RAD
Rural Aquaculture Development

THINKAQUA

RAD Impact Monitoring
Baseline report

October 2025

Table of Contents

Table of Contents **2**

Executive Summary **3**

Methodology **4**

Fish Farmer Impact Survey *4*

Market Shopper Survey *4*

Analysis *4*

Results **5**

Number and size of ponds *5*

Fingerlings *6*

Feeding *6*

Stocking densities & harvests *6*

Record-keeping & business finances *7*

Equipment *7*

Training *7*

Social Capital *10*

Farmer Confidence *11*

Labour *12*

Food security *14*

Environment *16*

Key Findings **16**

Executive Summary

This report contains the analytical results of the baseline census and impact monitoring survey for RAD Global's Rukungiri Hub using data collected March through July 2025. Methods included qualitative interviews and two questionnaires: one for pond farmers in Rukungiri and another for market shoppers in Rukungiri food markets. Data collection and analysis was conducted by ThinkAqua, a partner of RAD Global.

We found that, compared to farmers not engaged with the Hub, farmers engaged with the Hub are significantly more likely to:

- Stock 50% more fingerlings and have four times higher survival rates.
- Have pond designs that include inlet and outlet systems conducive to better pond management;
- Fetch a higher price per kg (almost double) for their fish (despite producing smaller-sized fish of 188g compared to over 250g);
- Keep records of some form (usually a notebook);
- Eat tilapia regularly (non-Hub farmers were more like to report no consumption);
- Have reduced their use of pesticides and fertilisers in the last five years.

Additionally, market shoppers felt the availability of fish in markets had increased in the past five years (i.e., since the Hub was founded). Although causation cannot be definitively established, the Hub's sustained efforts to regularly supply local markets with fish could reasonably have contributed to the perceived increase in fish availability. RAD's founder explained that before he founded RAD, his PhD found no evidence of regular fresh tilapia supply to local markets. We were unable to identify other plausible reasons to consumers' perceived increase in fish in local markets besides the establishment of RAD.

We intend to return in two-to-three years to measure the longer-term impact of RAD Rukungiri on the local community of fish farmers and fish consumers.

Methodology

In order to measure the impact on the community, ThinkAqua gathered data from two groups of people: fish farmers and fish consumers. The enumeration team used separate survey tools for each group. All potential participants were asked if they consented to completing the survey and were made aware that their answers would remain confidential. All questions were optional, and participants were made aware of their right to decline answering any questions they wanted to decline. For this reason, not all questions reflect the total number of farmers (e.g., although 100 farmers may have participated in the survey, only 40 may have answered a question).

Fish Farmer Impact Survey

Enumerators called all farmers listed on the "RAD Fish Farmer Census". The RAD Fish Farmer Census is a databased of fish farmers in Rukungiri District identified by the RAD team (based off but not limited to fish farmers on the local Government District Office's fish farmer census). Their Census includes descriptive farm data, including pond dimensions, water source, species cultured, source of fingerlings, feeding practices, record keeping, training, access to equipment, among others (See Appendix 1 for a complete list of variables). During the survey work, the enumeration team identified several other pond farmers who were not on the census list: these people were also approached for surveying.

Market Shopper Survey

Enumerators visited markets to randomly approach every third person in the market to request their consent to answer the fish consumer survey. Survey questions included whether or not the person ate fish, how often they ate different types of protein, and their preferred versus usual supplier and formats of fish (See Appendix 2 for a complete list of variables).

Analysis

Statistical analysis was primarily descriptive, although z-tests, Welch 2-Sample t-tests, Fisher's Exact Tests, and occasionally Chi-Squared Tests were used to examine differences between farmers both within ('Hub farmers') and outwith ('non-Hub farmers') the RAD network.

Results

A total of 116 pond farmers in Rukungiri were contacted; 106 farmers consented and completed the survey, of which 43% (n=46) were engaged with RAD in various ways (Figure 1). Many farmers engaged with RAD in more than one area, although training was the most common service RAD provided. Of the 106 farmers, 16% (n=17) were female. Of farmers in the Hub's network (n=46), 15% (n=7) were women, which is representative of the overall sample (confirmed using a z-test, p = 0.88).

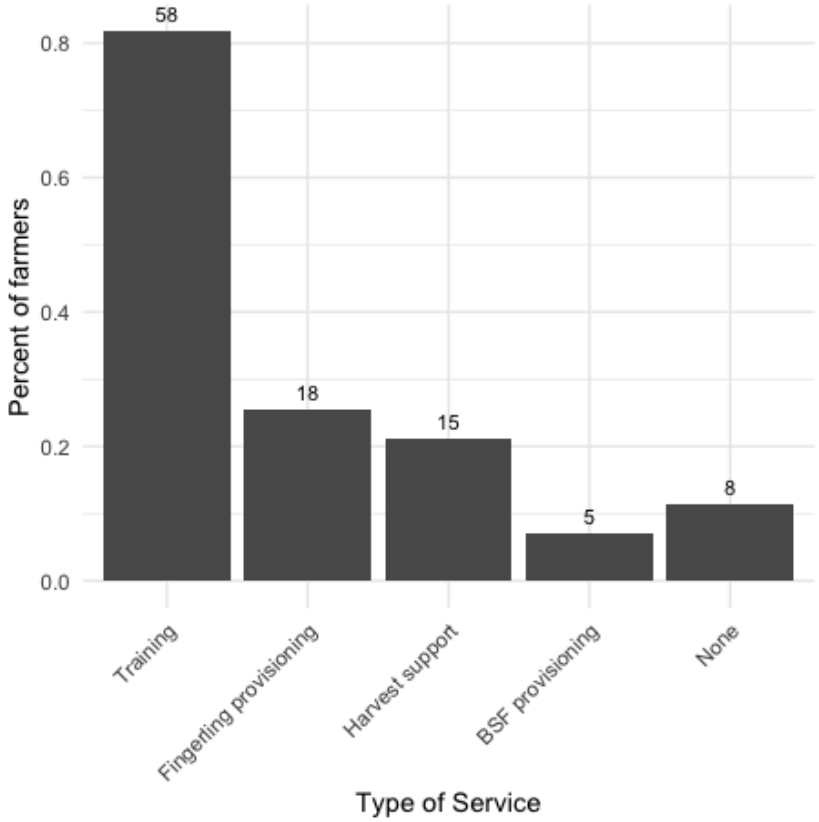

Figure 1: Percentage of farmers engaged with the various pillars of RAD.

Among farmers, 27 were 'new' farmers who started farming fish within the last five years, 44 were 'continuing' farmers who were farming fish five years ago and still farming them today, and 11 had stopped farming in the last five years. Engaging with the Hub did not make a difference to whether farmers had stopped, continued, or started farming in the last five years (using a Chi-Squared test, p=0.31). Farmers participated in fish farming mainly to generate income and to have fish for home consumption. Others described a passion for fish farming as a hobby, a need for cash to pay school fees, or a water source on their property that they wanted to capitalise on.

Number and size of ponds

On average, Hub farmers had 2.2 ponds totalling 427 m^3; non-Hub farmers had 1.9 ponds totalling 270 m^3. Neither the difference in pond number or size was statistically significant (using Welch 2-Sample t-tests, p= 0.26 and 0.056, respectively).

Enumerators also inquired about the change in number of ponds between 2020 and the present 2025. Most farmers (73%, n=40 of 55) had the same number of ponds in 2020 while 25% (n=14 of 55) had constructed additional ponds. Only one farmer had less ponds than they had five years ago (this farmer

reported that he had lost one pond but did not explain the reason). Engaging with the Hub did not make a difference to whether farmers had added ponds in the last five years (using a Fisher Test, p=0.24).

Fingerlings

Of the 46 Hub farmers, 25 sourced fingerlings from the Hub. An additional 12 received fingerlings from the government, which had purchased those fingerlings from the Hub. Exactly five Hub farmers sourced fingerlings from their neighbour, and one sourced fingerlings from a private hatchery. Of the 60 non-Hub farmers, 22 sourced fingerlings from their neighbour, 23 received fingerlings from the government, and 5 sourced fingerlings from private hatcheries. Thus, the Hub supplied 57% (n=60) farmers in Rukungiri, either directly or indirectly via the government.

The average number of Hub-sourced fingerlings stocked was 757 pieces, whereas the average number of fingerlings not sourced from the Hub was 390 pieces, which was significantly different (using a Welch 2-Sample t-tests, p= 0.0004). Hub-farmers who sourced their fingerlings directly from RAD (rather than through the government without any engagement with the Hub) also stocked higher numbers of fingerlings: Hub farmers stocked 708 pieces compared to non-Hub farmers who stocked only 540 pieces from the government, although this difference was not significant (using a Welch 2-Sample t-test, p = 0.16). This is likely because the government distributed less fingerlings per farmers because they were subsidising the fingerlings. Indeed, 66% of farmers who reported sourcing their fingerlings from the government (n=21 of 32) also reported that the government had paid for their fingerlings.

Overwhelmingly, farmers stocked fingerlings at 2g (78%, n= 83). Other farmers stocked fingerlings at 1g or 5g. Three farmers did not know what size fingerlings they stocked.

Feeding

The following table describes how many farmers fed their ponds with each feed type. While feeding practices were generally similar between Hub and non-Hub farmers, Hub farmers used less maize bran and greens than non-Hub farmers.

	Hub farm	Non-Hub Farm
Fertiliser	13	15
Pellets	25	24
Mukene	3	4
Maize bran	16	29
BSFL	0	0
Other (mainly greens)	24	39

Stocking densities & harvests

The following table summarises the difference in stocking densities between Hub and non-Hub farmers. Note: these stocking densities are based on the total pond area and the previous cycle data; however, it was unlikely that all ponds were used for the previous cycle and therefore these estimates indicate the productivity of the farm not of individual ponds. Only 10 farmers had records and/or were able to recall the quantity of their previous harvest, highlighting a significant opportunity for training. Data on these ten farmers show that Hub farmers have significantly higher final stocking densities, suggesting that Hub farmers have higher survival rates than non-Hub farmers.

It is important to contextualise the following results: *These statistics are based on numbers reported by the farmer. Considering that farmers overwhelmingly do not keep records, these numbers have a high risk of being inaccurate and should be considered relatively rather than in absolute terms. RAD sales records will be better positioned to provide more accurate production statistics.*

	Hub farmers	Non-Hub farmers	p-value

Initial stocking density	2.5 fish / m3	3.0 fish / m3	0.37
Final stocking density	0.74 fish / m3	0.58 fish / m3	0.47
Final stocking density	0.087 kg/m3	0.032 kg/m3	0.22
Final average body weight	188 g	258 g	0.27
Sales price	6,666 UGX/kg	3,512 UGX/kg	0.44
Estimated survival rate	18.5%	4.13%	

While Hub farmers harvested smaller fish than non-Hub farmers, Hub farmers fetched a higher price from their harvests on average than non-Hub farmers. This may be because the Rukungiri Hub offers consistent fish buy-back prices. In contrast, non-Hub farmers are subject to market fluctuations and/or may lower prices in order to sell their entire harvest quickly to prevent spoilage.

Most farmers were conducting the same number of cycles per year in 2025 as they were in 2020 (64%, n=28 of 44). A smaller portion had decreased the number of cycles per year (30%, n=13 of 44). Regarding harvest quantities per cycle, more farmers reported harvesting less fish than they harvested five years ago (46%, n=24 of 52). Only 29% (n=15 of 52) reported larger harvests in 2025 than in 2020. Engaging with the Hub did not make a difference to whether farmers had increased the number cycles per year (using a Chi-Squared Test, p=0.10) or had increased the number cycles per year (using a Fisher Test, p=0.06).

Record-keeping & business finances

The impact monitoring survey found that 21% (n=15 of 71) of farmers kept a logbook and another 21% (n=15 of 71) were able to keep the knowledge of their production numbers ‘in their head’; 58% (n=41 of 71) reported having no logbook or record at all, suggesting a need for training regarding record keeping so farmers can better understand their business. Furthermore, 57% (n=40 of 71) did not do any calculations related to their fish farming business. These practices did not significantly differ between Hub and non-Hub farmers.

Equipment

Of Hub-farmers, 37 had inlet pipes, 41 had outlet pipes, and 32 had PVC pipes; only 20, 14, and 21 of non-Hub farmers had inlet pipes, outlet pipes, and PVC pipes, respectively. Differences between Hub farmers and non-Hub farmers were not significantly different, likely due to small sample sizes ($p = 0.92$ for inlet pipes, 0.34 for outlet pipes, and 0.14 for PVC pipes). This finding indicates that Hub farmers may have better designed ponds: part of the Hub technical assistance includes helping farmers to position their ponds in appropriate locations so that they can be drained for complete harvest. For instance, many farmers place their ponds in wetland areas, which damages wetland ecosystems and makes pond drainage impossible. Farmers working with the Hub are encouraged to place their ponds on the fringe of wetlands, which allows for drainage and creates a protective barrier for wetlands (i.e., other activities cannot encroach on wetlands because the ponds are in the way).

Use of equipment was rare among all farmers. Only 8 Hub-farmers and 3 non-Hub farmers regularly sampled their fish with a scale. Additionally, only 4 Hub-farmers and 1 non-Hub farmers used bird nets. For harvesting fish, most Hub-farmers used a net from the government (n=20); the Hub currently borrows the government’s net for harvesting, so 11 of these farmers gained access to the net by selling their fish to the Hub (when farmers sell their fish to the Hub, the Hub supports the harvest using the government’s net). Many Hub-farmers did not have access to fishing nets at all (n=9) and thus relied on the Hub for harvesting their fish. In contrast, most non-Hub farmers used a mosquito net (n=8) or did not have any access to fishing nets at all (n=8).

Training

A large portion of farmers had received technical support and training from the Hub (85%, n=60 of 71) and 41% (n=29 of 71) reported that they have proactively called or visited the Hub to seek advice.

Exactly 19 farmers reported receiving formal training from the Hub (i.e., a formal workshop put on by the Hub in 2024). Another formal training conducted in March 2025 had 24 attendees.

About one third of farmers reported receiving support from the Hub during the harvest (30%, n=21 of 71). However, only 11 farmers reported participating in the fish buy-back program. The Hub has clarified that it rarely supports harvesting efforts without also purchasing fish; therefore, farmers may not be aware that they are selling fish to the Hub, indicating a need for improved branding.

The frequency of Hub employee visits to farmers varied significantly, with three farmers receiving visits multiple times per month, and others receiving visits less than yearly. The most common response was that farmers were visited by the Hub employees twice yearly (figure 2).

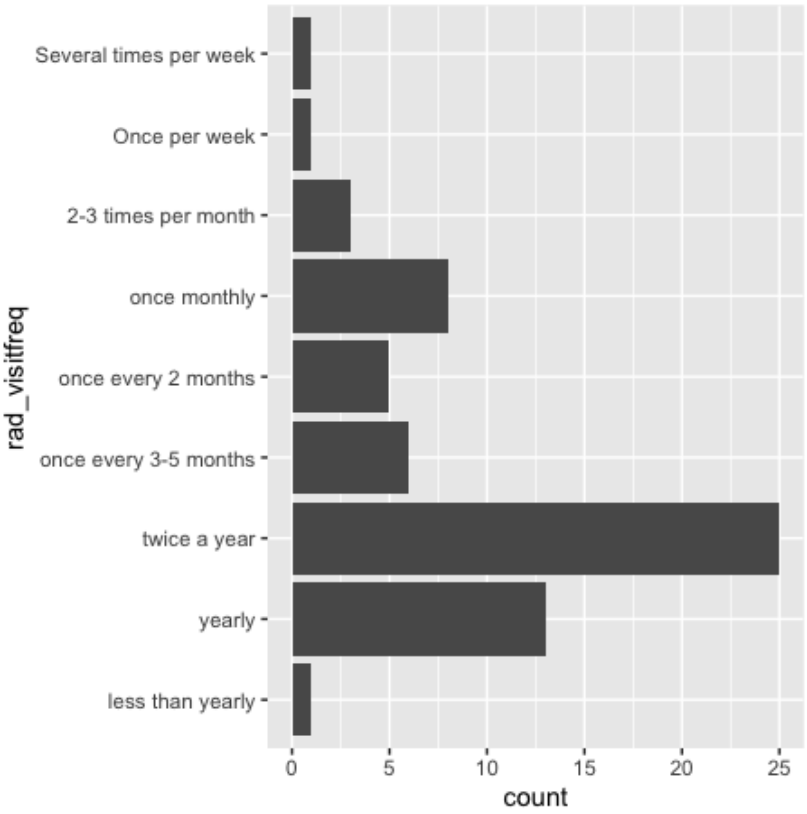

Figure 2: Frequency of Hub employee visits to farms

Farmers reported a variety of training needs (figure 3), representing opportunities for the Hub to address these topics.

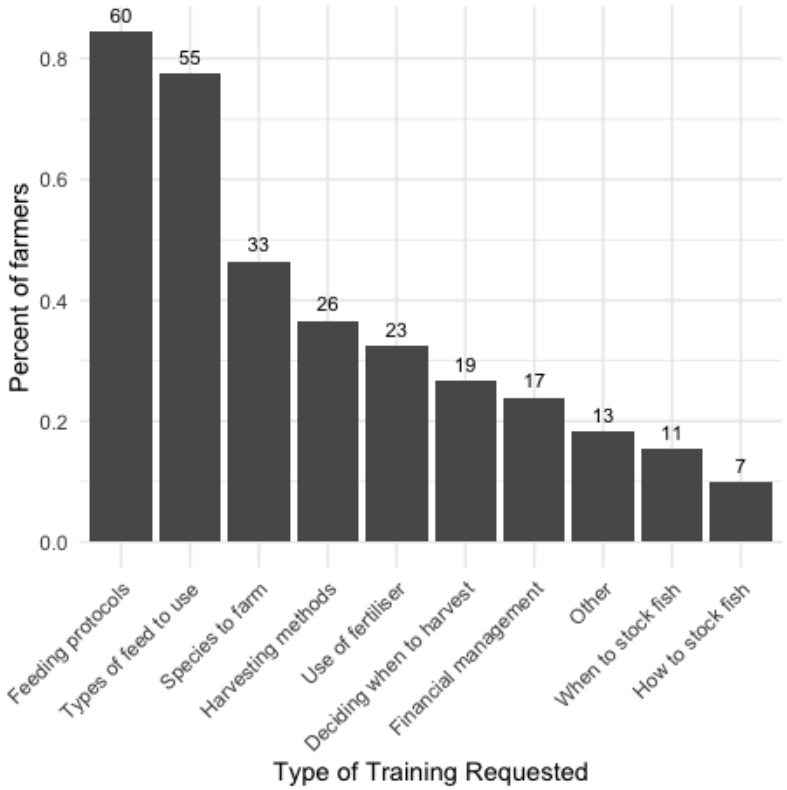

Figure 3: Requested training topics as reported by both Hub and non-Hub farmers.

Social Capital

Farming societies globally can often draw support from each other, for example by sharing knowledge or equipment. In Rukungiri, we examined how farmers were connected to each other and how social connection supported them in fish farming. Once motivated to start fish farming, the first step is generally pond construction and farmers generally received advice about constructing their pond from neighbours and friends, though many did not get any advice at all (figure 4).

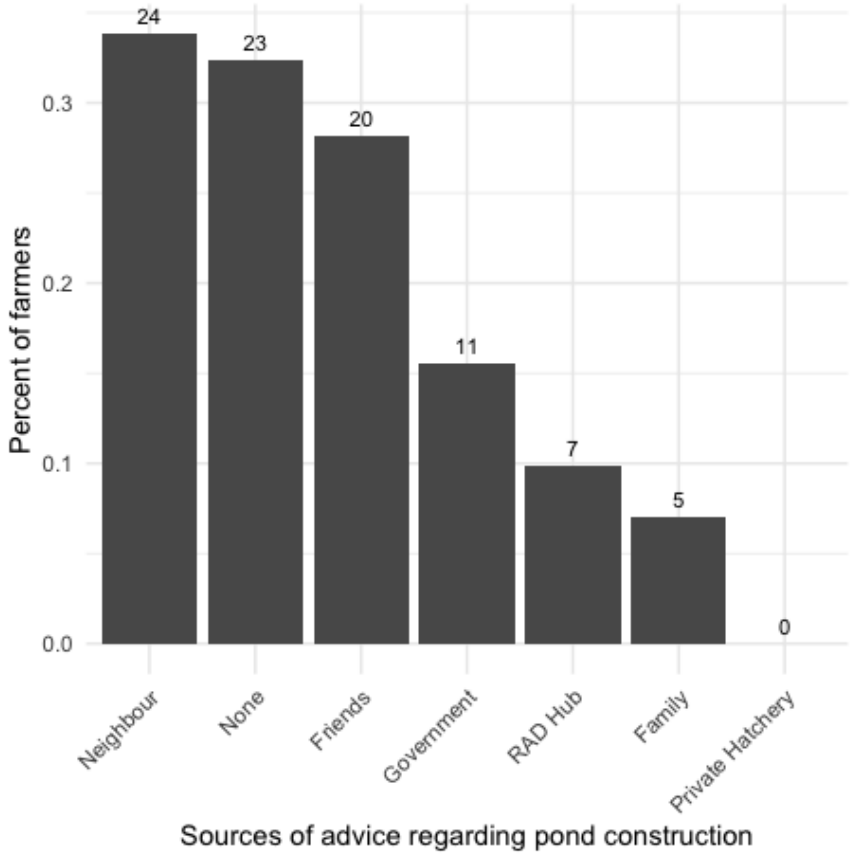

Figure 4: The percentage of farmers who received advice on pond construction from each source

The Hub aims to create a network of farmers; thus this assessment attempted to understand their current connectivity. Among farmers wishing to answer the question, 89% (n=76 of 85) knew other people who farmed. Compared to non-Hub farmers, Hub farmers are significantly more likely to know other fish farmers (using a Fisher test, p = 0.008); however, most farmers knew other farmers because they were neighbours and friends rather than because they had met through the RAD Hub network (figure 5).

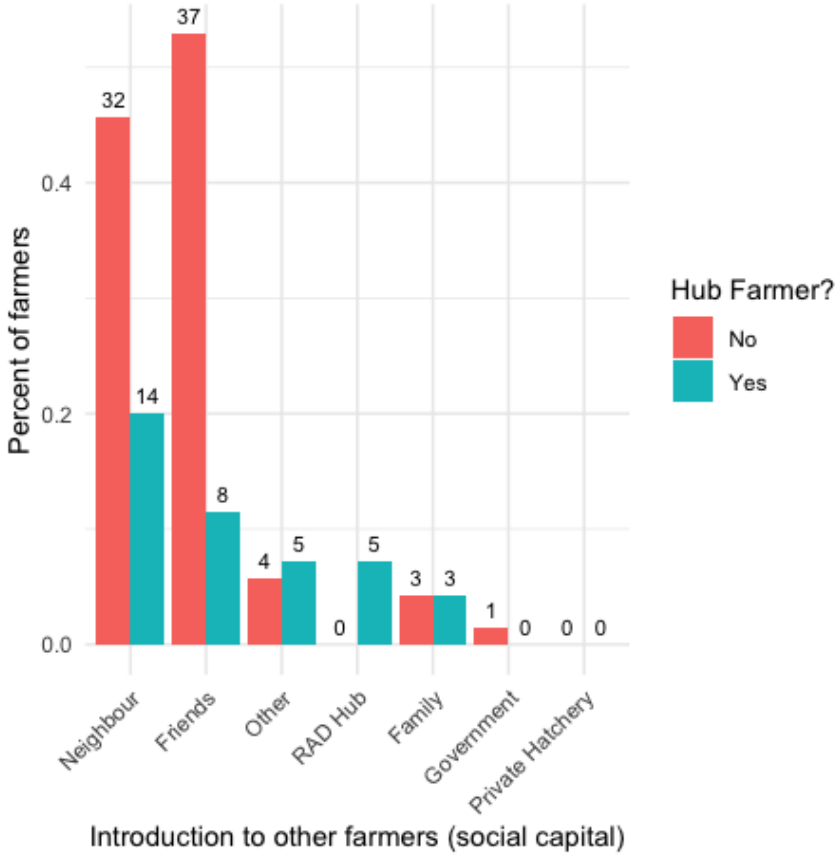

Figure 5: How farmers know other fish farmers

Farmer Confidence

Hub farmers were significantly more confident that they will make money from fish farming (using a Fisher test on a Likert-scale question, p = 2.1e-07): 100% of Hub farmers were confident or very confident that they would make money from fish farming, compared to 73% of non-Hub farmers. While both percentages reflect an optimism among farmers that there is sufficient market demand for their fish, the confidence was greater among Hub farmers.

Most farmers (95% n=42 of 44) were more confident that they would make money from fish farming now compared to five years ago – this result was not different between Hub farmers and non-Hub farmers. This may be due to the Hub's effort to develop local markets for farmed fish, although the causal relationship is hard to determine. Among all farmers, 76% (n= 32 of 42) believed this improvement was directly related to the presence of the Hub in Rukungiri.

Over 80% of farmers were planning on doing another cycle, further confirming their confidence and optimism in their fish farming business. Farmers who were unsure or not planning on doing another cycle cited the following reasons: "ponds dry up in dry seasons", "no fingerlings or feed", "I still have fish in my ponds and do not know how many", "I already have fish that reproduce", "the fish I have now are unhealthy and don't grow well", and "thieves steal my fish".

Most farmers cited income as the main benefit from fish farming; other benefits included paying school fees, eating fish, and food for the family. Indeed, 61% (n=43 of 71) said that fish farming increased their household's income; notably, 17% (n=12 of 71) did not know whether fish farming increased their household's income. Farmers mainly used income for food purchasing and school fees (figure 6). Furthermore, fish farming generally did not affect most fish farmers' ability to generate income from other activities (75% reported no difference, n = 53 of 71).

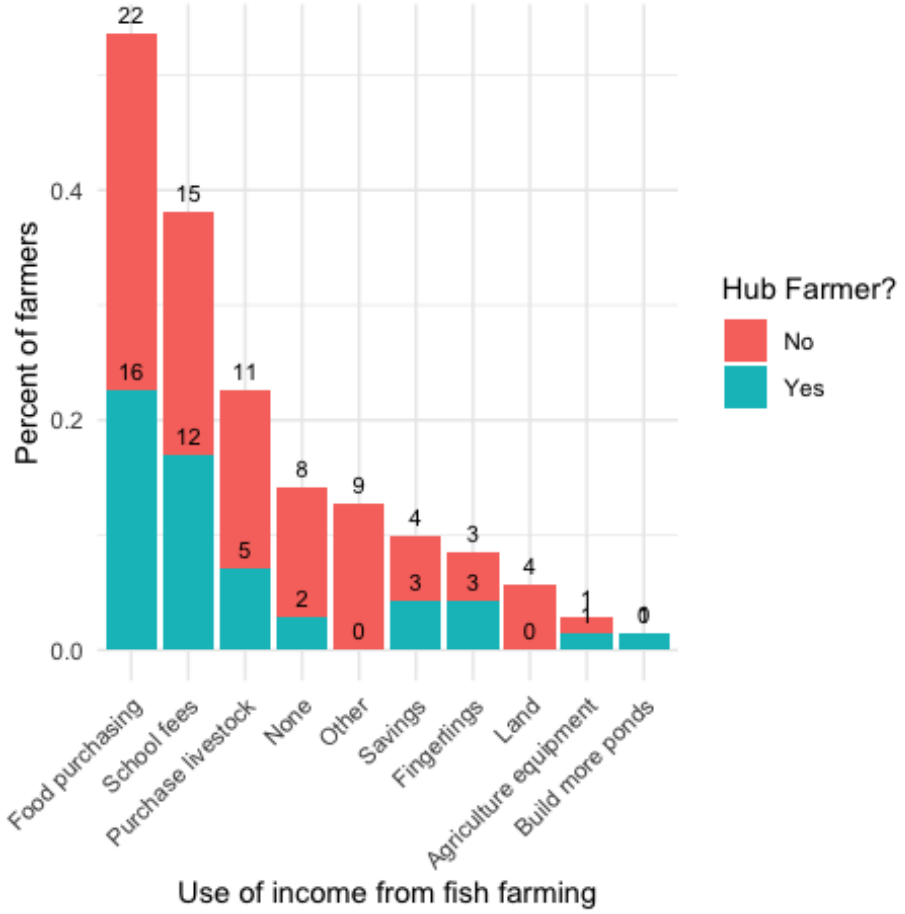

Figure 6: Farmers' use of fish farming income

Labour

Most fish farmers felt that fish farming did not affect the amount of time they had to spend on other income-generating activities (82%, n = 58 of 71), or the amount of leisure time they had (86% n = 61 of 71). Indeed, most felt that fish farming did not create an additional burden for them (96% n = 68 of 71). Most farmers did not think that the Hub reduced burdens associated with fish farming (75%, n = 53 of 71); however, this may be because they did not feel that fish farming was burdensome generally.

Most fish farmers used their own labour and hired employees to help, although a large portion also engaged their spouse in fish farming activities (figure 7). Most farms did not include women, youths, and children in fish farming activities (figure 8). Younger children (<18 years old) were more often involved that women and youths (e.g., feeding may be a chore). Less than 10% of farms involved women in fish farming activities. The reasons for their exclusion are unknown: they may have other income-generating activities or lack capacity for engaging. This point requires additional research and should be prioritised by the Hub to ensure inclusive opportunities for participation in aquaculture.

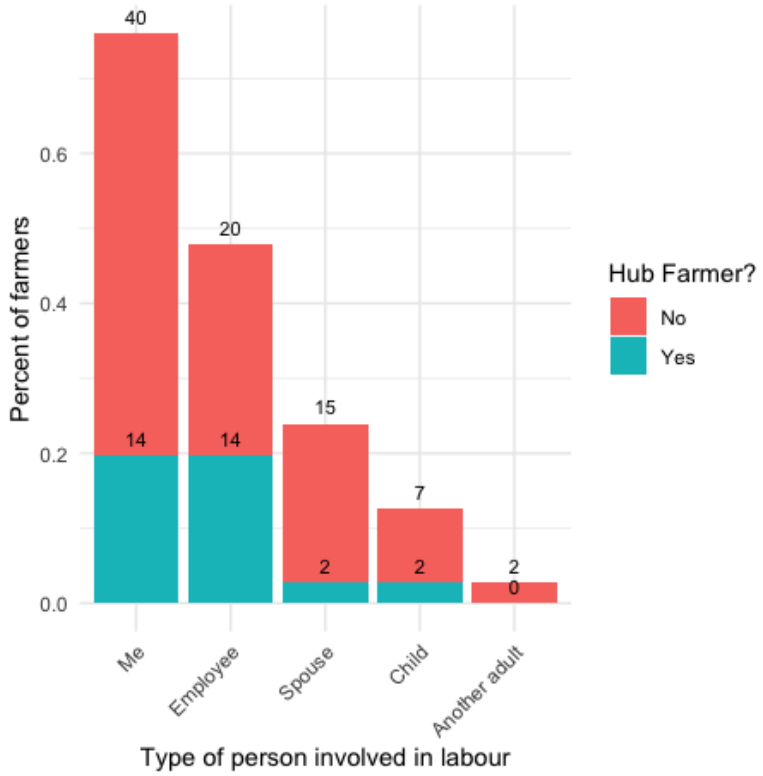

Figure 7: Farmers' report of who participates in fish farming labour at their farm

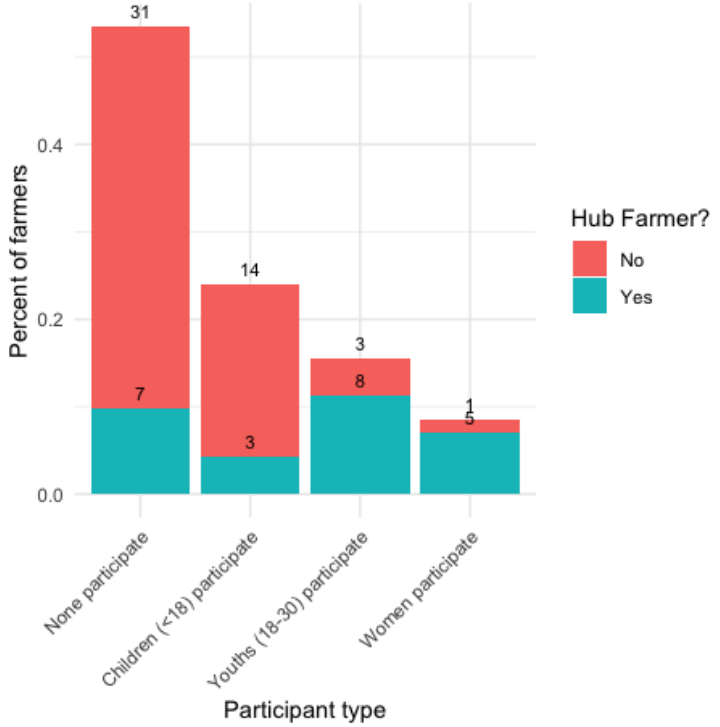

Figure 8: Women, youths, and children's participation in fish farming activities.

Food security

Farmers perceived themselves to be food secure: the average 'Food Insecurity Experience Score' was <1, which indicates strong feelings of food security[1]. No differences existed between Hub and non-Hub farmers. Beans were the predominant protein source among all farmers (figure 9); however, there was a significant association between RAD network participation and tilapia consumption frequency (Fisher's Exact Test, $p = 0.005$). Farmers who were part of the RAD network were considerably more likely to consume tilapia regularly, whereas non-members were more likely to report no consumption. This trend was also significant for goat consumption (Fisher's Exact Test, p = 0.0005). These findings suggests that engagement with the RAD network may influence dietary habits, potentially reflecting greater access to farmed fish or improved awareness of its nutritional value.

Most farmers reported eating more tilapia now than five years ago (75% n= 64 of 85); while engagement with the Hub was not an associated factor, results presented earlier in this document indicate that the Hub is perceived as responsible for building the tilapia market, and thus increased tilapia consumption may be a result of the Hub's effort in markets.

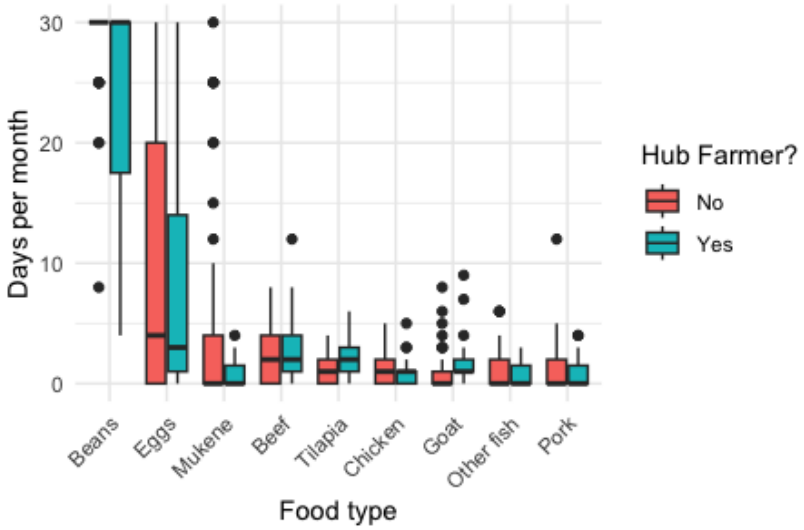

Figure 9: Monthly consumption frequency of protein sources among fish farmers

Among people shopping in markets, beans followed by eggs were also the most commonly consumed proteins (figure 10), with similar patterns to the farmers. Tilapia was consumed as frequently as beef and goat. Among shoppers, 64% (n= 145 of 266) ate fish. Of these, 39% (n=56 of 145) usually purchased fish from the Hub's market stand; 54% (n=78 of 145) usually purchased it from other vendors. However, 55% (n=79 of 145) had bought fish from the Hub's market stand at least once. Notably, 26% (n=37 of 145) did not know if they had bought fish from the Hub, indicating that Hub branding may be useful in differentiation and establishing a well-known reputation. Most people purchased fish from the Hub' market stand one to four times per month (figure 11). This frequency was similar to purchasing frequencies from other vendors, indicating that the Hub's market stall does not have an advantage or disadvantage over other vendors.

[1] Ballard, T.J., Kepple, A.W. & Cafiero, C. 2013. *The food insecurity experience scale: developing a global standard for monitoring hunger worldwide.* Technical Paper. Rome, FAO. Available at: FAO website.

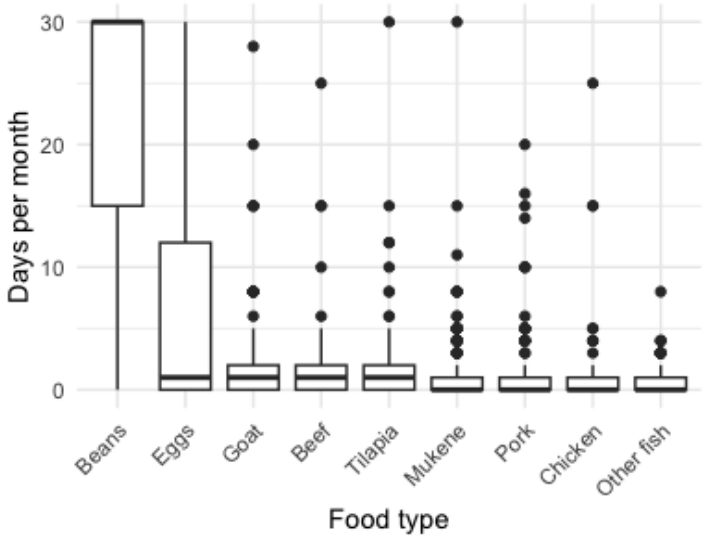

Figure 10: Monthly consumption frequency of protein sources among all market shoppers

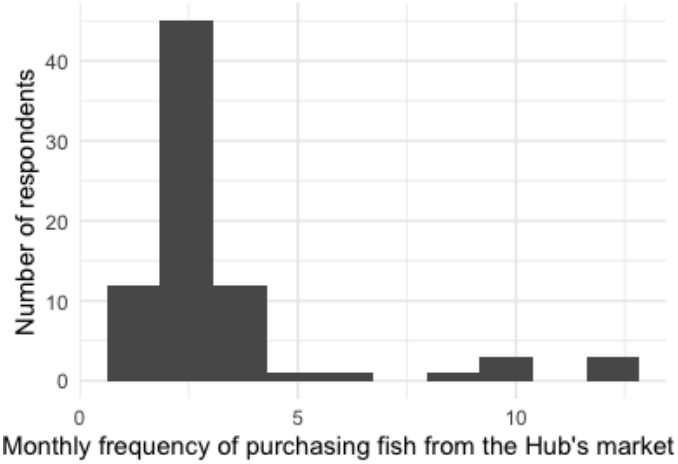

Figure 11: Market shoppers' monthly purchasing habits of fish from the Hub's market stall

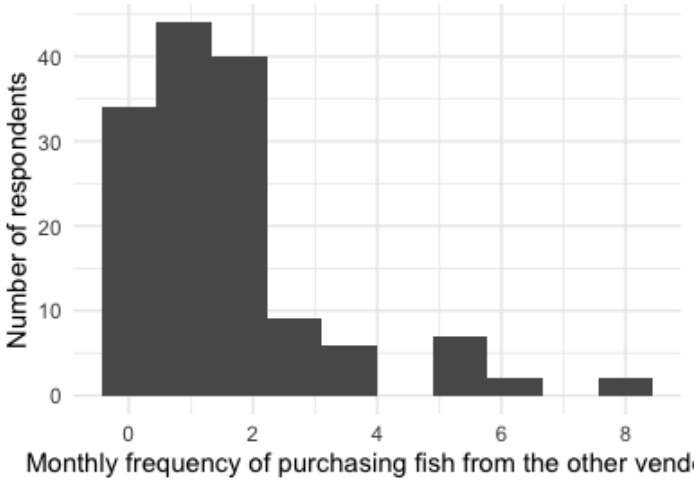

Figure 12: Market shoppers' monthly purchasing habits of fish from other vendors

When asked about the change in availability of fish now compared to five years ago, over two thirds of shoppers believed that the availability had increased generally (67% n=96 of 144), but only one third believed that the availability had increased in markets specifically (33% n=48 of 144). This suggests that hawkers and non-market methods of fish selling may be having a greater impact than fish sales in markets.

Most people usually ate and preferred to eat tilapia and usually ate their fish fried (figure 13), which aligns with the Hub's records (most fish is sold deep fried).

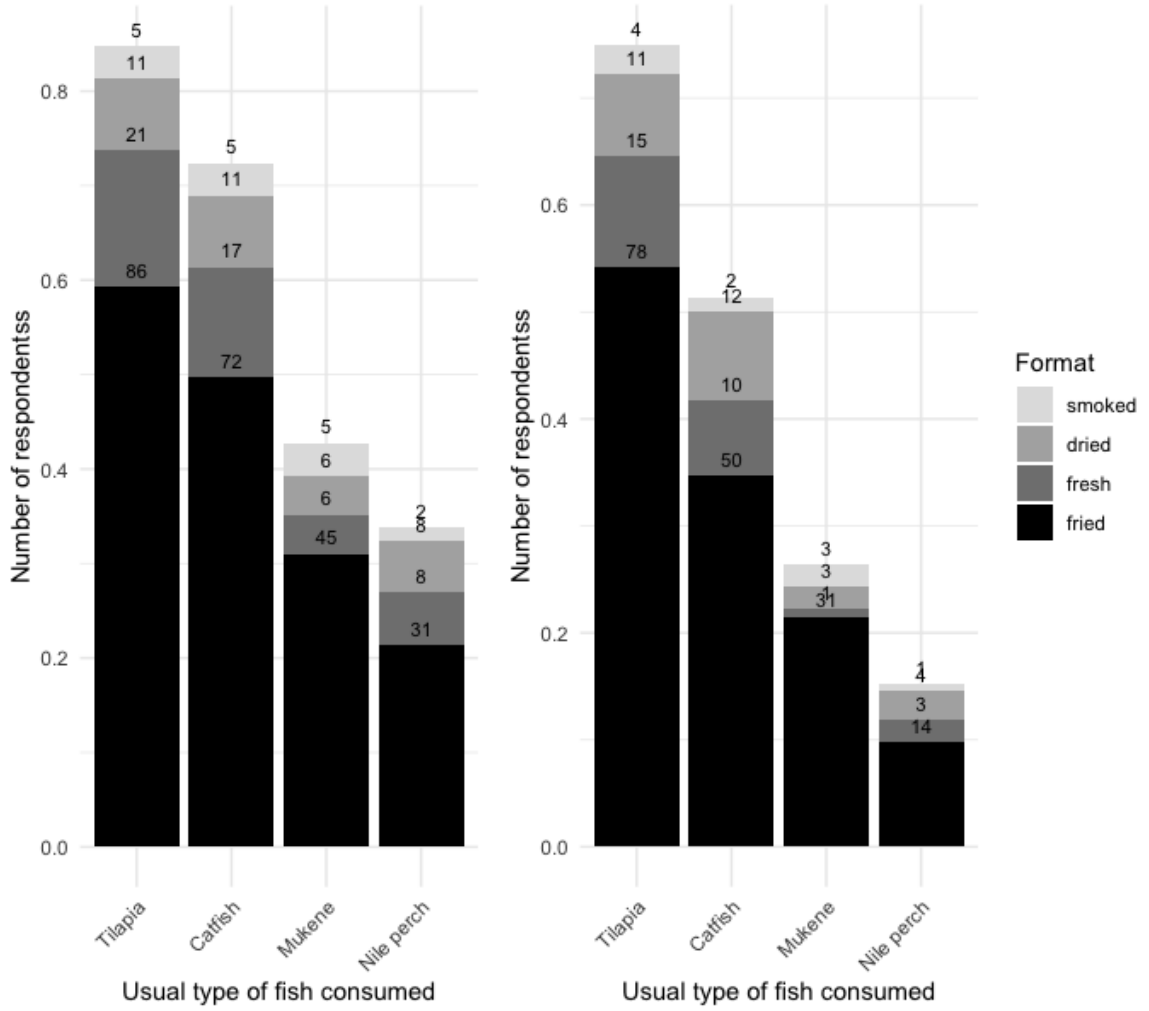

Figure 13: Type and format of fish (a) usually consumed by market shoppers and (b) preferred to be consumed by market shoppers.

Environment

Before the land was used for fish farming, it was either used for agricultural crops (43% n= 35 of 82) or was 'unused' swamp land (39% n=32 of 82). Hub farmers were significantly more likely to report that they used less chemicals, fertilisers, and/or pesticides now than five years ago (Fisher's Exact Test, p =0.03).

Key Findings

- Development of market
  - The Hub is creating a reliable demand for fresh fish and stabilizes fish selling prices for their farmers. This was evidenced by the finding that Hub farmers fetched a higher

price from their harvests on average than non-Hub farmers. Hub farmers also harvested smaller fish than non-Hub farmers, likely because the Hub accepts all fish sizes over 100g whereas broader markets for fresh fish demand larger fish sizes. In accepting smaller fish sizes, the Hub may be enabling shorter production cycles, improving farmers' cash flow.
    - While over half of randomly selected consumers had purchased fish from the Hub's market stall, a quarter did not know if they had bought fish from the Hub. People purchased fish from the Hub's market stall as frequently as from other vendors', indicating that the Hub's market stall does not have an advantage or disadvantage over other vendors. Hub branding may be useful in differentiation and establishing a well-known reputation.
    - Over two thirds of shoppers believed that the availability of fish had increased over the last five years. While causation is not possible to determine, this is likely due to the Hub's hawking sales team and market development.
- Production
    - Farmers in the RAD network stock higher numbers of fingerlings than those who are not in the RAD network.
    - Compared to non-Hub farmers, Hub farmers may have better designed ponds, indicated by their higher rates of inlet/outlet piping systems.
    - A significant data gap exists regarding harvest quantities and final stocking densities; farmers were largely unable or unwilling to share how much fish they last harvested. RAD is in the process of assigning farmer IDs to farmers in their network so that fish buy-back records can be used to calculate harvest quantities and final stocking densities.
    - While only 10 farmers were willing/able to recall their last harvest volumes, Hub farmers had higher final stocking densities than non-Hub farmers, suggesting that Hub farmers may be having higher survival rates than non-Hub farmers. This should be confirmed with larger datasets.
    - Both Hub and non-Hub farmers are reliant on the government's net for harvesting, and increasing the availability of nets in the area may reduce the risk of net accessibility.
- Gender Equality and Social Inclusion
    - RAD is currently engaging with 46% of fish farmers in Rukungiri.
    - RAD engagement methods are equally targeting female and male fish farmers, evidenced by the portion of female farmers in the RAD network being equal to the portion of female fish farmers generally. Thus, RAD is likely practicing gender-inclusive engagement methods.
    - Women in fish farming households (i.e., related to or living in the pond owner's household) were largely excluded from participation in fish farming activities and the reason for this was unclear. This point additional research and should be prioritised by the Hub to ensure inclusive opportunities for participation in aquaculture.
- Confidence and benefits
    - Compared to non-Hub farmers, Hub farmers were significantly more confident that they will make money from fish farming. All farmers were more confident that they would make money from fish farming now compared to five years ago, which most farmers believe is due to the Hub's effort to develop local markets for farmed fish.
    - However, very few farmers keep records and most did not know whether or not they were earning a profit from fish farming. Record-keeping training may help farmers understand the profitability of their business to encourage better management practices.
    -
    - Income from fish farming is supporting food security via increased food purchasing power in markets (income is used for food purchasing). Fish farming income is also used for school fees for longer-term impacts on education and wellbeing.
    - Farmers felt that fish farming was not generally burdensome and allowed them time to pursue their other income-generating activities without negative effects.

  - Farmers who were part of the RAD network were considerably more likely to consume tilapia regularly, whereas non-members were more likely to report no consumption.
- Regenerative practices
  - Hub farmers were significantly more likely to report that they used less chemicals, fertilisers, and/or pesticides now than five years ago.