 |
| 300 | 282 | 8.98 |
| 294 | 1 | 0.03 |
| 290 | 1 | 0.03 |
| 289 | 5 | 0.16 |
| 288 | 1 | 0.03 |

| Size of inactive ponds ($m^2$) | Number | Percentage |
|---|---|---|
| 210 | 2 | 0.1 |
| 200 | 109 | 5.6 |
| 195 | 1 | 0.05 |
| 180 | 23 | 1.18 |
| 176 | 1 | 0.05 |
| 173 | 1 | 0.05 |
| 170 | 3 | 0.15 |
| 160 | 7 | 0.36 |
| 155 | 1 | 0.05 |
| 150 | 393 | 20.17 |
| 144 | 16 | 0.82 |
| 140 | 13 | 0.67 |
| 139 | 1 | 0.05 |
| 135 | 1 | 0.05 |
| 132 | 2 | 0.1 |
| 130 | 8 | 0.41 |
| 128 | 1 | 0.05 |
| 126 | 1 | 0.05 |
| 125 | 1 | 0.05 |
| 120 | 60 | 3.08 |
| 119 | 1 | 0.05 |
| 117 | 1 | 0.05 |
| 112 | 1 | 0.05 |
| 110 | 5 | 0.26 |
| 108 | 4 | 0.21 |
| 106 | 2 | 0.1 |
| 105 | 7 | 0.36 |
| 104 | 3 | 0.15 |
| 100 | 284 | 14.58 |
| 98 | 1 | 0.05 |

| Size of active ponds ($m^2$) | Number | Percentage |
|---|---|---|
| 286 | 2 | 0.06 |
| 285 | 1 | 0.03 |
| 280 | 2 | 0.06 |
| 272 | 1 | 0.03 |
| 270 | 13 | 0.41 |
| 266 | 3 | 0.1 |
| 264 | 1 | 0.03 |
| 260 | 4 | 0.13 |
| 256 | 12 | 0.38 |
| 255 | 2 | 0.06 |
| 252 | 2 | 0.06 |
| 250 | 78 | 2.48 |
| 240 | 20 | 0.64 |
| 238 | 1 | 0.03 |
| 234 | 1 | 0.03 |
| 231 | 1 | 0.03 |
| 230 | 2 | 0.06 |
| 225 | 46 | 1.46 |
| 224 | 1 | 0.03 |
| 220 | 5 | 0.16 |
| 216 | 10 | 0.32 |
| 210 | 3 | 0.1 |
| 208 | 1 | 0.03 |
| 204 | 4 | 0.13 |
| 200 | 202 | 6.43 |
| 198 | 2 | 0.06 |
| 196 | 1 | 0.03 |
| 195 | 1 | 0.03 |
| 192 | 4 | 0.13 |
| 190 | 3 | 0.1 |

| Size of inactive ponds ($m^2$) | Number | Percentage |
|---|---|---|
| 96 | 22 | 1.13 |
| 90 | 13 | 0.67 |
| 80 | 54 | 2.77 |
| 78 | 1 | 0.05 |
| 77 | 1 | 0.05 |
| 75 | 14 | 0.72 |
| 72 | 6 | 0.31 |
| 70 | 18 | 0.92 |
| 66 | 1 | 0.05 |
| 65 | 1 | 0.05 |
| 64 | 1 | 0.05 |
| 60 | 38 | 1.95 |
| 56 | 4 | 0.21 |
| 54 | 1 | 0.05 |
| 50 | 94 | 4.83 |
| 49 | 2 | 0.1 |
| 48 | 3 | 0.15 |
| 45 | 2 | 0.1 |
| 42 | 3 | 0.15 |
| 40 | 18 | 0.92 |
| 36 | 3 | 0.15 |
| 35 | 2 | 0.1 |
| 32 | 1 | 0.05 |
| 30 | 7 | 0.36 |
| 28 | 1 | 0.05 |
| 25 | 17 | 0.87 |
| 24 | 6 | 0.31 |
| 21 | 1 | 0.05 |
| 20 | 5 | 0.26 |
| 16 | 5 | 0.26 |

| Size of active ponds ($m^2$) | Number | Percentage |
|---|---|---|
| 188 | 1 | 0.03 |
| 180 | 69 | 2.2 |
| 175 | 1 | 0.03 |
| 172 | 1 | 0.03 |
| 171 | 2 | 0.06 |
| 170 | 3 | 0.1 |
| 169 | 1 | 0.03 |
| 168 | 3 | 0.1 |
| 166 | 1 | 0.03 |
| 165 | 1 | 0.03 |
| 162 | 2 | 0.06 |
| 160 | 13 | 0.41 |
| 156 | 3 | 0.1 |
| 155 | 2 | 0.06 |
| 150 | 467 | 14.86 |
| 144 | 22 | 0.7 |
| 140 | 15 | 0.48 |
| 136 | 1 | 0.03 |
| 135 | 8 | 0.25 |
| 130 | 15 | 0.48 |
| 128 | 6 | 0.19 |
| 126 | 1 | 0.03 |
| 125 | 3 | 0.1 |
| 122 | 1 | 0.03 |
| 121 | 2 | 0.06 |
| 120 | 95 | 3.02 |
| 119 | 1 | 0.03 |
| 117 | 5 | 0.16 |
| 112 | 6 | 0.19 |
| 110 | 16 | 0.51 |

| Size of inactive ponds ($m^2$) | Number | Percentage |
|---|---|---|
| 15 | 3 | 0.15 |
| 12 | 3 | 0.15 |
| 10 | 1 | 0.05 |
| 6 | 3 | 0.15 |
| 4 | 1 | 0.05 |
| **Total** | **1948** | **100** |

| Size of active ponds (m²) | Number | Percentage |
|---|---|---|
| 108 | 3 | 0.1 |
| 106 | 1 | 0.03 |
| 105 | 10 | 0.32 |
| 104 | 2 | 0.06 |
| 100 | 390 | 12.41 |
| 99 | 4 | 0.13 |
| 96 | 21 | 0.67 |
| 95 | 1 | 0.03 |
| 91 | 2 | 0.06 |
| 90 | 20 | 0.64 |
| 88 | 1 | 0.03 |
| 85 | 2 | 0.06 |
| 84 | 4 | 0.13 |
| 82 | 2 | 0.06 |
| 80 | 94 | 2.99 |
| 78 | 1 | 0.03 |
| 77 | 1 | 0.03 |
| 76 | 2 | 0.06 |
| 75 | 18 | 0.57 |
| 72 | 21 | 0.67 |
| 70 | 27 | 0.86 |
| 69 | 1 | 0.03 |
| 66 | 1 | 0.03 |
| 65 | 1 | 0.03 |
| 64 | 14 | 0.45 |
| 63 | 2 | 0.06 |
| 60 | 47 | 1.5 |
| 56 | 2 | 0.06 |
| 55 | 1 | 0.03 |
| 54 | 2 | 0.06 |
| 52 | 2 | 0.06 |
| 50 | 146 | 4.65 |
| 49 | 3 | 0.1 |
| 48 | 5 | 0.16 |
| 46 | 1 | 0.03 |
| 45 | 30 | 0.95 |
| 42 | 4 | 0.13 |
| 40 | 19 | 0.6 |
| 37 | 1 | 0.03 |
| 36 | 8 | 0.25 |
| 35 | 4 | 0.13 |
| 32 | 2 | 0.06 |
| 30 | 15 | 0.48 |
| 28 | 4 | 0.13 |
| 27 | 1 | 0.03 |
| 25 | 27 | 0.86 |
| 24 | 4 | 0.13 |
| 23 | 2 | 0.06 |
| 21 | 1 | 0.03 |
| 20 | 6 | 0.19 |
| 18 | 2 | 0.06 |
| 16 | 3 | 0.1 |
| 15 | 4 | 0.13 |
| 12 | 3 | 0.1 |
| 10 | 4 | 0.13 |
| 9 | 5 | 0.16 |
| 4 | 1 | 0.03 |
| **Total** | **3142** | **100** |

**Table 30**. Size of active and inactive fishponds at the time of the census.

# Annex 4. Challenges faced by farmers by district

| Challenges | District (%) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Luwingu** | **Mbala** | **Mpulungu** | **Mungwi** | **Mporokoso** | **Samfya** | **Kawambwa** | **Chipili** | **Mansa** |
| | **n=421** | **n=374** | **n=160** | **n=225** | **n=243** | **n=195** | **n=358** | **n=98** | **n=267** |
| No feed | **46.6** | 34.8 | 20.0 | 17.8 | 18.9 | **41.0** | 25.4 | 28.6 | **34.5** |
| No fingerlings | 41.8 | **47.9** | **35.0** | **60.9** | **71.6** | 38.0 | **57.3** | **52.0** | 28.5 |
| No training | 2.4 | 5.1 | 9.4 | 9.3 | 3.3 | 9.7 | 10.1 | 14.3 | 6.0 |
| Fingerlings too expensive | 2.1 | 0.8 | 3.1 | 4.0 | 0.8 | 0.5 | 2.0 | 3.1 | 8.2 |
| Feed too expensive | 1.9 | 0.3 | 0.6 | 0.9 | 1.2 | 2.1 | 1.1 | 1.0 | 20.6 |
| Stunted growth | 1.4 | 2.4 | 9.4 | 0.9 | - | - | - | 1.0 | - |
| Predation | 1.2 | 6.4 | 12.5 | 2.7 | 2.5 | 3.1 | 2.2 | - | 0.4 |
| Human theft | 1.0 | 0.8 | - | 0.4 | 0.8 | 1.0 | 1.4 | - | 1.5 |
| Limited finances | 0.7 | 0.5 | 1.3 | - | 0.4 | 2.1 | - | - | - |
| Water shortage | 0.7 | 0.8 | 3.8 | 3.1 | 0.4 | 2.1 | 0.6 | - | 0.4 |
| No access to nets | - | - | 2.5 | - | - | - | - | - | - |
| Other* | 0.2 | 0.3 | 2.5 | | | 0.5 | | | |

**Include poor soil quality, limited markets and inadequate access to labor and transport.*

**Table 31**. Challenges faced by active farmers by district.

| Reasons abandoned | Northen Province | | | | | Luapula Province | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Luwingu** | **Mbala** | **Mpulungu** | **Mungwi** | **Mporokoso** | **Samfya** | **Kawambwa** | **Mansa** | **Chipili** |
| | **n=40** | **n=58** | **n=64** | **n=58** | **n=68** | **n=93** | **n=179** | **n=31** | **n=39** |
| | % | % | | | | | | | |
| Water shortage | 17.5 | 17.2 | **28.1** | **55.2** | 25 | 25.8 | 15.1 | 19.4 | **56.4** |
| Lack of seed | **32.5** | **22.4** | 3.1 | 10.3 | **45.6** | **31.2** | 29.1 | **32.3** | 35.9 |
| Theft by humans | 20 | 15.5 | 7.8 | 12.1 | 14.7 | 14 | **36.9** | 29 | |
| Predation | 5 | 19 | 20.3 | 12.1 | 10.3 | 17.2 | 14 | 9.7 | 2.6 |
| Flooding | 2.5 | 6.9 | 18.8 | | 2.9 | 3.2 | 4.5 | 6.5 | 5.1 |
| Stunted growth | 10 | 13.8 | 14.1 | 3.5 | | | | | |
| Limited finances | 5 | | 3.1 | 1.7 | 1.5 | 8.6 | 0.6 | 3.2 | |
| No feed | 2.5 | 1.7 | 1.6 | | | | | | |
| No training | 2.5 | | | 1.7 | | | | | |
| Relocated | 2.5 | 1.7 | 1.6 | | | | | | |
| Sickness | | 1.7 | | 1.7 | | | | | |
| Owner died | | | 1.6 | | | | | | |
| Lack of market | | | | 1.7 | | | | | |

**in bold is the top mentioned reason per district*

**Table 32**. Reasons why inactive farmers abandoned fish farming by province and district.

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## About WorldFish

WorldFish is a nonprofit research and innovation institution that creates, advances and translates scientific research on aquatic food systems into scalable solutions with transformational impact on human well-being and the environment. Our research data, evidence and insights shape better practices, policies and investment decisions for sustainable development in low- and middle-income countries.

We have a global presence across 20 countries in Asia, Africa and the Pacific with 460 staff of 30 nationalities deployed where the greatest sustainable development challenges can be addressed through holistic aquatic food systems solutions.

Our research and innovation work spans climate change, food security and nutrition, sustainable fisheries and aquaculture, the blue economy and ocean governance, One Health, genetics and AgriTech, and it integrates evidence and perspectives on gender, youth and social inclusion. Our approach empowers people for change over the long term: research excellence and engagement with national and international partners are at the heart of our efforts to set new agendas, build capacities and support better decision-making on the critical issues of our times.

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